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The systematics and nomenclature of the European freshwater fishes have been critically reviewed. Using the phylogenetic species concept (PSC), 358 species are recognised in Europe (exclusive of former USSR). Former checklists recognised only about 170 to 213 species for the same area; the increase is in part due to differences in species concepts but also to former checklists overlooking most of the diversity documented for salmonids and coregonids.

The nomenclatural status of the 1931 names applied to European freshwater fishes since 1758 has been reviewed. The original descriptions of 1429 (99.4%) of the 1437 nominal species based on material from Europe (exclusive of USSR) have been examined; the original spellings have been checked, type localities are listed as well as information on primary type specimens when available. The correct names of all species have been established in accordance with the International Code of Zoological Nomenclature. It is found that 47–89 (28–42%) of the names of the 170 to 213 species and subspecies recognised by earlier authors were incorrect (incorrect names, incorrect generic placement, incorrect spelling). Many names were found to be very poorly based or with very poorly 'legal' base and in order to stabilise the nomenclature, lectotypes are designated for 18 nominal species and neotypes are designated for 18; the type localities of 8 species are restricted, and the original indications of 5 species are restricted (Table 2). The following species known by previous authors but unnamed or with invalid names are named: *Coregonus fatioi*, *C. arenicolus*, *C. atterensis*, and *Salmo aphelios*.

Despite having being the object of research for more than 450 years (double than the fauna of any other continent), the systematics and nomenclature of European freshwater fishes has been found to be in a chaotic state without equivalent elsewhere. The absence of established nomenclatural rules until the middle of last century is responsible for most of the 'old' nomenclatural problems. Poor practices, poor theoretical concepts, poor writing, absence of international communication and nationalism are responsible for the poor quality of systematic work in recent European ichthyology and ignorance of the rules are responsible for poor taxonomy and unstable nomenclature. The main cause is that contrary to most other fields of zoology and most other parts of the world, fish systematics and fish taxonomy has been a playing ground for fisheries biologists and not a research field for trained taxonomists.

Poor systematics and poor taxonomy are directly responsible for the non-identification of the severe threats to the survival of many species. Twelve of the recognised species are probably extinct: *Eudontomyzon* sp., *Chondrostoma scodrense*, *Coregonus fera*, *C. hiemalis*, *C. confusus*, *C. restrictus*, *C. gutturosus*, *Salmo schiefermuelleri*, *Salvelinus inframundus*, *S. profundus*, *S. scharffi*, and *Gasterosteus crenobiontus*.

"As long as there are active, creative ichthyologists, there will be major disagreements in our classification in the foreseeable future (similarly there is disagreement in almost all important fields of biology). Fish classification is in a dynamic state, and the student pursuing ichthyology will find that all groups can be reworked. There are many challenges, both in developing the theory of classification and in its actual practice. Because particular classifications eventually become obsolete (as will most biological information), they should be regarded as frameworks that will provide a basis for building as advances are made".
J. S. Nelson (1994: x)

"We shall never know how many [... species ...] inhabited the planet when we began its destruction. It is past time to get afield and away from minutiae and speculations, back to solid facts of ... distribution, variation and migration. Successful conservation will require intelligence, realism and *knowledge*, based on better collecting of what *is* to conserve ... It can hardly be achieved while "conservationists" and misled officials impede the collecting, preservation, and study of our fast vanishing wealth. ... Meanwhile, our scientific "establishment" unanimously ignores most ... species and concentrates on supporting industry (profitably) by emphasizing computers and expensive equipment designed to give fantastic Ultimate Answer (based on proteins and molecules) that, to date, have been largely wrong. Truly, we are in a new Decline and Fall, with our scientific establishment fiddling while Rome burns, instead of conserving biological diversity."
A. R. Phillips (1982: 615)

Prologue

This essay is not a definitive treatment of the systematics of the European freshwater fishes, it is not a systematic revision, it is not an exhaustive literature review, it is not .... So what is it ?

This essay is a review of the (poor) state of the systematics of European freshwater fishes and the related (absence of clear) concepts, (ignorance of) basic biological principles, and (non application of) nomenclature rules. It illustrates a (poor) situation resulting in part from (the neglecting or rejection of) systematics in western (as an outmoded discipline) as well as eastern Europe (until recently, as a static and non-revolutionary discipline), from the (lack of) adequate funding and from the (now virtual absence in most European universities of) competent teaching of systematic methodology (by staff with first hand experience of the subject).

This essay is a brief catalogue of what we know and what we should know, of what has been done and what still has to be done. It aims to provoke thought and to stimulate a new wave of critical and innovative research.

Although a ritual answer and justification for not moving, the 'need to wait for more or better data' is not an acceptable answer to most problems or questions. This essay addresses several of these problems (some known for over a century) and proposes pragmatic ways of handling some unresolved cases.

The efficient conservation and responsible management of the rapidly vanishing European fish diversity requires a sound knowledge of this diversity. This knowledge needs to be based on coherent systematics. To wait for 'more data' is definitively not acceptable when there is no sign that these advocated additional researches will be funded, conducted by experienced staff, completed, published, and will lead to results other than ... 'we need more data'. If the data ultimately arrive, we will certainly be pleased to use them. But we cannot wait indefinitely for them.

Ars longa, vita brevis.

Introduction

European ichthyology was born with the Greek philosopher Aristotle (384–322 BC). Even though formal binominal fish nomenclature began with Carl von Linné (Linnaeus, 1758), the history of European fish systematics actually goes back to the sixteenth century with Pierre Bélon (1518–1564), Hippolyto Salviani (1513–1572), Guillaume Rondelet (1507–1566) and Conrad Gesner (1516–1565) (see Cuvier, in Cuvier & Valenciennes, 1828a: 1–270, for a history of ichthyology). The *Libri de piscibus* and the *Universae aquatilium historiae* of Rondelet (1554, 1555) and the *Nomenclator aquatilium* and *Fischbuch* of Gesner (1560, 1575) are the corner stones on which European ichthyology was built. Modern ichthyology started with Peter Artedi's (1705–1735) posthumous *Ichthyologia* (1738) whose system and nomenclature have been adopted by Linné.

Having enjoyed 4 1/2 centuries of study (about double that for the fauna of any other continent), one would expect our knowledge of the European fish fauna to be very good, and especially that the most basic information would be easily available.

The last reasonably comprehensive bibliography of European freshwater fishes actually is included in Günther's (1859–1870) *Catalogue of fishes* which is also the last published catalogue of all fishes of the world. The latest checklist of European freshwater fishes apparently dates back to 1971 (Blanc et al., 1971) and is of unequal quality (see Balon, 1974: 802, for criticism; see also Bănărescu & Hureau, 1976: 414 and Balon, 1976: 416). There are several popular or semi-popular books on European freshwater fishes which have been translated into several languages (e.g., Maitland, 1976; Muus & Dahlström, 1967); most of them are already quite old (between 20 and 30 years) and out-dated. Newer ones or revised editions tend to be written not by competent authors but by so-called 'science journalists' who uncritically collect data from various sources (or more commonly, paraphrase other's books); sometimes, artists are given photocopies from other books and commissioned to draw the same fishes and give them a new look (in terms of copyright laws or ethics) and this results in a fish with more bars, less spots, longer or shorter barbels etc. For obvious reasons, I cannot list references to such books here.

The only recent technical book which aims at dealing with European fishes is the series *The Freshwater Fishes of Europe* which suffers from its more than prohibitive price, unpredictable schedule, heterogeneous editorship, and scanty illustrations (see reviews by Wheeler, 1988: 1099, 1993: 249). The situation with national faunae is very variable; there are good ones, but in many instances, they are poor and very outdated (if still available). For a few countries, there is nothing published this century.

This is more or less the horrifying situation I discovered when I needed to find a checklist from which to extract a few basic data like number of species, distribution, conservation status, etc. for a paper comparing knowledge of the European and Southeast Asian freshwater fish faunae. I thought that the situation was not desperate, and judging from the figure of 215 species recorded by Maitland (1976) for Europe west of the Urals or 393 species and subspecies listed by Blanc et al. (1971) for Europe west of the Urals and the Levant, I decided that it would not take too long to review the literature and compile my own list.

This was the second shock. As a systematist, I discovered the astonishingly poor state of European fish systematics and nomenclature. To be short, I discovered that our knowledge of the systematics of European freshwater fishes, though seemingly extensive, is very often of poor quality, that there is an enormous number of bad or very bad publications whose authors have obviously no idea what systematics is or is not and who have probably not even heard of the existence of nomenclatural rules (or at least have not read them). It seems that for decades, most of the 'contributions' to the systematics of European fishes have not been the result of work by systematists, but by fisheries biologists and others without formal training in systematics. Many researchers are just restricted to what happens within national boundaries and do not seem to realise that fish do not recognise political borders. Admittedly, the exchange of information is hampered by language and until recently by political problems.

Is this situation that important or that dramatic? It is certainly irritating to see the money, efforts and time wasted in collecting these data, writing, editing, and publishing all this material for such low quality of output. Basic systematic data are important because they allow communication and exchange of information between scientists: discoveries made by a scientist on the biology of a species A are only meaningful to other scientists if they can be sure that their species A is really the same as the species A of other researchers. Basic systematic data are important for conservation; without detailed surveys and accurate taxonomy, it is impossible to identify the various species and evaluate their real conservation status, it is impossible to properly manage their fisheries, it is impossible to evaluate the conservation value of various habitats or areas, it is impossible to establish strategies and it is impossible to set priorities. Without accurate names, it is impossible to list species as endangered or threatened and to take conservation action. The situation, strategy and actions needed for managing European coregonid stocks obviously are not the same if we have a single species with hundreds of local morphs or populations, if we have 7–8 species ranging across all Europe and present in different combinations in different lakes, or if we have a collection of some 30 species.

It is also dramatic to state that because of this chaotic state of fish taxonomy in Europe, most competent scientists tend to avoid getting involved in the usually sterile controversies which would unavoidably result from innovative papers. As a result, European fish taxonomists work on foreign faunae, while knowing perfectly well that a lot of work still has to be done at home, but predictably under unpleasant (psychological or social) conditions. The influence of the academic social philosophy and rites is not irrelevant to this discussion (Kottelat, 1995).

As a result of these factors, it is extremely difficult to evaluate the real status of the European freshwater fish species. After spending some time compiling lists, evaluating the literature, checking interpretations and re-interpreting data, I put together a more or less reasonable and up-to-date check-list. I certainly do not consider it as a systematic revision but more as a working document on which to base further researches. Many of my conclusions are still tentative, because a direct examination or re-examination of the material used by earlier authors is essential to solve several of the problems. For the reasons mentioned in the preceding paragraph, I was at first not inclined to publish this list. But, as the situation is so bad, it serves no purpose to postpone this any further.

Even if many points are still imperfect, even if many questions are still unanswered, it seems preferable to have these data instead of wrong data or no data at all. At least readers who are not specialists in the field of fish systematics will know that there are problems. Many nomenclatural problems still have to be solved; I solved all those which could be solved now and have pointed to remaining ones. Some might argue that it would have been better to postpone this publication until all these problems have been addressed. This attitude is not acceptable to me because many of the problems I am pointing to have been known for decades and have not been addressed (subsequent authors often translated tentative conclusions of earlier authors into definitive 'facts', overlooking existing reservations, and recent authors just ignore that problems exist); waiting for external answers would in most cases mean just additional decades of inaction. I do not think that science should be restricted merely to bear witness to problems, but should act on solving them.

Also, the immediate (and tentative) solution of several of the systematic problems we now recognise is important for conservation. Postponing this further could mean that by the time the problem is really addressed, the concerned species will be extinct (and then the problem probably can never be solved). In many cases it seems that we have only two alternatives: 1) to reach a tentative solution leading to adequate conservation and possibly to a definitive solution later; or 2) to wait for a definitive solution, with the risk of extinction of the problem organisms, and ipso facto disappearance of any chance of solving the problem. Conservation-minded scientists will recognise the urgency of the situation.

Results and discussion

Although unusual, I find convenient to present and discuss in this position the general pattern of the results of my review.

My survey reveals that some 358 fish species can be recognised in European freshwaters West of the former USSR. This compares with the 170 native species listed by Maitland (1976) or 213 species and subspecies listed by Blanc et al. (1971) for the same area. The difference is partly explained by new taxa described since these books have been published and revalidation of taxa earlier considered as synonyms, but mainly it results from the use of a more objective species concept, the Phylogenetic Species Concept (see discussion and definitions below). Earlier authors have often claimed to have used the so-called 'Biological' Species Concept (other concepts are also 'biological' !) which is now found to be non operational and whose criteria are virtually impossible to apply. Actually most authors have probably been working without really paying much attention to concept formulation and to practical implications.

Most earlier checklists also have avoided as much as possible dealing critically with salmonoid (Salmonidae and Coregonidae) systematics and this resulted in a much underestimated number of species. The species-level systematics of these families is still far from resolved, but even with this limitation a pragmatic handling of their nomenclature is possible. Using a few simple concepts and definition, I tentatively recognise here 44 European monophyletic evolutionary units within the genus *Coregonus* which can be called species and 27 within the genus *Salmo*. (Admittedly my treatment of these two families is not geographically even and I apparently deal with the peri-Alpine stocks in greater detail than with the Scandinavian ones. There is an old 'rule' in systematics stating that the number of species in a given area is inversely related to the distance between them and the laboratory of the systematist working on them; this bias seems confirmed here).

At least 1931 names have been applied to these 358 species since the beginning of the modern nomenclatural system in 1758, or an average of 5.4 names per species, with a maximum of 57 names for *Salmo trutta* sensu stricto). This profusion of names and the long history of some of them is partly responsible for a relatively frequent occurrence of nomenclatural problems.

Nomenclatural problems are of many types. Grossly, they can be divided into ancient and modern problems. The ancient-type problems are classical cases which taxonomists are accustomed to. 1292 (66.9%) of the 1931 names have been created before 1900 and most of the problems relating to these older names result from the non-existence of precise nomenclatural rules at that time. One of the most frequent problem is species described without explicit designation of type material (a concept which appeared towards the end of last century). For 258 names there is no type material and for 370 the whereabouts of designated types are not known (Table 1); to these should be added types theoretically deposited in an institution where they can no longer be found because they have been misplaced, discarded or lost during wars, fires, etc. The situation is very dramatic for south-eastern Europe where most nominal species have no known extant types, even for species described in recent years.

The modern-type problems are more interesting because they reveal a tragic pattern. They include an incredible number of nomina nuda (see p. 12 for definition), dramatic misunderstanding of nomenclatural rules or obvious signs of ignorance of their existence, poor background knowledge of fish morphology or biology. For obvious reasons, I do not wish to list here precise examples of these cases.

Fundulus heteroclitus, a North American fish introduced in Spain has been described as a new endemic Spanish fish in 1984 and I am aware of another similar case which could be stopped before publication. In 1990, a 'new' subspecies of the North American catfish *Ameiurus nebulosus* has been described from Hungary on the basis of an introduced stock.

Two species names have first been made available in conference abstracts between 1982 and 1995. Many species (not counted) have been described without explicit mention of type material and the actual existence of this material for most is still unclear. Type material is vanishing from museums and universities. The curators of several European fish collections surveyed in Kottelat et al. (1993) answered that the collections under their care do not include types, while their holdings have earlier been documented in the literature as type repositories.

Table 1 shows that the percentages of new names proposed in the last 50 years which do not present nomenclatural problems (types, availability of the names) is not superior to those of last century. The very high figure (83%) for the decade 1980–1989 is to be corelated with the absolute number of 23 new names proposed for that period, the lowest for any decade since 1758. The proportion of unavailable names (see definition p. 12; in other words, names proposed in ignorance of nomenclature rules) is higher than ever. For the period 1758–1830, at the beginning of the history of zoological nomenclature, the main causes of unavailability were nomina nuda and the inconsistent use of the then not fully established binominal system. From 1850 to 1970, the main cause is the

Table 1. Number of names (total, available, not available) proposed between 1758 and 1996, in 10-years intervals, including indication of problems with type specimens of available names (NT, no types; LU, location of types unknown [not including types subsequently lost]) and cause of unavailability (nomina nuda, infrasubspecific names, or others). Percentages refer to the total number of names for a given 10-years interval.

	names														
	total	available						not available							
		no type problems		type problems				total		nomina nuda		infrasubspecific		others	
			%	total	%	NT	LU		%		%		%		%
1758–1769	93	30	32	59	63	58	1	4	4					4	4
1770–1779	25	7	28	9	36	5	4	9	36	1	4			8	32
1780–1789	41	20	49	19	46	17	2	2	5					2	5
1790–1799	33	11	33	15	45	11	4	7	21	4	12			3	9
1800–1809	52	18	35	33	63	20	13	1	19	1	19				
1810–1819	65	4	6	51	78	12	39	10	15	9	14			1	15
1820–1829	82	32	39	42	51	34	8	8	10	8	10				
1830–1839	184	85	46	69	38	18	51	30	16	25	14	3	2	2	1
1840–1849	194	108	56	48	25	14	34	38	20	20	10			18	9
1850–1859	119	85	71	22	18	6	16	12	10	5	4	4	3	3	3
1860–1869	158	108	68	21	13	5	16	29	18	7	4	12	8	10	6
1870–1879	91	47	52	31	34	8	23	13	14	6	7	2	2	5	5
1880–1889	93	43	46	30	32	15	15	16	17	1	1	13	14	2	2
1890–1899	62	32	52	4	6	2	2	26	42	6	10	17	27	3	5
1900–1909	84	49	58	10	12	4	6	25	30	2	2	12	14	11	13
1910–1919	36	20	55	6	16		6	10	28			10	27		
1920–1929	110	42	38	50	45	1	49	18	16	1	1	17	15		
1930–1939	141	38	27	40	28	8	32	63	45	4	3	54	38	5	4
1940–1949	71	27	38	20	28	1	19	24	34			22	31	2	3
1950–1959	62	21	34	17	28	6	11	24	39			24	39		
1960–1969	44	18	42	9	21		9	17	39	1	2	15	34	1	2
1970–1979	48	24	50	17	35	11	6	7	15			1	2	6	13
1980–1989	23	19	83	4	17		4								
1990–1996	20	10	50	2	10	2		8	40	8	40				
	1931	898	47	628	33	258	370	401	21	109	6	206	11	86	4

proposal of infrasubspecific names (see definition p. 18). New infrasubspecific names peaked in the period 1930–1970 and then abruptly disappeared; most were proposed by Russian and eastern European authors and the abrupt drop in the 1970s probably reflects a change in emphasy of biological research and, more recently, the sad shrinking support to research. Since 1970, the main causes of unavailability of new names is again nomina nuda, use of non-binominal system, etc. Tragically, these are the same main causes as for the period 1758–1830 and this simply reflects ignorance of the nomenclature rules and possibly (in the case of the nomina nuda) the stress to publish.

It is now well known that systematics as a whole is not doing well in Europe, but it does not seem that any other animal group is in such a chaotic situation, with so few species, but of concern for so many specialists. I think that part of the explanation lies exactly there. In other geographic areas, in other groups, systematic researches are conducted by systematists, usually with the appropriate background and based in research or teaching institutions. Any research on fish, due to their economic and food significance, has too often been appropriated by fisheries or agriculture agencies (I really mean *appropriated*; for many agencies, to pause as 'the' specialists does not involve a moral or ethical responsibility and commitment to produce sound research but merely taping at the money source to keep the administration running and, not seldom, to prevent other institutions or agencies from entering the field). Fisheries biologists might certainly be competent and efficient for some kind of fisheries management, but few only have been successful as taxonomists.

I think it is greatly time that fish taxonomists gain control again on taxonomy of European fishes. It is vital for their conservation that we can rely on sound data obtained by critical and experienced taxonomists. A failure to understand this need now will soon have irreversible impact on the survival chances of many species. The recognition and correct identification of species is not just an academic problem. Sound management and conservation depend of correct identification. We have great potential of seeing maybe up to 50 species going extinct in the next 10–20 years. Failure of competent demonstration of their distinctness, of recognition of their distribution and of identification of their ecological requirements is the best guarantee for seeing them disappearing. Recognising them may not save them, but definitely is a first, big step towards their survival.

At least 12 (3.4%) of the European freshwater fish species are probably extinct: *Eudontomyzon* sp., *Chondrostoma scodrense*, *Coregonus fera*, *C. hiemalis*, *C. confusus*, *C. restrictus*, *C. gutturosus*, *Salmo schiefermuelleri*, *Salvelinus inframundus*, *S. profundus*, *S. scharffi*, and *Gasterosteus crenobiontus*. The population of *Alosa vistonica* has decreased very sharply in recent years and the species has not been seen for 2 years (P. Economidis, pers. comm., 1996). The taxonomic status of several populations is not clear and it is likely that some of them, now extinct, might actually have represented valid species (e.g., *Gobio antipai*, see p. 62). But the lack of record should not be taken as an absolute indication that a fish species is extinct; Mayden & Kuhajda (1996: 267) list several examples of fishes inhabiting readily accessible and easily collected habitats which have only been rediscovered after a hiatus of 23 to 110 years in North America. On the other hand, it is likely that species went extinct unnoticed in historical times (see Hoffmann, 1996, for discussion of environmental changes in aquatic ecosystems in medieval Europe).

At least 14 species reported in the literature have no valid scientific names, either because they have not been recognised as valid species before, because the proposed names are invalid or unavailable, or because wrong names have been applied to them. I here provide new names for four of these species (*Coregonus fatioi*, *C. arenicolus*, *C. atterensis*, *Salmo aphelios*). This does not mean that I consider their systematic status to be definitively solved, but that with the existing data or evidences they are treated as species; for handling them and for consistency they require a name. This is also a way to ensure that the names are properly established and that types are properly designated and lodged in suitable institutions. The descriptions of four other species are in press. There are evidences or strong indication of the existence of 6 additional unnamed species (*Eudontomyzon* sp., *Coregonus* spp., *Salmo* spp., *Salvelinus* sp.), but despite many attempts I could not personally examine material of these species and I do not wish to name them without personally examining them.

Similarly, when I met a nomenclatural problem which could reasonably be solved in the present context by mean of simple nomenclatural acts, I did them. This includes 8 restrictions of type localities, 5 restrictions of orig-

Table 2. Nomenclatural acts included in the present work.

act	taxon	page
Restriction of type locality		
	Clupea sardinella Vallot, 1837	38
	Cobitis taenia Linnaeus, 1758	89
	Cobitis trichonica Stephanidis, 1974	90
	Fario argenteus Valenciennes, 1848	142
	Salmo lacustris Linnaeus, 1758	143
	Salmo punctatus Cuvier, 1829	131, 153
	Salmo salvelinus profundus Schillinger, 1901	154
	Salmo saxatilis Paula Schrank, 1798	137, 141
Restriction of original citation		
	Cyprinus albula Nardo, 1827	64
	Cyprinus cephalus Linnaeus, 1758	66
	Gardonus wyrozub Walecki, 1863	77
	Salmo cenerinus Chiereghini, 1847	134
	Salmo maraena gutturosus Gmelin, 1818	112
Lectotype designation		
	Alosa finta lacustris Fatio, 1890	37
	Barbus caninus Valenciennes, 1846	48
	Blennius cagnota Valenciennes, 1836	175
	Cobitis caspia romanica Bacesco, 1943	92
	Coregonus balleus Fatio, 1885	108
	Coregonus exiguus albellus Fatio, 1890	108
	Coregonus restrictus bondella Fatio, 1885	105
	Coregonus schinzii alpinus Fatio, 1885	108
	Coregonus wartmanni alpinus Fatio, 1890	109
	Cyprinus barbus Linnaeus, 1758	48
	Cyprinus umbra Walbaum, 1792	68
	Leuciscus leuciscus roulei Bertin & Estève, 1948	69
	Petromyzon japonicus Martens, 1868	28
	Petromyzon lampetra Pallas, 1814	29
	Petromyzon marinus Linnaeus, 1758	29
	Salmo ferra Walbaum, 1792	113
	Salmo maraena ferra Gmelin, 1818	113
	Salmo nigripinnis Günther, 1866	138
Neotype designation		
	Acipenser kostera Fitzinger, 1832	32
	Acipenser schypa Gmelin, 1788	34
	Acipenser schypa Bonnaterre, 1788	34
	Acipenser shyp Forster, 1767	34
	Chondrostoma rysela Agassiz, 1835	71
	Coregonus candidus Goll, 1883	105
	Coregonus nobilis Haack, 1882	109
	Cyprinus agone Scopoli, 1786	37
	Cyprinus morella Leske, 1774	74
	Petromyzon branchialis Linnaeus, 1758	27
	Petromyzon fluviatilis Linnaeus, 1758	27
	Petromyzon lumbricalis Pallas, 1814	28
	Petromyzon marinus camtschaticus Tilesius, 1811	28
	Phoxinus laevis punctatus Benecke, 1881	59
	Phoxinus percnurus gdaniensis Berg, 1932	59
	Salmo carpio Linnaeus, 1758	134
	Salmo lavaretus Linnaeus, 1758	105
	Telestes rysela Heckel, 1852	71

inal indications, 18 lectotype designations and 18 neotype designation (Table 2) to definitively link some (sometime potentially) problem-making names with their present acceptation or to definitively eliminate them from the nomenclature.

The nomenclature used in this list is as up-to-date as known to me by 31 December 1996 and strictly in agreement with the International Code of Zoological Nomenclature. Compared to earlier work of similar scope, the names of 89 (42%) of the 213 species and subspecies recognised by Blanc et al. (1971) for the same area had to be changed and 143 (67%) additional species are recognised; the names of 47 (28%) of the 170 species recognised by Maitland (1976) are changed and there are 186 (109%) additional species. Noteworthy changes are:

present name	earlier
Lethenteron camtschaticum	*Lethenteron japonicum*
Alosa agone	*Alosa lacustris*
Alosa immaculata	*Alosa pontica*
Eupalasella perenurus	*Phoxinus percnurus*
Salmo cettii	*Salmo macrostigma*
Sander lucioperca	*Stizostedion lucioperca*
Sander volgensis	*Stizostedion volgense*
Padogobius bonelli	*Padogobius martensii*

Most of these name changes are justified by the new name being the oldest available; thus according to nomenclature rules, they are the valid name of the species. Some of these names had been overlooked by previous authors while others were regularly cited in synonymies by authors who for some reasons had decided to ignore the rules. That quite so many names have been overlooked would be surprising in other fields or in other areas, and again I am tempted to link this with a lack of knowledge of the practice of nomenclature, a lack of knowledge of the literature and a blind acceptance of previous data. The role of large, then exhaustive works cannot be ignored; they often lead people to think that everything has been done. For example there is probably some kind of "Günther effect". Günther's eight volume *Catalogue of fishes* (1861–1870) is the last attempt at providing a more or less complete bibliography of world fishes; while there have been very detailed and quite exhaustive bibliographies for some areas since (e.g., Africa, north-eastern Atlantic) there still is nothing more recent for European freshwater fishes. Works which were not available to Günther were not cited, and they have largely been ignored since and mistakes introduced by Günther (e.g., misspellings) have been repeated by compilers who did not check the original sources. This phenomenon is not unique to Günther, and is paralleled in most national faunae.

The suggestion arose that the International Commission on Zoological Nomenclature should be petitioned to suppress these older, valid names in favour of those more commonly used. Such proposals are usually made on the ground of preserving stability, but too often the sense of such applications is somewhat dubious except for their authors (see Kottelat, 1995: 568).

In the present case, I think there is ample evidence that the apparent stability is an illusion; there is no strong base on which to build a robust, stable nomenclature at this stage. The fact that between 28 and 42% of the names used in relatively recent monographs and checklists are incorrect demonstrates the lack of previous detailed and critical literature review, the first basic step for sound nomenclature and systematics. (The real number actually would be much higher if I had not been able to eliminate some 15 names by judicious neotype and lectotype designations). The changes resulting from a strict application of nomenclature rules concern only a few species in regard of the number of name changes or new names potentially resulting from normal, critical systematic research. Finally, the conservation of each name would require a separate application and a separate decision of the Commission. The whole process would span over years and the uncertainty about each decision for sure is creating instability, not to mention that the Commission has an impressive and extensive catalogue of cases on which it never decided anything or which have been authoritatively or arbitrarily blocked by its secretariat.

Is there a risk that I overlooked some earlier names for other 'established' species ? I cannot estimate how many, but some possibly exist.

Concepts

This and the following sections on species concepts, etc. may seem superfluous to systematists as they summarise more extensive discussions published elsewhere. As stated in the Introduction, most of the publications on European fish systematics during the last decades have been authored by non-systematists. As a result, many problems appear to be due to out-dated, poor or wrong concepts, poor translation of terminology, poor definition and misunderstanding. Such basic rules as the International Code of Zoological Nomenclature are obviously unknown to many authors and key concepts (e.g., species) are often misunderstood. As this check-list is aimed at a general readership, it seems appropriate to start by providing brief summaries of some of the fundamental principles of systematics and nomenclature and to clarify what is a species. A brief summary of the evolution of the species concept is presented in order to explain how this concept evolved and how presently accepted concept(s) differ from earlier ones and the implications for the present review.

Although aberrant, systematics and nomenclature are no longer part of the biology curriculum in most European universities (or are too often taught by lecturers without personal experience in that field) and this has a clear and significant impact on the ability of non-systematists to understand and interpret systematic data as well as the ability of systematists to understand theoretical discussions on systematics. While it appears normal that a student conducting a PhD research involving genetics or any specialised field will have a geneticist or the appropriate specialists in his advisory board, it now just seems normal, if the thesis involves systematics, to consider it superfluous to involve a competent systematist. This trendy but unprofessional approach to systematics also has obvious negative side-effects for conservation, as the systematists (the specialists on biodiversity) are becoming extinct even faster than most of the threatened animal groups themselves.

Systematics, taxonomy, classification and phylogeny

Systematics is the study of the diversity of life and the relationships between living organisms, using all available information. **Taxonomy** is the theory and practice of describing, naming and classifying living organisms. **Nomenclature** is the system of names and the provisions for their formation and use (see below).

Classification is the grouping of objects into a hierarchical system. Classifications are usually based on shared similarity and objects with similar appearance are likely to be placed in the same group. Grouping criteria can be very diverse, depending of the needs or tastes of the observer. This is how the first classifications were made. Gesner (1560), in his *Nomenclator aquatilium*, put together fish, whales and mermaids, while eels were grouped with snakes, etc. This kind of classification can be satisfactory for inanimate objects but, in today's standards, is not meaningful for living beings. Individuals are members of species which have evolved over time; they are related to other species not only by general appearance but by genealogical links. Biological classifications aim to depict these phylogenetic (genealogical) relationships between organisms. **Phylogeny** is the history of the evolution of a given lineage.

There are different ways of reconstructing phylogenies and the different schools supporting them have been at times engaged in colourful conflicts. Ironically, one regrets that many of the most vociferous participants at these debates were not known as practising systematists (an important *distinguo* in my eyes). The main schools have been called 'evolutionary systematics', 'numerical taxonomy' (or pheneticism; apparently a dead school in its original form) and 'phylogenetic systematics' (or cladism) (this terminology is inappropriate as cladistics is as evolutionary as 'evolutionary systematics', but it is quite firmly established). Of course, these schools can be subdivided in narrower groups. Most practising systematists possibly belong to a fourth school, 'opportunistic or applied systematics'. For the following discussions, I shall follow a minimal cladistic approach in that I agree that lineages can only be defined by derived character states and not by primitive character states. [A derived (or apomorphic) character state is a novelty which appeared in the common ancestor of all members of the lineage and which is passed down to its descent; the primitive (or plesiomorphic) character state is the situation which then existed in the other, related taxa and which may still be retained in other lineages. Note the distinction between **character** and **charac-**

ter state; e.g., the number of branched dorsal-fin rays is a character which may have a plesiomorphic state [e.g., 7 in a whole family] and an apomorphic state [e.g., 9 in a given lineage]; the plesiomorphic state is useless to define any evolutionary lineage within the family, while the apomorphic one [ideally in conjunction with concordant apomorphic states of other characters] could be used to define a lineage within the family or within a genus in this family; refer to systematic text book for further discussion, e.g., Wiley, 1981]. I have doubts about some of the other axioms of the cladistic theory (e.g., the dichotomy principle) or do not believe in some corollary tools like parsimony. [If phylogeny has to depict evolution it should depict it, not find a mathematically parsimonious way of representing it; a parsimonious lie is not the truth. Admitting the reality of evolution and hypothesizing that the most parsimonious explanation is the most likely to correctly describe evolutionnary patterns, is the creationist theory not the most parsimonious evolutionnary theory as it requires a single assumption ? If this is correct (I do not know), then, the most parsimonious explanation is the negation of the reality, thus, *ad absurdum*, the most parsimonious explanation is not acceptable]. Although sophisticated numerical approaches may look more scientific they are not the only testable ones; it remains to be demonstrated that they are better descriptors of reality or if they are merely preferred because of the psychological need to buy new toys, or for their impact when courting funding agencies. Anyway, most of this theoretical background is not needed here because *the present discussion deals with species* and only marginally with phylogeny (although, of course, the species are the result of evolution and phylogeny is relevant in that context).

Finally, it must be stated that unfortunately one of the negative point of cladistics is that it sometime appropriate terms widely used and uses them with a different sense, creating confusion. Stability of scientific terms is needed to allow communication: this is demonstrated at will by the endless polemics between cladists and other schools, many of which result only from the insidious use of the same terminology with different meaning (e.g., phylogeny, monophyly). Some of these polemics could have been easily avoided. The latest example is the use of the word diagnosis. If some are unhappy with its classical meaning (a statement of characters that distinguish a taxon from other similar or related taxa), they should create another name for their new concept, but not use the same name for a different concept. The reason is very simple: one may like it or not, but the classical concept behind the word diagnosis is very important for applied systematics, for other fields of biology, and for identification, where the other concept is of limited use or sense. If the diagnosis concept is not satisfactory for some, they are right to replace it, but also they should be logical and coin a new name for their new concept. It is not for the rest of the world to adjust to the idiosyncrasy of some and create new names for old concepts. No school has the monopole of the vocabulary.

"While seeming eclectic in its choice of biological data, systematics organizes those data through taxonomy and nomenclature in its own particular way, to arrive at a yet more meaningful interpretation. .... No branch of biology can advance to more general principles without comparative studies, which would be meaningless unless based on sound systematics. ... Surprisingly large areas of biological investigation still pay mere lip service to up-to-date identifications and nomenclature in the belief that these are unnecessary refinements ... Far from losing its role as biology becomes more complex, systematics has become even more necessary" (Whitehead, 1990: 181).

Nomenclature

To give names to objects and living beings appears to be natural and important for humans because it allows them to communicate with others. This explains why most things which play a role in their life, positive or negative, have been given names. Animals are no exception. Each language, each country has its own set of names. In order to reach a high level of precision, zoologists developed a nomenclatural (naming) system which gives one (and only one !) name to every different animal species. This system is governed by a set of rules known as the International Code of Zoological Nomenclature (here the Code or ICZN), which is revised from time to time, the last revision having being published in 1985 (Anon., 1985). This code prescribes a neat and regulated system of naming which is of vital importance to all biologists because unambiguous communication depends on it.

Zoological nomenclature formally starts with the tenth edition of Linnaeus's *Systema naturae* (1758). This starting date was agreed on much later, with the introduction of the 1886 Code of Zoological Nomenclature, so earlier authors were at times quite inconsistent in their nomenclatural practices. Linnaeus's nomenclature was derived from Aristotelian philosophy and Logical Division; in Linnaeus's view, the genus was the key element of classification (see Cain, 1957). Although these Aristotelian principles are no longer used or disagree with today's principles and although the species is now broadly accepted as the real unit of systematic discussion, we still use the Linnaean binominal nomenclatural system; Aristotelian logic is still surfacing in (and biasing) some taxonomic treatment, especially in poorly known groups (e.g., the definition of clear-cut discrete groups which have no theoretical justification in evolutionary taxonomy but was a practical necessity under the Logical Division [and still is for keys], Cain, 1957: 150; the erroneous idea that some characters are indicative of species, genus or family-rank; symmetrical or parallel classifications in different lineages such as the quinary system). From both philosophical and practical points of view, there would be arguments to abandon this binominal nomenclature, but its replacement by an other nomenclature for several million names already proposed is probably not realistic and could only result in a long lasting chaos. Similarly, there would be arguments to abandon naming any supraspecific category and especially to abandon naming long successions of hierarchies (subtribe, tribe, supertribe, infrafamily, subfamily, etc.).

These weaknesses being stated, the zoological nomenclature system is quite dynamic in order to allow the incorporation of results of new research. Examples of data which have to be incorporated into the system are:

– the discovery of new species or new genera which need to be given names; the Code includes provisions on how the names have to be created;

– the discovery that some species in a genus actually belong to another genus or even represent an entirely new genus; again, the Code includes provisions on how these names have to be treated;

– the discovery that two different names have been given to a single species; such names are called **synonyms**; the Code has provisions that the oldest name (senior synonym) has to be retained (this is the principle of priority);

– the discovery that the same name had been given to two different species; such names are called **homonyms**; the Code has provisions that the first named species (senior homonym) has to retain the name while the junior homonym has to be replaced by a new name (this, again, is the principle of priority).

Several words will be used here in a very formal way which may differ from other meanings they might have in other contexts or in everyday usage. New names which satisfy the conditions of the Code are called **available names** and they can be used in zoological nomenclature. A name which does not follow these rules is an **unavailable name** and cannot be used. A **taxon** (plural: taxa) is any taxonomic unit (e.g., a family, a genus, a species). The **valid name** of a taxon is the oldest available name applied to it, unless it is invalidated by a provision of the Code; all the other names applied to the taxon are **invalid**. A name can thus be available but invalid. Junior synonyms and junior homonyms are invalid names. A name proposed without any description is called a **nomen nudum** (plural: nomina nuda) and is unavailable.

A **nominal species** is a nomenclatural concept denoted by an available name; it may be a **valid species** (a species distinguished by taxonomic characters), a synonym of a valid species or a name of uncertain status. The phrase 'nominal species' is commonly used to mean 'a species or a subunit of a species which at some time had been recognised as distinct but whose actual status is not relevant for the present discussion'.

Each family has a **type genus** which gives its name to the family (*Cyprinus* is the type genus of Cyprinidae), each genus has a **type species** and each species has one (or more) **type specimen(s)** (termed holotype, lectotype, neotype, paratype, paralectotype, or syntypes, depending of technical criteria – other 'type' categories have no nomenclatural status, e.g., allotypes, iconotypes, topotypes, etc.). Contrary to what non-systematists often perceive or state, this is not a typologist misconception; *a type is not an individual selected because it is thought to represent an idealised conception of the species.* A type is merely a name-bearer or a standard for a given name, and nothing else. That means that if one discovers that two species have been confused under a single name, the type specimen for that specific name determines to which of the two species the name has to apply; the other species must be designated by another name. Name-bearing types have an international validity and are the 'property' of the whole scientific community. They are kept and curated by institutions or museums which are responsible for maintaining them in a good state and for making them accessible to researchers; they are sensitive objects, are easily damaged, and should be curated with great care and handled only if justified. Authors should only deposit name-bearing types in internationally recognised collections with large holdings and permanent ichthyological staff. A new potential threat to the survival of old types is that they can now be used for 'biochemical systematics'; it is the responsibility of curators to ensure that types be used for such analyses only if justified by outputs relevant for nomenclature and if the resulting data can be used in a systematic context (see p. 19 for discussion).

A potential and significant source of nomenclatural instability in European ichthyology is the absence of types for many species. Systematics started in Europe, and logically, the first naturalists were interested in the European fauna and described a great number of species in the very early days of European ichthyology. The rules of nomenclature were very unstable at the beginning and, in a way, every researcher had his own rules (using the word loosely). Different 'rules' and concepts appeared (and disappeared) with time and it is only in this century that nomenclature became formally codified. The concept of a type, as explained above, only appeared around 1870. As a result, there are no formal type designations for most species described in the 18th and 19th centuries; in many cases it is possible to find out on which specimens the various new species descriptions were based and these can be considered as types (the Code also has rules about type definitions). But in a large number of cases, there is no extant type material. This particularly applies to the earlier authors who usually were also those giving the shortest or least detailed descriptions, and in several cases, it appears that these descriptions either were based on a mixture of several species, or could apply to a variety of species. This is potentially problematic and could lead to a great amount of nomenclatural instability if not handled properly. This is a field that workers without a serious background in the practice of systematics should refrain from entering.

Species concepts

I shall not discuss here if species have an actual existence in nature, independently of the judgement of an observer, or if they are mere concepts designed for the purposes of our subjective understanding of nature. The reader is referred to Griffiths (1974), Hull (1976) and Ghiselin (1975) for discussions on this subject.

I consider here that species are real entities. This means that "they may be discovered and recognised with greater or lesser success, depending on whether suitable techniques have been applied. Such species exist, whether we can recognise them or not, and the naming of such a species represents a hypothesis that the named unit corresponds to an actual entity in nature" (Brothers, 1985: 35). (I am not convinced that categories above the level of species exist or are objectively defined – but perhaps they are necessary; anyway the present work is essentially concerned with species and current nomenclatural rules require that species be given a generic and a specific names).

If species or higher categories were considered to be imaginary constructs, their naming would not be a hypothesis, and they would be "classes [concepts constructed from similarities], the membership of which is defined by the possession of essential characteristics specified by man" (Brothers, 1985: 35). The typological and nominalistic concepts (for history of systematics, see Mayr, 1982b) considering species as classes, they cannot be applied to real species.

Three main species concepts have been successively proposed which refer to real units in nature: the biological species concept, the evolutionary species concept, and the phylogenetic species concept. Clearly, the group of organisms studied or the aims of the research influences a researcher's view of what a 'species' is (Mishler & Donoghue, 1982: 493; Endler, 1989: 625), as do the genesis of this researcher's education, his social background, etc. (e.g., city born and educated biologists are unlikely to perceive nature's [un]organisation the same way as those born in country-side). It should be remembered that the earlier (and present ?) concepts were based on just a handful of groups like *Drosophila* flies and birds which cannot be taken as representative of the whole animal kingdom.

The **biological species concept** (BSC) appeared in the 1930s; in its classical form (Mayr, 1969: 26), it is restated as a "group of actually or potentially interbreeding populations, which are reproductively isolated from other such groups". The BSC has been criticised for theoretical (e.g., Sokal & Crovello, 1970) and practical reasons. The criticisms are:

– The BSC confuses pattern and process in speciation (Cracraft, 1982: 411, 1983: 170; Donoghue, 1985: 173), and it biases toward a particular type of process (Cracraft, 1987, 1989: 32). In other words, before identifying species, one has to identify a given process of speciation. But we wish to reach conclusions, even if the speciation process is not known (anyway, a speciation process can never be objectively known with certainty). From a pragmatic point of view, in complex groups with uncertain speciation histories (e.g., *Coregonus, Salvelinus*) there is an obvious advantage in having a process-free species concept. The BSC emphasises the process of reproductive disjunction and not the discovery of taxonomic differentiation, excluding the recognition of a large number of evolutionary taxa that are diagnostically distinct but not completely reproductively isolated from other such populations (Cracraft, 1983: 163–165, 1989).

– The BSC is difficult to apply in case of the existence of a contact zone between differentiated taxa (e. g. Warren, 1992) or can lead to the recognition of illogical taxa. Rosen (1979: 276–277) considered that it has logical flaws associated with its criterion of sympatry used to test for reproductive incompatibility.

– The BSC is not applicable to uniparental species.

The practical problems with the use of the BSC are even more serious than the theoretical ones. The key element in identifying 'biological species' is reproductive isolation; it can rarely be applied and researchers have to deduce reproductive isolation from other criteria (morphological, ecological, biochemical, ethological, etc.) which are *assumed* to reflect reproductive isolation or incompatibility; obviously, this is very subjective. Characters assumed to be adequate are likely to change with better knowledge and experience with similar cases. Additionally, there is not obligatorily a relationship between the potentiality of interbreeding and phenotypic or genotypic differentiation. Interbreeding is not therefore evidence of conspecificity (see discussion on the nonsignificance of hybrids, p. 17).

The BSC is only applicable in the case of sympatry; its inapplicability to allopatric units is "an underemphasised problem because there are thousands of allopatric ... populations" (McKitrick & Zink, 1988: 3). In order to incorporate allopatric populations, Mayr developed the polytypic species concept, in which disjunct populations would be considered conspecific if *assumed* to be reproductively compatible *if* brought into contact. Again this is a subjective decision. (A *polytypic* species should not be confused with a *polymorphic* species as is often done in literature; a polymorphic species is a species whose members can exhibit permanent or temporary different morphologies depending on sex, ontogenetic stage, social status, substrate, etc.).

As reproductive isolation is a criterion almost impossible to apply, more and more workers have had difficulties with standard practices or definitions of the BSC. Some have abandoned it (e.g., in ichthyology: Etnier & Starnes, 1986: 836; Warren, 1992), paid less or no attention to the criterion of reproductive isolation (e.g., Etnier & Bailey, 1989: 22) or concluded that using magnitude of differentiation as an argument for 'lumping' taxa "serves no purpose and would not be indicative of the biological factors involved in differentiation and speciation" (Buth & Mayden, 1981: 589). Common sense seems to require that a concept which is inapplicable, or applicable only if the key criterion is overlooked, has no great value and should be abandoned. In practice, systematic ichthyologists have generally considered morphologically distinct but allopatric populations as species; in North America, this has been applied for the Cyprinidae and Percidae, but not for the Salmonidae (Cavender, 1980: 296); this apparently corresponds more or less to areas and groups worked out by taxonomists, as against those worked out by non-taxonomists.

The BSC has been used mainly in ornithology and was felt not workable in most other fields, where it has been abandoned (Donoghue, 1985: 173). Although people frequently mentioned that they used the BSC, actually it seems that its basic criterion (reproductive isolation) could only be used in a handful of cases. Although irrelevant to the discussion of the BSC itself, it is worth mentioning that in many instances the authors who claim to have used the BSC probably did not understand it; for example, Steinmann's work on coregonids is supposed to be based on the BSC (Steinmann, 1952).

The argument (e.g., May & Ashlock, 1991: 27) that the BSC is important because it is widely accepted in a large number of biological disciplines is at best irrelevant in a discussion of species concepts. The supposed popularity of the context is not that obvious (see previous paragraph; also Mayden & Wood (1995: 101) and, anyway, popularity (or fashion, wide-acceptance, etc.) is not sufficient to justify the use of a scientific concept. Many once popular concepts, theories or philosophies lead to scientific fiasco, social disasters or mass murders; many unpopular ones later gained wide acceptance.

The above discussion of the BSC is based on Donoghue (1985), Cracraft (1983, 1987, 1989), Frost & Hillis (1990), Mayden & Wood (1995); McKitrick & Zink (1988), and Warren (1992: 33).

A variant of the BSC is the **'Recognition' species concept** (RSC) for which a species is the "most inclusive population of individual biparental organisms which share a common fertilisation system" (Paterson, 1985: 25).

The RSC changes the perspective from reproductive isolation to specific mate recognition and should correspond as closely as possible to the species as perceived by the organisms themselves, that is the actual unit in nature. My perception of nature makes me consider the RSC as making more sense than the BSC. However, it suffers from the same practical problem; that is mate recognition is usually *inferred* from other criteria. Also, the RSC is not process-independent (see Chandler & Gromko, 1989: 122).

The **evolutionary species concept** (ESC) was first proposed by Simpson (1961). As now understood, an 'evolutionary species' is "a lineage of ancestral descendant populations which maintains its identity from other such lineages and which has its own evolutionary tendencies and historical fate" (Wiley, 1978: 17). The ESC has been considered as non-operational and Rosen (1978: 176) considered that it "conforms, in practice, with Regan's (1926) definition that a species is what a competent taxonomist says it is". (Several authors quote Regan as having written "a species is what a competent taxonomist says it is"; they obviously have not checked the original. Regan [1926: 75] actually was more subtle and wrote "a species is a community ... whose distinctive morphological characters are, in the opinion of a competent systematist, sufficiently definite to entitle it ... to a specific name". Probably, this is still the most popular species concept).

In a review of species concepts and biodiversity, Mayden & Wood (1995: 108) and Mayden (1997) consider the ESC as the most flexible of the species concepts and recommend its use as a conceptual basis for units of biodiversity. They retain the species as being "an entity composed of organisms which maintains its identity from other such entities through time and over space, and which has its own independent evolutionary fate and historical tendencies". These works have been received too late for including a discussion of details here, but it seems that for practical purposes in the present context, use of the ESC or the PSC (see below) are equivalent and that many of the advantages of the PSC over the BSC listed below apply to the ESC vs. BSC. The differences mainly concern the recognition of ancestral species and fossil biodiversity.

Considering the difficulty or impossibility of measuring reproductive isolation as required by the BSC and the unclear role of reproductive isolation in speciation, a more objective concept, the **phylogenetic species concept** (PSC), has been proposed, based on the generally accepted statement that evolution occurs and produces differentiated taxa (Cracraft, 1983, 1987, 1989; Donoghue, 1985). A species is thus "... an irreductible (basal) cluster of organisms diagnosably distinct from other such clusters, and within which there is a parental pattern of ancestry and descent" (Cracraft, 1989: 34–35).

Species are recognised in terms of their hypothesised status as diagnosable evolutionary units (Warren, 1992: 34). It is definitively more objective to decide whether characters are diagnostic or not than to speculate on whether allopatric population could potentially hybridise or not. "The grouping criteria of the PSC are diagnosability and monophyly ... The smallest diagnosable cluster is given the rank of species" (McKitrick & Zink, 1988: 2). An advantage of the PSC is that it removes the necessity "to interpret [intraspecific] variation from a taxonomic point of view" (Cracraft, 1983: 171).

The most common objection to the application of PSC or ESC is that they result in an increase of the number of recognised species. I doubt that this argument makes sense: if these units are real, they should be recognised and I do not see the advantage of systematics which actually would conceal biological diversity. The potential 'increase' in number of species is compensated for by the removal from our classification of the numerous arbitrarily-defined subspecies (see Subspecies section, p. 17). I fully agree with Frost & Hillis (1990: 94) when they state "We believe that prior to phylogenetic analyses, or studies of geographic variation, it is better to overestimate biological diversity (...); we see no theoretical or operational advantage in underestimating biological diversity". Lets give the benefit of the doubt to unresolved stocks for which names are available.

The argument that recognition and naming of (let us say) 50 species of *Salmo* and 200 species of *Coregonus* would lead to a chaotic systematics of course is irrelevant. Under a given species concept, stocks or population satisfy or not the species criteria and are or not distinct species. The chaos does not result from the number of named species, but from the poor quality of the concepts, from their inconsistent application and from poor base-line work. I do not perceive a system which recognises 4 species of *Salmo* with 50 Evolutionarily Significant Units (ESU) and 1 species of *Coregonus* with 200 ESU as less chaotic, especially if all or most ESUs satisfy the species criteria (for further discussions of ESUs, see Mayden & Wood, 1995; Mayden, 1997). Speciose genera are known in most groups of organisms and unless unnatural (polyphyletic) they do not create problems; why should it be different for a few genera of fishes ? It is noteworthy that these discussions always centre around salmonids, coregonids and a few species of concern for fisheries. If the problem is merely administrative, biology simply cannot help; at best administrators may fund sound research by competent biologists to produce sound systematics as soon as possible.

Considerations on 'lumping' or 'splitting' (qualified as "traditional inanities" by Frost & Hillis, 1990: 94; I concur) do not contribute anything relevant to the discussion (incidentally, these considerations seldom originate from workers with practical experience of systematics); under the PSC or ESC, species are defined by objective criteria and are testable hypotheses. This is not the case with the BSC.

Considering the recent concern for biodiversity documentation and conservation, application of the ESC or PSC allows a better and more objective measure of biodiversity (see also Mayden & Wood, 1995). The use of a species concept which does not allow to recognise significant part of the biodiversity obviously reduces our ability to inventorise and manage this biodiversity.

Another argument against PSC is that its application may result in recognising and naming potentially unstable evolutionary units or short-lived species. Actually, all but very few species are probably short lived (one just need to consider the fossil record) and with this logic one should question the sense of naming fossil species or of naming just about anything. Anyway, short-lived species certainly exist in nature and I do not see any justification not to recognise and name them. If it could be demonstrated that a given species has been separated from its sister-species for only 300 years and evolved in this time span, it would certainly become the subject of much research, and even just for communication it would certainly need a formal name. Anyway, 300 years would already be a time-span longer than our present systematic practices, and something like six times older than the BSC or any 'modern' species concept. Such species are likely to survive a few more revolutions in biological thinking before ending their 'unstable' existence (if mankind gives them this opportunity). But I admit that there is probably no real practical point in naming species which can only be identified by biochemical subtleties. Any species, of course, has the potential to split into several independent lineages, but this does not mean that significant divergence must occur (Wiley, 1978: 23); when two populations are separated and diverge, it is subjective to use criteria such as magnitude of difference to deduce if they are conspecific or not, because this relies on experience with other taxa; in stressing diagnosability, the PSC is more objective because it relies on intrinsic characters. In freshwater fish, each basin or sub-basin has a potential for weakly differentiated populations; this possibly relates to the linear nature of their distributions (a drainage is a set of lines organised in an arborescent way and dispersal usually implies moving along the lines; movements across the lines often leads to speciation) while most terrestrial and aerial organisms have a two-dimensional distribution and dispersal possibilities.

Speciation is not necessarily linked with morphological (Larson, 1989: 583) or genetic divergence (Templeton, 1981: 24; see also example under *Gasterosteus*, p. 164) or adaptive radiation. Morphological divergence generally seems to be induced by the availability of new or non-exploited habitats or resources (but this does not mean 'environmentally induced', as too often translated); adaptive radiation generally seems to be a response to competition, but not directly a result of speciation. (In this context, one should not underestimate the influence of subjective sociological components in science: the psychic need to explain diversity and the perceived superiority of a paper creating a theory over those reporting diversity are responsible for many teleological theories [as well as unnecessary theorisation, rules, axioms, and wasted paper]; to be complete, one should blend these psychological components with nationalistic, political or religious idiosyncrasy, the semantic requirements of different languages and their influence on translation or perception of other's languages).

Finally, our ability or inability to perceive different lineages which exist in nature is not the key criterion for deciding whether they are real. The key criterion is the organism's ability to meet and recognise its conspecifics and several criteria are likely to be used which escape our sensory capabilities. Fish do not read our books and do not always know what they are supposed to do. If they could read they would certainly die of laughing (just as non-western populations can be shocked when they read ethnographic books on themselves or as I am surprised when I read a tourist guide on my country). 'Cryptic species' are only cryptic for our eyes or our tools, they certainly are not cryptic for individuals of these particular species (humans and apes are probably cryptic species for most deep-sea fishes).

The pragmatic species concept which I have mentioned elsewhere (Kottelat, 1995: 567; Kottelat & Ng, 1994) serves a quite different purpose, is much less sophisticated and has a much less elaborate theoretical base; but in application it would reach about the same result. In the precise case of the two systematic and nomenclatural nightmares of European ichthyology, coregonids and salmonids, the PSC could not be used consistently because the available data are too confusing, incomplete and incompatible, and I have had to resort to a blend of 'pragmatic species' taking into account the blurred result of the conjunction of a century of confused nomenclature, chaotic publications, teleological or metaphysical species concepts, incompatible methodologies and, on top of it, irremediable damage to the original populations resulting from translocation, introductions, hybridisation and extinction. This is discussed under the families concerned.

A few words seem justified here to point to the **non-significance of hybrids** for systematic analysis. Hybrids have often been used as indicator of genetic compatibility or as a measure of relationships (e.g., Dubois, 1982; Daget, 1983). On the contrary, Rosen (1979: 277) considered reproductive compatibility as a plesiomorphy marked by mosaic distribution within a group ("a primitive attribute for the members of a lineage and has ... no power to specify relationship within a genealogical framework"). As concluded by Howes (1981: 48), "this hypothesis would certainly account for those conflicting cases ... where supposedly phylogenetically closely related taxa fail and distantly related ones succeed in being reproductively compatible". While the inability to hybridise is a useful information, especially for species-level analysis, the ability to hybridise indicates that the two stocks have had a common ancestor sometime and somewhere, but does not allow any other conclusion and especially not a dating of the age of this ancestor neither in absolute nor in relative terms. The greatest use of hybridisation is not as a systematic but as an environmental indicator as it usually reflects environmental stress (natural or man-made) or introductions (Hubbs, 1955; Wheeler & Easton, 1978; Howes, 1981: 49; 1991: 8).

In the following checklist, I have tried to apply the PSC whenever possible. In most cases there is no significant difference between application of the different species concepts. The main difference concerns the way polytypic species and subspecies are treated (this also points to inconsistency of earlier concepts) as they are recognised as real entities by neither the PSC nor the ESC.

The **subspecies** seems to be a convenience construct. Many authors see the use of subspecies as a simplification of the classification. For example, Mayr (1982a: 594) sees "the downgrading to subspecies rank of every isolate, even when not clearly connected by intermediates, ... [as] an extraordinary simplification of taxonomy at the species level". I doubt the relevance of this kind of argument; I think that the aim of systematics is to describe nature as it is, not to find a simplified way; its task is not to introduce order, but to understand the existing order (if any, or the existing disorder). In any case, I do not perceive as real simplification the use of trinominals instead of binominals (the *ad absurdum* extrapolation of this simplification is Berg's [1932a] nomenclature for European coregonids in which a single species is recognised together with several subspecies, and more than a hundred infrasubspecies, natios, subnatios, morphs, varieties, etc.). I do not understand the purpose of simplifying a classification for convenience by denying the existence of real diversity. Anyway, within the framework of phylogenetic systematics, the subspecies is unobservable and undefinable (Rosen, 1979: 277). If a species is the smallest unit, it is logically not possible to construct something smaller than the smallest unit; subspecies are not evolutionary units and have no status under the PSC.

Mayr (1982a: 594) concluded that "the primary use of subspecies is as a sorting device in [museum] collections". If it is a clerical tool used for filing and shelving, then it is not more relevant for biological discussion than the size of the jars or the management software. After all, local populations can be talked about by geographic names.

Similarly, the hierarchy species, infraspecies, subspecies, infrasubspecies, natio, infranatio, subnatio, infrasubnatio, subsubnatio, etc. (e.g., Berg, 1935) cannot be adopted as the categories are not based on intrinsic characters of the units, but on a similarity with other units and subjective decision of the degree of distinctness.

Like the subspecies, the **polytypic species** is a taxonomic construct or a category of convenience, not an evolutionary one. Under the polytypic biological species concept, there is no consistent, objectively defined unit of evolution and the concept does not provide a sound ontological basis for the study of the pattern or process of speciation (Cracraft, 1989: 32).

Hereunder, the status of subspecies of earlier authors has been evaluated individually on the basis of available data. Where conclusions could be reached, the logical nomenclatural changes have been made. In other cases, heuristic comments are given on the data missing for reaching a conclusion or about existing problems.

Application of the PSC or ESC results in the disappearance of those subspecies which were nothing but arbitrarily delimited sections of clines, etc. Phenetic distances, which have often been used to justify recognition of subspecies, are irrelevant because they do not by themselves make a unit diagnosable; at best, they can be regarded as an additional tool to confirm the results of a character analysis. ("Some enthusiasts of similarity analysis seem to assume that this study alone is the key to understanding the world and all else is non-sense. They are consequently led to futile efforts to construct concepts of other kinds as similarity extension. [The] book by Sokal & Sneath (1963) [...] consists largely of an exegesis of methods unsuited to the apparent purpose"; Griffiths (1974: 89). This apparently also applies to any similar indices and genetic distances. McKitrick & Zink (1988: 9) note that an individual discriminant score might be a diagnostic 'character' but that it is not clear if it is heritable and indicates a monophyletic group.

As a result of the strict application of the Code, of the application of the PSC and in some cases the critical review of the available data, the resulting check-list differs from those of earlier authors. There are some modifications in nomenclature, but the most striking difference is in the number of recognisable species resulting from the reevaluation of the subspecies of earlier authors (the subspecies concept completely disappears) and of a pragmatic and heuristic handling of salmonoid nomenclature to replace biological nonsense, systematic heresy and nomenclatural chaos.

Some may argue that such abrupt changes as in the case of salmonoids is threatening the stability of nomenclature. Frankly, this cannot be the case when one considers 150 years of nomenclatural anarchy and that names presently in use do not even follow the most basic principles of zoological nomenclature. The proposed nomenclature follows the conclusions of such sound systematic data as are available and is not very different from what is presently done by sensible fisheries managers with the use of scientific names followed by a river or a lake name to distinguish particular stocks. A correct formal nomenclature therefore should facilitate communication. It points to evolutionary uniqueness of several species/populations (as well as the uniqueness of several communities) and attracts attention to their threatened status, biodiversity value and conservation needs. Coregonid and salmonid populations have been so much impacted by translocations, introductions and extinctions that it is difficult to clarify further their systematics on an European scale. This might be possible but would require a fair funding and that the funding goes to trained and competent systematists.

Proofs of the need for a sound and coherent formal nomenclature abound and the consequences of poor taxonomic practices can be dramatic. Gerdeaux (1993: 23) reports that in 1982, following a decrease of coregonid catches in lake Genève, eggs have been imported as *Coregonus lavaretus* and later turned out to be *C. peled*. The pre-existing situation is confusing (the two names are likely to be incorrectly used; the endemic species of lake Genève are extinct; the local stock is the result of introductions) and accidental introductions might have devastating effects in many watersheds and lakes. A formal nomenclature recognising unambiguously the different stocks contributes to reduce such risks.

In the following taxonomic discussions, I have tried to avoid using distribution patterns as evidence in favour of one or the other decision. Sound zoogeographic analysis has to be based on systematics and phylogeny, and to use the zoogeographic conclusions of others as the base for systematic decisions which will in turn be used by others to support zoogeographic discussions quickly leads to circular reasoning. This circular reasoning is only avoided by the sole use of intrinsic characters of the taxa. The same kind of circular reasoning also seems to be present in some genetic or morphometric analyses where distances are considered as indicating a given taxonomic level or rank.

Infrasubspecific taxa are taxa of a rank lower than that of a subspecies, i.e. subdivisions of the subspecies. Infrasubspecific names are a significant source of potential future nomenclatural problems. The Code is very precise about them: they are not available for nomenclatural purposes (ICZN art. 1(b)(5)). This explicitly applies to the race, natio, subnatio, infrasubnatio, morph, aberratio, etc. categories frequently used in eastern European literature (ICZN art. 45(f) and example). The exceptions are 'forms' and 'varieties' described explicitly as such; if published before 1961 they can be considered as subspecies under certain conditions (ICZN art. 45(g)(i)). Those proposed after 1960 are infrasubspecific and therefore not available (ICZN arts. 16, 45(g)(ii)). A name which is not available cannot be used in nomenclature.

The problems is that an infrasubspecific name becomes available if it is used subsequently as a name for a species or a subspecies; its author is the one who first uses it as a species or subspecies (ICZN arts. 10(c), 50(c)(i)); its publication date, types and type locality are determined by that usage (if done before 1985 and if precise conditions are satisfied, the name might be available with its original author and date [ICZN art. 45(g)(ii)(1)]). In practice, this means that an author who inadvertently uses an earlier infrasubspecific name as a subspecific one is deemed to be the author of a new subspecies (or makes available an unavailable name). Example: *Leuciscus leuciscus* natio *roulei* Vladykov (1931) is an infrasubspecific name and thus is not available; but the inadvertent use of the name with the form of a subspecies (*Leuciscus leuciscus roulei*) by Bertin & Estève (1948) in a type catalogue where it is treated as available *and* adopted as the name of a subspecies makes the name available. As the use of infrasubspecific categories has been quite chaotic and inconsistent, and often the work of non-taxonomists, such inadvertent new names or validations occur not infrequently. The problem in most instances is to trace the oldest use of a given combination and I see there a great potential for nomenclatural instability. In order to avoid the inadvertent creation of nomenclatural problems, *authors who use names for units of a rank lower than the subspecies or for morphs or varieties should never use a latinised or an italicised name.* It is wrong to use latinised and italicised trinomens for a morph or a variety because a trinomen means a subspecies (see also Species Concepts, p. 13).

The use of infrasubspecific names should be discontinued, even if the involved stocks are later considered as valid species. In such cases, new names should be created to avoid confusion.

Biochemical and genetic techniques

The development of biochemical and molecular systematics has often led to what is yet the fantasy that herein lies the ultimate answer. These new techniques certainly contribute to our understanding of evolution and phylogeny of fishes, but until now the number of papers really contributing to this knowledge and leading to actual conclusions is limited. The problems are not in the techniques themselves, but more in the philosophy with which they are used and the way results are interpreted. The weakest point is that these techniques are often applied not by systematists working on a precise group of which they already have a minimum knowledge, but by researchers more interested in the technique itself. It is diagnostic that in several of these studies one can read that the authors' experience of the species is limited to tissue samples sent by correspondents. One is always tempted to equate discrepancies between these and morphological data with misidentification, and only too often this cannot be contested as there is no voucher of the examined material. Most of the difficulties arising in analysis of morphological systematic data are also encountered with molecular data (Avise, 1983: 104). "Not all species should be expected to differ from one another for either allozymes or DNA sequences that we are currently able to visualize" (Mayden & Wood, 1995: 85).

A recurrent problem is that results are often presented as 'distances' which may be of interest for phenetic reconstruction (admitting that all taxa within a lineage have been investigated, which is only exceptionally the case; a situation hardly acceptable for phylogenetic studies), but uninformative for systematic analysis as there is no theory to support the link of a given distance with a given systematic relationship or taxonomic rank. Moreover, distances like Nei's (1978) genetic distances, are based upon allele frequencies and are not strongly affected by unique alleles at low frequencies (see, e.g., Beaumont et al., 1995: 887). In a phylogenetic study, this means that the phylogeny would be based mainly on plesiomorphic character states and that apomorphies would be neglected; this disagrees with the accepted principles (p. 10) that a reconstructed phylogeny has to be supported by apomorphies and that plesiomorphies are uninformative.

The non-significance of distances is evidenced by the available data on African Cichlidae. Mitochondrial DNA data (Meyer et al., 1990; Avise, 1990) on the speciose cichlid species-flocks of lake Victoria, Africa showed that the flock contains less genetic variation than the human species – which itself exhibits less intraspecific variation than many other vertebrates. See Moran et al. (1994: 282–5) for restriction enzyme analysis of mtDNA of lake Malawi cichlids with similar results and discussion of limits of mtDNA analysis and problems associated with time estimations based on sequence divergence.

Doyle (1992: 161) commented that "molecular systematics .... ironically may represent an insidious new form of one-character taxonomy" and this should be seriously considered, as well as the distinction between phylogeny of organisms and phylogeny of genes. A gene-tree is not a species-tree. The reader is also referred to Miyamoto & Cracraft (1991), Minelli (1993: 59–61) and Avise (1994) for a more detailed summary of biochemical and molecular systematics.

On 'classical' vs. 'modern' taxonomy. Some authors have been tempted to distinguish between what they perceived as 'classical' taxonomy and 'modern' taxonomy and statements like "classical taxonomy alone cannot solve this question" are not rare (see also discussion of *Salmo*, p. 130). Beside the fact that there is no definition of what 'classical' and 'modern' taxonomies are, a few comments are in order.

There is not a dichotomy between a 'classical' and a 'modern' taxonomy. There is a taxonomy which can use morphological, ecological, biochemical, ethological or any other type of data, *providing* that they are presented in a usable format. They are not alternative taxonomies, they are complementary data sets. The main problem is that most of the 'modern' taxonomic data are presented in a way which makes them impossible to incorporate in taxonomic analysis; in other words, the 'modern' data are too often presented in an antiquated fashion which makes them useless for modern systematic analysis.

In most cases (and all those I looked at) where it is advertised that 'classical taxonomy' could not solve a given systematic problem, it appears that: 1) no competent taxonomist ('classical' or 'modern') investigated the case; and 2) the case has not been solved by 'modern' taxonomy either. (The trivial case that the 'problem' is already solved for a long time also occurs).

Certainly the molecular techniques (and other still to be discovered techniques ...) will progress and hopefully most of the conceptual shortcomings can be addressed. But still, this does not mean that a single technique alone will answer all questions and it does not mean that morphological methods are becoming obsolete. Biochemical and molecular data form, at best, an additional set of characters, nothing more. "We will have to be content, for centuries if not millennia, with imprecise verbal descriptions of many biological characters" (Griffiths, 1974: 113).

Morphology and comparative anatomy, among others, share the positive aspect that students need to 'meet' the organism they study and to *describe with words* (a psychical process of the utmost importance) what they see and the patterns of relationships they perceive; these aspects have to be incorporated into biochemical systematics too, or they will not be systematics but mere button-pushing science, expensive machine testing or computer games.

It is not rare to read comments, usually emanating from uninformed biologists or from lay persons, that taxonomic decisions should not be based on morphology alone but should wait for information on genetics, biochemistry, ethology, etc. Indeed, taxonomic hypotheses should ideally include all possible data. But 'all possible data' means an endless catalogue of possible additional research and methods. While this may be intellectually desirable, for any practical purposes it does not make sense. This criticism sometimes also hide other, less scientific arguments (an inability to conclude or to switch to another project, rivalry, etc.). One must be able to take decisions and to once close a case (it can always be re-opened if needed).

With the limited funding available for systematic research, priorities have to be set (Kottelat, 1995) and I doubt that an exhaustive survey with all possible tèchnologies is reasonable. Methods have to be selected according to the needs and the questions to be answered. While it can be justified that a plethora of methods be used to investigate a particularly interesting case, it is not desirable (and financially feasible) to routinely apply all possible methods to every case. In most instances, a trained eye and morphological analysis will always be the fastest, most efficient and cost-effective means of answering identification problems, especially outside of a laboratory. More sophisticated and expensive methods should be used in priority to investigate cases where these methods really have something to contribute. One should also distinguish between using a method to solve a problem or using a problem to test a method.

Checklist

Content and limits of the present checklist. First of all, the following checklist is not an authoritative or ultimate treatment of the systematics of European freshwater fishes. A greatly underestimated amount of work remains to be done before we reach an acceptable level of knowledge. In several instances where data were ambiguous or contradictory, I have tended to chose unconventional alternatives, not for the pleasure of being provocative (criticism will surely focus on these few unconventional alternatives and overlook the overwhelming number of cases where I followed conventional conclusions) but partly because unconventional positions will attract more attention and hopefully generate the much needed detailed studies.

Taxonomy and systematics have two main goals. One is primarily of academic interest, to elucidate phylogenetic relationships among living organisms. The other is of immediate practical interest: inventories, surveys, documentation of biodiversity, and compilation of identification tools. For proper management of natural resources, we need information on number of species and their identification now, not in 50 years. If definitive conclusions are not possible with the available data, then tentative decisions are needed. As for other components of environment management strategies, the precautionary approach should be the rule. In the present context, in case of doubt on the distinctness of two species, the precautionary approach is to treat them as distinct awaiting (possible) further research.

The checklist includes references to original descriptions of all freshwater fish species naturally occurring in Europe (exclusive of the former Soviet Union) as well as their synonyms. Introduced species which became established are listed, but neither references nor synonymies are provided, except for those synonyms based on material from European localities. Marine species regularly entering freshwaters are included. These references have been checked in the original publications. Publication years in **bold face** indicate references which were not accessible and which I could not check personally; in such cases the source of the record is usually indicated. It might be argued that it would be better to postpone such a publication until all of these references could be checked or until all the problems can be solved. From a strictly academic point of view, this is possibly correct. But, again, from a practical point of view and when considering the needs and use of systematic data by other fields, it seems desirable to publish now. The present state is a compromise between the justified desire for exhaustiveness, urgency of needs, and time needed to reach the missing literature because clearly the point of diminishing returns has been reached and the efforts to examine the few remaining references have been vain or would represent travel and time expenses far greater than those needed for all the already examined literature.

Families and genera. Families are listed following the sequence in Nelson (1994). When there is disagreement between authors about limits of genera or higher categories, I generally followed common practice, but have noted alternatives.

Transliteration of non-Latin alphabets. Author names, place names, and journal names in non-Latin alphabets have been transliterated; titles of books and papers have been translated. When a transliteration is used in the original paper, the same spelling is used here. As it happens that different transliterations have been used in the literature for the same name, some inconsistencies may result. Frequently, transliteration systems have changed with time and no standardisation has been attempted here. Older bibliographies or indexes used earlier transliterations systems and I consider that a standardised use could actually complicate data retrieval, especially for those not familiar with these languages.

Unfortunately, some accents and diacritic marks disappeared as standard western European softwares do not support them.

Geographic coverage. All species occurring in freshwaters of Europe west of the former Soviet Union are included. Species known only from the countries of the former Soviet Union have not been included, not because of lack of interest, but because of the near impossibility of locating a significant amount of both recent and ancient literature in libraries accessible to me and also my inability to read it, thus to objectively extract data from it. Synonyms of European species based on material from European Russia, Ukraine, Moldova, Belarus, Latvia, Lithuania, Estonia, Armenia, Georgia, Azerbaidjan, etc. are also given; these have not been checked methodically, but only whenever I came across relevant literature. Synonyms of European species based on Asian, North African material are listed when I encountered them and when the synonymy seemed reasonable. Synonyms based on North American material have usually been omitted. In most cases, I suggest that these synonymies should be examined very carefully and should be confirmed by critical revision. The purpose of the inclusion of these extra-European synonyms is to illustrate the geographical dimension of the systematic problems to be solved.

Listed names. I list all names which I found, including infrasubspecific names which are given in their original form. The only names which are not included are those subspecific or infrasubspecific epithets *typicus* when they are just intended to denote the nominotypical subspecies; such names are usually not nomenclaturally correct and should not be used; in one case (*Salmo letnica typicus*), this epithet has been 'widely' used and I traced its origin.

Spellings. In the synonymies, all names are given with their original combination (except that interpolated subgeneric names are omitted) and spelling, including misspellings, capitalised letters, and diacritic marks (which have to be emended, ICZN arts. 27, 28, 32(c), 32(d)).

Publication dates. Publication years have usually been accepted as they appear in the publications, unless a different, actual date is well documented. For nomenclatural purposes the actual publication date might differ from the published one, but I did not search exhaustively for effective publication dates; this would have been very time and effort consuming and the expected return justifies it only in cases where respective priority of two names is involved or if one has to determine if a given work appeared before or after some of the dates important to the ICZN. Additionally, dates as they appear in the publication are much more important than actual dates for efficient retrieval on library shelves or interlibrary loans.

Type localities. The type locality is the locality where the holotype, lectotype or neotype was collected. In cases where there is only a series of syntypes, the various localities are listed (separated by a slash [/] where clarity required it). In a few cases when the list of localities is too extensive, I have merely given a general description of the localities. *Localities are usually given with the original spelling*; this sometimes results in the same name being spelt differently under different headings; I have tried to introduce some consistency, but only in cases where I was certain that different authors were really referring to the same place under different spellings. Alternative spellings or modern equivalents are occasionally given in square brackets. Locality descriptions have been translated into English when possible; in some cases, words meaning river, lake, etc. are part of the name in the original language and they have not been deleted in order to avoid ambiguities when using local maps [but the name river, lake, etc. has been added]. Local names have been used, except for a few well known rivers (e.g., Rhine, Danube) and lakes. For larger topographic features which have several different names, a single one has been consistently used; this especially applies to several of the central European lakes; I usually retained the name easiest to find for readers not familiar with local toponymy (e.g., lake Genève instead of Léman, lake Konstanz instead of Bodensee, lake Garda instead of Benaco, lake Maggiore instead of Verbano or lake Locarno).

Type localities are given only for those original descriptions which I have seen personally. For the others I list the 'locality' as indicated in my sources and wait for direct examination before confirmation of the type locality. Infrasubspecific names and nomina nuda having no nomenclatural status, they do not have a type locality and I thus list only a 'locality'. Localities are usually not indicated for infrasubspecific names based on aberrant specimens; they are given only if the name has been created for a particular geographical form.

FYROM stands for Former Yugoslavian Republic of Macedonia.

Primary types. Primary types only are listed. Primary types are holotype, lectotypes, neotypes and syntypes; holotypes are recognised only if explicitly designated as such (alternatively as 'type', singular) by the original author, or if there is clear evidence that the author based the species on a single specimen. In all other cases, type specimens are syntypes. References to the designation of lectotypes or neotypes are given. Paratypes and paralectotypes are not listed as they have no significance as name-bearing types. Other 'type' categories (e.g., allotypes, topotypes, paratopotypes, paraneotypes) are not recognised by the ICZN, should not be used and are ignored. When known, institutions where the primary types are deposited have been listed, together with accession register number. The source for the catalogue number is given whenever it is not the original description; data on material in NMW, ZMB and NRM have been provided by B. Herzig, H.-J. Paepke and S. O. Kullander, respectively. When there is a series of syntypes, I listed those which I could trace in the literature, but made no effort to trace the whole series; this would have been tedious, a good number of them having been used for later exchanges between institutions, etc. NT indicates that there is *apparently* no preserved type material, LU that there was apparently type material but that the location is not known. A question mark (?) following the acronym indicates that the material is probably deposited in this institution but that it should be confirmed. Institution acronyms follow those in Kottelat et al. (1993) which are those provided by the concerned institutions; for institutions for which no acronyms have been given, acronyms follow current use by workers at that institution (when possible) or Leviton et al. (1985; Leviton & Gibbs, 1988). (I did not follow Leviton et al. as a standard because for non-US collections, the acronyms they list often are not those actually used by the institutions themselves). The present status of collections earlier stated to be in Ferrara, Pavia (Italy), Istambul (Turkey), Metz, Poitiers (France), and Valencia (Spain) is not known.

AMNH, American Museum of Natural History, New York, USA;
ANSP, Academy of Natural Sciences, Philadelphia, USA;
BELUM, Ulster Museum, Belfast, U.K.;
BFSU, Department of Hydrobiology and Ichthyology, Biology Faculty, Sofia University, Sofia, Bulgaria;
BMNH, Natural History Museum (formerly British Museum, Natural History), London, U.K.;
BZF, Bioloski Zavod, Titograd, Montenegro;
CUP, Charles University, Praha, Czech Republic;
DZAUT, Department of Zoology, Aristotle University, Thessaloniki, Greece;
EAWAG, EAWAG Forschungszentrum für Limnologie, Kastanienbaum, Switzerland;
GNM, Naturhistoriska Museum, Göteborg, Sweden;
HZM, Hrvatski Zooloski Muzek, Zagreb, Croatia;
IMNH, Iceland Museum of Natural History, Reykjavik, Iceland;
ISBB, Institutul Stiinte Biologice, Bucuresti, Romania;
ISNB, Institut Royal des Sciences Naturelles, Bruxelles, Belgium;
IZA, Dipartimento di Scienze Ambientali, Universita, L'Aquila, Italy;
IZPAN, Zoology Institute, Polish Academy of Sciences, Warszawa, Poland;
LJG, Landesmuseum Joanneum, Graz, Austria;
LSL, Linnean Society, London, U.K.;
MB, Museu Bocage, Lisboa, Portugal;
MCZ, Museum of Comparative Zoology, Cambridge, USA;
MCVR, Museo Civico di Storia Naturale, Verona, Italy;
MGAB, Museul de Istorie Naturala 'Gr. Antipa', Bucuresti, Romania;
MHNG, Muséum d'Histoire Naturelle, Genève, Switzerland;
MHNN, Musée d'Histoire Naturelle, Neuchâtel, Switzerland;
MMB, Moravské Muzeum, Brno, Czech Republic;
MMNHS, Macedonian Museum of Natural History, Skopje, FYROM;
MNCN, Museo Nacional de Ciencias Naturales, Madrid, Spain;
MNH, Magyar Nemzeti Múzeum, Budapest, Hungary;
MNHN, Muséum National d'Histoire Naturelle, Paris, France;
MNHV, Museum of Natural History, Varna, Bulgaria;
MNHW, Museum of Natural History, University, Wroclaw, Poland;
MSNG, Museo Civico di Storia Naturale, Genova, Italy;
MSNM, Museo Civico di Storia Naturale, Milano, Italy;
MZH, Zoological Museum, Helsinki, Finland;
MZUT, Museo Zoologico, Universita, Torino, Italy;
NMC, National Museum of Canada, Ottawa, Canada;
NMI, National Museum, Dublin, Ireland;
NMNHS, National Museum of Natural History, Sofia;
NMW, Naturhistorisches Museum, Wien, Austria;
NRM, Naturhistoriska Riksmuseet, Stockholm, Sweden;
OLL, Oberösterreichisches Landesmuseum, Linz, Austria;
RMNH, Nationaal Natuurhistorisch Museum (earlier Rijksmuseum van Natuurlijke Historie), Leiden, Netherlands;
SMF, Forschungsinstitut Senckenberg, Frankfurt, Germany;
SMNS, Staatliches Museum für Naturkunde, Stuttgart, Germany;
SNM, Slovenské Národné Múseum, Bratislava, Slovakia;

USNM, National Museum of Natural History, Washington, USA;
UUZM, Uppsala University, Zoological Museum, Uppsala, Sweden;
ZISP, Zoological Institute of the Academy of Sciences, St. Petersburg, Russia;
ZMB, Zoologisches Museum, Humboldt Universität, Berlin, Germany;
ZMH, Zoologisches Museum, Hamburg, Germany;
ZMMSU, Zoological Museum, Moscow State University, Moscow, Russia;
ZMT, Georgian State Museum (earlier Caucasus Museum), Tbilisi, Georgia;
ZMUC, Zoologisk Museum, København, Denmark;
ZSM, Zoologische Staatssammlung, München, Germany.

Infrasubspecific names. For infrasubspecific names, I have indicated the locality stated by the original author, but have not listed material. Even if these have been called type localities and types, as the names are not valid (in the sense of the ICZN), these type localities and types have no nomenclatural validity.

Whenever I found an infrasubspecific name validated by a subsequent use as a subspecies I noted it; if such subsequent uses are not listed, it does not mean there is none, just that I did not find one. Most of these 'validations' have been accidental (the authors were not aware of the nomenclatural implications of their decisions) and appeared in non-systematic publications and usually escaped indexing. A search through the whole ichthyological literature was simply not feasible during the time available. An other obvious bias of this search is that I have had only a limited access to eastern European (especially Russian) literature.

Stocks. In discussions, I generally use the neutral word 'stock' to designate groups of individuals whose taxonomic status or entity is not ascertained. This has the advantage of avoiding confusion with other categories regularly used in systematic discussions, like population, species, form, etc.

Vernacular or common names. Common names are not listed, because there is no list of standard and accepted vernacular names for European fishes. Lists of common names exist for some countries (e.g., USA and Canada, see Robins et al., 1991) but it is not certain that this is easily possible (or really needed) for Europe. While it makes sense in a large area with one or two official languages to have a single common name for each species, in the European context (with some 25 official languages) it is less obvious. If the need arises, I feel that this should be achieved by a representative society or committee, and European ichthyologists would be advised to establish a list by themselves before some list be imposed on them from outside or, worst, by bureaucrats. At present, the most universal common names are still the scientific names. Blanc et al. (1977) provides a list of local names in most European languages for the species then recognised.

I only occasionally use vernacular names in this text. To follow English usage in scientific literature, common names are not capitalised; when non-English local names are used, they are consistently without capital initial, even if derived from languages (e.g., German) which require that nouns be capitalised. Vernacular names are only used where this makes comprehension easier or removes risks of ambiguities. The nomenclature of species of *Coregonus* has long been so confused that most workers still distinguish them mainly by their vernacular names and in order to clarify the link with earlier works, I usually give the main local names in the various lakes; these local names should be used carefully because a single name may be used in different lakes for different species, or different names may be used in different places for a single species.

For species with restricted distribution for which a single, unambiguous name is locally used, this name should be retained as vernacular name, unless a well accepted English name already exists.

Linnaean species. The synonymy of species described by Linnaeus (Linnaean species) and other early authors present particular problems. In his *Systema naturae*, Linnaeus (1758) based most species on earlier accounts by himself or others. These have been traced and the exact bibliographic references are given. Those titles I could access have been examined; very often this actually creates additional problems because these authors themselves refer to older publications, etc. I have usually not included such 'secondary' citations. Additionally, several of these earlier works exist in various editions and Linnaeus's bibliographic references are not detailed enough to decide which one he used; for example, I have had the rare opportunity of examining side by side nine different editions of Gesner's *Nomenclator aquatilium* and *Fischbuch* but could not find all texts to which Linnaeus referred (it might be best to use Linnaeus's own copies in the library of the Linnean Society of London; A. Wheeler, pers. comm., 1996). As these books usually are considered to be antiquities or collector items, interlibrary loans or photocopies are not possible; to examine and compare various editions would mean travelling to many different libraries and quite some time and money and it was beyond the limits of the present work. The utility of the exercise also is not obvious in most cases. In such instances, I merely list the reference as given by the original author. References to unpublished data are omitted as they are not relevant for nomenclatural purposes. Type localities listed are those given by Linnaeus; but the actual type localities are those listed by the authors on which Linnaeus based his accounts. Where holotypes are extant, or if lectotypes or neotypes have been designated the localities of these specimens of course becomes the type localities. To identify Linnaeus's type specimens, one has to follow about the same procedure, that is to find the specimens on which the accounts cited by Linnaeus are based (for examples, see Wheeler, 1958, 1985, 1991; Fernholm & Wheeler, 1983). This is a very tedious and time consuming task; unless already documented in the literature, I made no attempt to this, but obviously this work has to be done for some of the Linnaean species in order to stabilise their nomenclature and clarify their identity.

Systematic and nomenclatural notes. I have distinguished between comments on systematics and comments on nomenclature. I have found that a frequent source of confusion in earlier works resulted from the mixing in the same discussion of two completely different topics, species and names. Comments on systematics relate to species (their number and distinctness, their relationships, their generic position, their distribution, etc.). Comments on nomenclature relate to names (their validity, their authors, their publication date, their name-bearing types, their type localities, etc.). Keeping the two issues distinct eases the discussion and also draws the line between biology (on which research should focus) and nomenclature (a marginal, but necessary concern). Systematic problems should be resolved before addressing nomenclatural aspects. The resolution of systematic problems is independent of nomenclatural issues, while nomenclature depends of systematics.

Petromyzontidae

1.1.1 *Eudontomyzon danfordi* Regan, 1911

Lampetra minor Grossinger, 1794: 207 (not binominal, name not available)

Eudontomyzon danfordi Regan, 1911a: 200 (type locality: Transylvania and river Sebés, Romania; syntypes [total 13]: BMNH 1951.5.22:1–5 [6], Renaud & Holčík, in Holčík, 1986: 147)

Lampetra Bergi Vladykov, 1925a: 251 (type locality: not explicitly stated, but can be assumed to be the upper Tisza basin, Ukraine; syntypes: LU [about 100])

Lampetra (Eudontomyzon) gracilis Kux, 1967: 294 (type locality: stream Topľa, Lukov [river Tisza basin, Slovakia]; holotype: MMB 1247/7)

Systematic notes. *Eudontomyzon gracilis* is treated as a synonym of *E. danfordi* by Renaud & Holčík (1988: 127).

1.1.2 *Eudontomyzon hellenicus* Vladykov, Renaud, Kott & Economidis, 1982

Eudontomyzon hellenicus Vladykov, Renaud, Kott & Economidis, 1982: 2898, fig. 1 (type locality: brook Kefalárion, a tributary of river Struma, near Kefalárion, Greece; holotype: NMC 77-1773)

Systematic notes. This species has earlier been recorded with a disjunct range; it appears that two species might be involved (Economidis, 1995: 201).

1.1.3 *Eudontomyzon mariae* (Berg, 1931)

? *Petromyzon ponticus* Yashchenko, **1895: 95** (nomen nudum; Noworossijsk, Russia) from Berg, 1911: 40

Lampetra mariae Berg, 1931: 94 (type locality: river Kharkov near Kharkov, river Donets basin, Ukraine; syntypes: ZISP 23124 [36])

Systematic notes. See *Eudontomyzon danfordi* for status of *Lampetra minor*.

Hubbs & Potter (1971: 46) mention that the non-parasitic *Eudontomyzon* (*E. vladykovi*, *E. mariae*) may comprise an irregularly distributed complex of variable forms. *Eudontomyzon vla-*

dykovi is considered as a valid species by Hubbs & Potter (1971: 45) and Holčík (1963). Holčík & Renaud (in Holčík, 1986: 166, 174) treat it as a synonym of *E. mariae* but without giving arguments; they further comment that three subspecies might be recognised after further studies: *E. m. mariae* (Neman and Vistula basins, and Black Sea drainage), *E. m. vladykovi* (Danube basin) and *E. m. stankokaramani* (Drin and Vardar basins). Considering that they are diagnosable and have discrete and disjunct distributions, I treat them as valid species. Contrary to Holčík & Renaud (in Holčík, 1986: 172), I cannot treat them as a cline because they are discrete populations without gene flow. I am willing to admit a relation between temperature (as inferred from latitude) and number of myomeres if it is demonstrated for a given population, but not as a rule or implied from data for another species.

The trunk myomere counts of *E. stankokaramani* only slightly overlap those of *E. vladykovi* (58–62, mean 60.2, vs. 61–67, mean 63.1) and only marginally overlap those of *E. mariae* (62–73, mean 66.1) (data extracted from Holčík & Renaud, in Holčík, 1986: 169). The only '*E. mariae*' population whose myomere counts overlap to some extent with *E. stankokaramani* is the Kuban one (59–65, mean 61.8). River Kuban is on the northern slope of the Caucasus, at the eastern extremity of the range of *E. mariae*. The population of the next basin to the west, the Donets, has very distinctive counts (64–73). To me, the distribution of these counts is not suggestive of a single, variable species, but more of the existence of four species with discrete and disjunct distributions. There is apparently no name available for the Kuban species.

The main weakness of the present argument is the same as can be used against Holčík & Renaud (in Holčík, 1986): these counts are compiled from many different sources and there is no certainty that all have been obtained with the same method. Awaiting better data, we have no choice but to use them. Information on additional characters would be needed, too.

1.1.4 *Eudontomyzon stankokaramani* Karaman, 1974

Eudontomyzon vladykovi stankokaramani Karaman, 1974b: 2, fig. 2 (type locality: brook Istočka Reka near Istok (vicinity of Peć) and brook Rastavički Pateek near Peć, tributaries of the river Beli Drim, Serbia; holotype: LU)

Systematic notes. See *Eudontomyzon mariae* for discussion of systematic status.

1.1.5 *Eudontomyzon vladykovi* Oliva & Zanandrea, 1959

Eudontomyzon danfordi vladykovi Oliva & Zanandrea, 1959: 2 (type locality: river Danube near Čilistovo, Bratislava, Slovakia / Linz, Prater Krieau, Grünau [Wien], Graz, Styrien, Austria / river Drava [Croatia] / lake Maksimir, Zagreb, Croatia / Sava and Drava basins, Serbia / stream Ljubjana in Ljubljana, Slovenia / creek Topľa, Tibisco [Tisza] basin near Lukov, Slovakia; syntypes [total 348, see list in Zanandrea, 1959: 239]: CUP 4525 [1, Čilistovo], other specimens in CUP, MCVR, OLL, NMW 50013 ? [1], 50020 [1], 76823:1 [1], LJG, ? HZM)

Systematic notes. See *Eudontomyzon mariae* for discussion of systematic status.

Nomenclatural notes. According to Holčík (1963), the paper by Oliva & Zanandrea (1959) appeared before Zanandrea's (1959) original 'description' of *Eudontomyzon danfordi vladykovi* and the name is thus available from this earlier paper. Oliva & Zanandrea referred explicitly to a specimen from the Danube river in Čilistovo, Slovakia and illustrated a specimen from Graz, Austria; they also explicitly mentioned having examined lampreys from the Danube basin in Austria and Yugoslavia for which they state having used the name *E. d. vladykovi*; there is a reference to Zanandrea (1959) which was then in press. Finally (p. 4) there is mention of one more locality, Lukov. No holotype is clearly stated and thus all specimens included by Oliva & Zanandrea constitute the type series (ICZN art. 72(b)(i)), that is the Čilistovo and Graz specimens as well as those which Zanandrea (1959a) had examined. Holčík (1963: 57) designated a neotype but this designation is not valid because it does not fulfil the conditions of ICZN art. 75(d), especially condition (iii), the demonstration that all the syntypes are lost. Holčík examined the Čilistovo specimen which is a syntype; the argument that the oral disc is damaged (although critical for an accurate identification) is nomenclaturally irrelevant to discard this specimen as a syntype.

1.1.6 *Eudontomyzon* (?) sp.

Systematic notes. According to Holčík & Renaud (in Holčík, 1986: 174), the large (up to 280 mm TL), anadromous, parasitic lamprey from the Prut (the river making the border between Romania and Ukraine), the Dniester and the Dnieper reported by Wajgel (1884: 317) and Zhukov (1965a:

73, 1965b, 1968, **1975**) is a still unnamed species apparently related to *E. mariae*. It is now extinct (Holčík, 1995: 27) and the causes of the extinction are not known. Wajgel's specimens are apparently not preserved (they have not been found in NMW; B. Herzig, pers. comm. 1995).

1.2.1 *Lampetra fluviatilis* (Linnaeus, 1758)

Petromyzon fluviatilis Linnaeus, 1758: 230 (based on Linnaeus [1746: 102, n. 273], Artedi [1738: gen. 64 [99], syn. 89, spec. 99 [64], Petromyzon unico ...], Gesner [p. 597, Lampetra alterum genus; edition not stated, seen in Gesner, 1558: 705, 1563: 181, 1604: 597], Salviano [1554–58: fol. 63, lampetra], Jonston [**1649: pl. 24 fig. 6**, Pricka], Willughby [1686: 106, Lampetra medium genus] and Ray [**1710: 35**, idem]; type locality: "in fluviis Europae", restricted here to river Rhine in Basel, Switzerland, by neotype designation; neotype: MHNG 816.18, present designation)

Petromyzon branchialis Linnaeus, 1758: 230 (based on Linnaeus [1746: 102, n. 274], Rondelet [1555: 202, Lampetra parva & fluviatilis; locality: "tales in Arvernie"], Gesner [p. 598, idem; edition not stated, seen in Gesner, 1558: 706, 1604: 598], Willughby [1686: 104, idem], Ray [**1710: 35**, idem], and Salviano [1554–58: fol. 63, Lampetra minor]; type locality: "aquis dulcibus Europae", restricted here to river Rhine in Basel, Switzerland; neotype: MHNG 816.18, present designation)

Petromyzon argenteus Bloch, 1795: 74, pl. 415 fig. 2 (type locality: Tranquebar, India [obviously an error]; syntypes: ZMB 4683 [2], Paepke & Schmidt, 1988: 159)

Pétromyzon pricka La Cepède, 1798: 18 (not latinised, context shows that the name was not used as a scientific name [ICZN art. 11(b) and second example under 11(b)(ii)], name not available)

Petromyzon sanguisuga La Cepède, 1800: 101, pl. 1 fig. 3 (type locality: river Seine, France; syntypes: LU)

Petromyzon Jurae MacCulloch, 1819: 187, pl. 29 (type locality: island Jura, Scotland, U.K.; holotype: LU)

? *Petromyzon macrops* Blainville, 1825: 7, pl. 2 fig. 2 (type locality: "all large rivers" [of France]; type material: NT ?)

? *Petromyzon argenteus* Chiereghini, in Nardo, 1847: 111 (type locality: Venezia, Italy; syntypes: LU; junior primary homonym of *P. argenteus* Bloch, 1795: 74)

Ammocoetes communis Gistel, in Gistel & Bromme, 1850: 340 (unnecessary replacement name for *Petromyzon branchialis* Linnaeus, 1758)

Petromyzon Omalii Van Beneden, 1857: 551, pl. figs. 1–3 (type locality: shores of Belgium; syntypes: LU [3])

Petromyzon fluviatilis forma *major* Smitt, 1895: 1189 (infrasubspecific, name not available)

Lampetra opisthodon Gratzianow, **1906: 18** (type locality: river Neva near St. Petersburg, Russia; syntypes: ZMMSU ?) from Berg, 1907b: 368, 1911: 26

Lampetra fluviatilis f. *praecox* Berg, 1931: 111 (infrasubspecific, name not available; localities: several localities in rivers Neva and Kavash, lakes Ladoga and Onega, and other rivers falling into the Finnish Gulf, Russia)

Lampetra fluviatilis morpha *ladogensis* Ivanova-Berg, 1966: 565 (infrasubspecific, name not available; locality: lake Ladoga, Russia)

Nomenclatural notes. There is no extant type material for Linnaeus's *Petromyzon fluviatilis* and *P. branchialis* (Fernholm & Wheeler, 1983; Wheeler, 1985, 1989: 157). Linnaeus accounts are also based on earlier authors who are not known to have preserved specimens. Specimen MHNG 816.18 from river Rhine in Basel, Switzerland, is here designated as neotype of both *P. fluviatilis* and *P. branchialis*. Both are simultaneous objective synonyms and as first reviser I retain *P. fluviatilis* as having priority.

According to Hardisty (in Holčík, 1986: 249, 278), *Petromyzon branchialis* Linnaeus, 1758 includes ammocoetes of both *L. fluviatilis* and *L. planeri*; no supporting data are provided but this seems a possibility. Linnaeus's account is very brief and quite uninformative; this is also true of his bibliographic sources. Earlier authors (e.g., Günther, 1870: 504) had considered *P. branchialis* as conspecific with *L. planeri*. If this were followed, *P. branchialis* would have priority and the name of the present species, the subject of numerous researches, would have to be changed. The above neotype designation definitively rules out such a nomenclatural change.

Berg (1931: 111; 1948: 49) reports as *Lampetra fluviatilis* f. *praecox* a stock sympatric with *P. fluviatilis* in streams draining to the Gulf of Finland and southern Norway. They differ apparently by size at reproduction. Berg (1948: 50) seems to suggest that they might be a single breeding population. If it turns out that the *praecox* characteristics are hereditary traits, it may then be likely that two species are involved; the name *praecox* would not be available for the small stock because it is infrasubspecific (ICZN art. 45(g)) and it should be redescribed. See Vladykov (in Hureau & Monod, 1973: 4) for further comments.

Petromyzon sanguisuga La Cepède (1800) and *P. macrops* Blainville (1825) are referred to the present species, although it seems likely that the original material might have been a mixture of *L. fluviatilis* and *P. marinus* (N. da Costa Pereira, pers. comm.).

1.2.2 *Lampetra planeri* (Bloch, 1784)

Petromyzon Planeri Bloch, 1784: 47, pl. 78 fig. 3 (type locality: creeks of Thüringen, Germany; syntypes: ZMB 4686 [3], Paepke & Schmidt, 1988: 160)

Petromyzon septoeuil La Cepède, 1802: 667, pl. 15 fig. 1 (type locality: rivers Seine, Epte and Audelle, Pont de l'Arche, France; syntypes: LU ?)

Petromyzon niger La Cepède, 1802: 667, pl. 15 fig. 2 (type locality: rivers Seine, Epte and Audelle, Pont de l'Arche, France; syntypes: LU ?)

Petromyzon Plumbeus Shaw, 1804: 263 (unnecessary replacement name for *Petromyzon septoeil* [sic, *septoeuil*] La Cepède, 1802: 667)

Petromyzon Bicolor Shaw, 1804: 263 (unnecessary replacement name for *Petromyzon niger* La Cepède, 1802: 667)

? *Petromyzon caecus* Couch, 1832: 23, figs. 9–10 (type locality: Cornwall, U.K.; type material: NT ?)

? *Petromyzon anomalum* De la Pylaie, 1835: 526 (nomen nudum; locality: stream Nanson at Fougères, Ille-et-Vilaine, France)

Petromyzon fluviatilis forma *minor* Smitt, 1895: 1189 (infrasubspecific, name not available)

Petromyzon fluviatilis forma *larvalis* Smitt, 1895: 1189 (infrasubspecific, name not available)

1.3.1 *Lethenteron camtschaticum* (Tilesius, 1811)

Petromyzon marinus Camtschaticus Tilesius, 1811: 240, pl. 9 (type locality: Jeddo and Yokohama, Japan, by present neotype designation [originally "portus Divi Petri et Pauli Camtschatici" (Petropavlovsk Kamtchatskii, Siberia)]; neotype: ZMB 6475, present designation)

Lampetra variegata Tilesius, 1811: 247 (not proposed as a new name, not binominal, name not available; locality: "in sinu Bolschaja fluvii prope ostium")

Petromyzon lumbricalis Pallas, 1814: 69 (type locality: Jeddo and Yokohama, Japan, by present neotype designation [originally river Ienissei and Kamchatka, Siberia]; neotype: ZMB 6475, present designation)

Petromyzon borealis Girard, 1858: 377 (available by indication to *Petromyzon fluviatilis* of Richardson, **1836: 294**; type locality: Great Slave Lake, Canada; syntypes: BMNH ?)

Petromyzon Japonicus Martens, 1868: 3, pl. 1 fig. 2 (type locality: Jeddo and Yokohama, Japan; lectotype: ZMB 6475, present designation)

Petromyzon Kameraticus Dybowski, 1869: 948 (nomen nudum)

Petromyzon Ernstii Dybowski, 1872: 220 (type locality: mouth of river Amur, Siberia; syntypes: IZPAN?)

Lampetra mitsukurii major Hatta, 1911: 268, pl. 9 figs. 1–2 (type locality: Sapporo, Japan; syntypes: LU)

Lampetra japonica septentrionalis Berg, 1931: 100, pl. 5 fig. 4 (type locality: river Onega at Podporozhye, Siberia, Russia; syntypes: ZISP 12159 [10])

Lampetra japonica f. *praecox* Ioganzen, **1935: 3** (infrasubspecific, name not available) from Holčík, 1986: 199

Systematic notes. In the area covered by the present review, *L. camtschaticum* is recorded only from the Pasvik river which forms the border between Norway and Russia (Holčík, 1986: 207).

Nomenclatural notes. Holčík (1986: 199) treated *Petromyzon marinus camtschaticus* Tilesius, 1811 as unavailable because the work is not using binominal nomenclature (ICZN art. 11(c)). The sections of the work that I have examined clearly use the binominal systems and new names proposed in it are available. This appears to be the first available name for *L. japonicum* and it has priority. The types are not extant in ZISP (N. Bogutskaya, pers. comm.). Specimen ZMB 6475 (the lectotype of *Petromyzon japonicus* Martens, 1868) is designated as neotype of *P. m. camtschaticus*.

According to Holčík (1986: 199, 220), *P. lumbricalis* Pallas, 1814 is based on ammocoetes of both *L. japonicum* (material from Kamchatka) and *L. kessleri* (Anikin, 1905) (material from river Ienissei). I could not find any nomenclatural act restricting the name to one or the other species. Such an act is needed and one of these two species has to become a junior synonym of *L. lumbricalis*. Pallas's material of this species is no longer extant (Svetovidov, 1978, 19981; Paepke & Schmidt, 1988: 159) and there are not even traces of it in ZISP files (N. Bogutskaya, pers. comm., 1995). As first reviser, I designate specimen ZMB 6475 (the lectotype of *Petromyzon japonicus* Martens, 1868) as neotype of *P. lumbricalis* Pallas, 1814. I prefer to restrict the name *P. lumbricalis* to *P. japonicus* because this name is invalid anyway (a junior synonym of *P. camtschaticum*, see above). If *P. lumbricalis* is treated as synonym of *L. kessleri*, both *L. kessleri* and *L. japonicum* would have to change their names. By changing a single name instead of two, the solution adopted here thus creates the smallest amount of nomenclatural changes.

Holčík (1986: 199) listed *Petromyzon borealis* Girard, 1858 as a senior synonym of *L. japonicum* (Martens, 1868) but did not use it on the ground that it is a nomen oblitum. He did not indicate by whom and when this name has been treated as a nomen oblitum and I could not find such a nomenclatural act. Names can only be rejected as nomina oblita if they have been declared as such between 6 November 1961 and 1 January 1973 (see ICZN art. 79(c)(iii), Glossary 'nomen oblitum') and if they had not previously been used for 50 years. The name has been used by Jordan, Evermann & Clark (1930: 10; a work reprinted since) and by Hubbs & Potter (1971: 51) and does not qualify as a nomen oblitum.

1.3.2 *Lethenteron zanandreai* (Vladykov, 1955)

Lampetra zanandreai Vladykov, 1955: 216, pls. 1–4 (type locality: river Guà de Lonigo, Vicenza, Italy; holotype: NMC 86-0001)

Systematic notes. See also comments by Bailey (1980, 1982) and Vladykov & Kott (1982).

1.4.1 *Petromyzon marinus* Linnaeus, 1758

Petromyzon marinus Linnaeus, 1758: 230 (based on Artedi [1738: gen. 64 [–], syn. 90, [descr. 64], Petromyzon maculosus ...], "Bel" [Belon, **1553: 76**, Mustela f. lampetra, 1555: 66–67, la lamproye], Gesner [p. 590, idem; edition not stated, seen in Gesner, 1558: 696, 1604: 590; figured specimen from Basel, Switzerland], Rondelet [1554: 398, Lampetra; locality: France], Willughby [1686: 105, Lampretra] and Ray [**1710: 35**, Lampetra]; type locality: Basel, Switzerland, by lectotype designation [original locality information: "in mari Europaeo"]; lectotype: specimen illustrated by Gesner, 1604: 590, by present designation)

? *Petromyzon ruber* La Cepède, 1800: 99, pl. 1 fig. 2 (type locality: river Seine, France; holotype: LU)

Petromyzon lampetra Pallas, 1814: 66 (type locality: Basel, Switzerland, by lectotype designation; lectotype: specimen illustrated by Gesner, 1604: 590, by present designation)

? *Petromyzon Adriaticus* Chiereghini, in Nardo, 1847: 109 (type locality: Quarnero [? = Carnero = Kvarner, Croatia (strait between Cres island and Istra)]; syntypes: LU)

Petromyzon maculosus Gronow, 1854: 2 (available by indication to Linné [1766: 394, Petromyzon ore intus papilloso ...], Artedi [1738: gen. 42 n. 2 [sic; desc. 64, syn. 90], Petromyzon maculosus ...] and Willughby [1686: pl. G.2, Petromyzon major]; type locality: "in fluminibus majoribus Angliae"; type material: NT)

Petromyzon marinus dorsatus Wilder, in Jordan & Gilbert, 1883: 869 (type locality: lake Cayuga, New York, USA; syntypes: USNM ?)

Nomenclatural notes. Holčík (1986: 119, 198) considers that *Petromyzon lampetra* Pallas (1814: 66) is based on both *L. japonicum* and *Caspiomyzon wagneri* (Kessler, 1870). If this were correct, it would have to be the valid name for one of these species. Actually *P. lampetra* is also based on earlier accounts (Marsili, 1726: pl. 1 [Lampetra], Linnaeus, 1766: 394 [*Petromyzon marinus*], Bloch, 1784: 38 pl. 87 [Die Lamprete (*Petromyzon marinus*)], Pennant, 1776: vol. 3: 67 n. 27, pl. 8 [Sea-lamprey]). This apparently includes two species as Marsili's Danube species is unlikely to be conspecific with the material of the other authors. As first reviser I restrict the use of the name to Linnaeus's (1766) reference; this is the same text as Linnaeus's (1758: 230) original description of *Petromyzon marinus*. As there is no type material for both species, the specimen illustrated by Gesner (1604: 590 [page referred to by Linnaeus, 1758]) is designated as lectotype of *P. marinus* Linnaeus, 1758 and *P. lampetra* Pallas, 1814; this makes *P. lampetra* an objective junior synonym of *P. marinus* Linnaeus, 1758 and restricts the type locality. Gesner explicitly states that the illustrated specimen is from Basel, Switzerland. The lectotype is lost (it probably has not been preserved).

Petromyzon maximus in Cuvier (1816: 118) is a misprint for *P. marinus*, but the name has been repeated by several 19th century French authors (e.g., Ogérien, 1863: 374, fig. 87).

Acipenseridae

Due to their large size, museum samples of most species of Acipenseridae are rare. As a result, many species descriptions were based on few specimens only and their variability is not very well known. On the other hand, the commercial interest in these species and their peculiar morphology have attracted considerable attention. For various reasons (usually unsuitable concepts and methods), this resulted in only few data usable in a systematic analysis. One of the significant problems (recurrent in eastern European fish systematics) is that authors very rarely compare specimens, but only compare data compiled from a variety of sources, whose consistency can always be doubted.

Many sturgeon stocks are already extinct or seriously endangered. At this stage, it cannot be excluded that the actual number of species could be seriously underestimated. For most 'species', we are badly missing critical, careful and first hand comparisons of material from the various basins, the different seasonal 'races' and the migratory and non-migratory 'races'.

Acipenser baeri Brandt, 1869 **introduced**

2.1.1 *Acipenser gueldenstaedtii* Brandt & Ratzeburg, 1833

Acipenser pygmaeus Reisinger, 1830: 93 (type locality: river Danube, Hungary; syntypes: LU; junior homonym of *Acipenser pygmaeus* Pallas, 1814: 102)

Acipenser Güldenstädtii Brandt & Ratzeburg 1833: 13, pl. 3 fig. 2 (description apparently based on several earlier accounts [including Lepechin, **1771b: 161** [Schip-Kostera] and Marsili, 1726: 37 [Antaceus stellatus]], including material from rivers Volga, Ural, Terek, Kura and their main tributaries, Azov Sea, rivers Don, Dnieper and Danube; type material: NT)

Acipenser aculeatus Lovetzki, 1834: 262, pl. 19 fig. 2 (type locality: "fluvius Borysthenes ... locis restrictis Gubern. Catherinoslawl" [river Dnieper in Yekaterinoslav province; Berg, 1911: 247]; holotype: LU; author stated as Fischer, but Lovetzki is actual author of conditions making name available)

Acipenser tücka Brusina, 1902: 49 (listed in synonymy, name not available)

Acipenser medius Brusina, 1902: 50 (listed in synonymy, name not available; author stated to be Heckel, reference not found)

Acipenser brevirostris Brusina, 1902: 50 (listed in synonymy, name not available; author stated to be Heckel, reference not found)

Acipenser macrophthalmus Brusina, 1902: 50 (listed in synonymy, name not available; author stated to be Heckel, reference not found)

Acipense [sic] *Güldenstaedtii* var. *scobar* Antipa, 1909: 260, figs. 101–102 (infrasubspecific, name not available; locality: river Danube)

Acipenser Güldenstaedtii var. *golis* Antipa, 1909: 261, figs. 103–104 (infrasubspecific, name not available; locality: river Danube and Black Sea at mouth of Portitza)

Acipenser Güldenstaedtii var. *longirostris* Antipa, 1909: 262, fig. 106 (infrasubspecific, name not available; locality: river Danube and Black Sea)

Acipenser Güldenstaedtii var. *acutirostris* Antipa, 1909: 262, fig. 107 (infrasubspecific, name not available; locality: river Danube)

Acipenser güldenstädti var. *tanaica* Marti, **1940: 869** (Azov Sea) from Berg, 1948: 84

Acipenser güldenstädti var. *colchica* Marti, **1940: 869** (river Rioni and pre-estuarine area of river Inguri, Georgia) from Berg, 1948: 84

Acipenser güldenstädti colchicus natio *danubica* Movchan, 1967: 31 (infrasubspecific, name not available; locality: river Danube)

Systematic notes. See family introduction for general comments. Vlasenko et al. (in Holčík, 1989: 298–305) report biochemical and morphological differences (but do not state explicitly which differences) between various stocks. Migratory and non-migratory 'races' are known from the Danube basin.

2.1.2 *Acipenser naccarii* Bonaparte, 1836

Accipenser lutescens Rafinesque, 1820: 79 (nomen nudum; locality: Old continent)

Acipenser Heckelii Brandt & Ratzeburg, 1833: 29 (nomen nudum)

Acipenser Naccarii Bonaparte, 1836: [fasc. 16–17, p. 377], pl. 129 fig. 2 (type locality: rivers Brenta, Adige, Piave, Livenza, Bacchiglione, Tagliamento / Firenze, Italy; syntypes: ANSP 624-625 [2], Böhlke, 1984: 17)

Acipenser Heckelii Fitzinger, in Fitzinger & Heckel, 1836: 303, pl. 26 fig. 4, pl. 29 figs. 11–12 (type locality: Adriatic Sea, rivers Po, Etsch [Adige] and Brenta, Italy; syntypes: NMW 76784 [1], 92877 ? [1])

Acipenser platycephalus Bonaparte, 1846: 21 (listed in synonymy, name not available, ICZN art. 11(c))

Acipenser Nardoi Heckel, 1851c: 557, pl. 24 fig. 2 (type locality: Venezia, Italy; holotype: NMW 63076)

Acipenser nasus Heckel, 1851c: 551, pl. 23 (type locality: Venezia, Italy; holotype: NMW 63093)

Acipenser Ladanus Nardo, 1847: 111 (cited in synonymy, name not available), Molin, 1853: 367 (cited in synonymy, name not available)

Acipenser sturionellus Nardo, 1860: 71 (cited in synonymy, name not available)

Acipenser ladanus Ninni, 1872: 33 (unnecessary replacement name for *Acipenser naccarii* Bonaparte, 1836; could possibly also be treated as available by indication to 9 earlier works)

Acipenser sturionaster Brusina, 1902: 52 (listed in synonymy, name not available; author stated to be Nardo according to Bonaparte, but reference not found)

Nomenclatural notes. Although Bonaparte (1846: 21) indicated Heckel as author of *Acipenser platycephalus*, this was only a manuscript name (Fitzinger & Heckel, 1836: 304).

Both *Acipenser naccarii* Bonaparte and *A. heckelii* Fitzinger appeared in 1836. In his account of *A. naccarii*, Bonaparte explicitly provides a full bibliographic reference to the description of *A. heckelii* in Fitzinger & Heckel (1836), and obviously the latter name has priority. As the species is endangered and listed in several national and international legal instruments, the conservation of the commonly accepted name seems justified and Kottelat & Wheeler (in press b) have petitioned the International Commission on Zoological Nomenclature to conserve the name *A. naccarii*. Awaiting the decision, the existing usage has to be maintained (ICZN art. 80(a)), that is *A. naccarii*.

2.1.3 *Acipenser nudiventris* Lovetzky, 1828

? Schypa: Acipenser Gueldenstaedt, 1772: 533 (name sometime listed in synonymy, but not available because not binominal)

Acipenser nudiventris Lovetzky, 1828: 78, pl. 6 fig. 2 (type locality: Aral Sea [Berg, 1948: 66]; type material: LU)

Acipenser glaber Fitzinger, 1832: 340 (available by indication to Marsili [1726: 34, pl. 10 fig, 2, Antaceus glaber]; type locality: river Danube in Austria; syntypes: NMW 91292 [1]; author given as Heckel, but Fitzinger is actual author); see Fitzinger & Heckel (1836: 270, pl. 25 fig. 3, pl. 28 figs. 5–6) for illustration of possible syntypes

Acipenser turritus Brusina, 1902: 61 (published in synonymy, name not available; based on a museum label)

Acipenser nudiventris derjavini Borzenko, **1950** (Caspian Sea) from Sokolov & Vasilev, in Holčík, 1989: 209

Systematic notes. The type locality of *A. nudiventris* is the Aral Sea. Borzenko (**1950**, cited by Sokolov & Vasilev, in Holčík, 1989: 209) considered that the Caspian Sea specimens belong to a distinct subspecies, a conclusion rejected by Sokolov & Vasilev. However, as their conclusion is based solely on a coefficient of difference, it is irrelevant to a systematic discussion (see p. 18) and inconclusive. The status of the Black Sea specimens is simply not discussed and no data are provided in their table 19. I could not find a critical, first hand comparison of the Black Sea, Caspian Sea and Aral Sea specimens. The hypothesis that more than one species is involved should be envisaged. A detailed comparison of the diadromous and non-migratory 'races' would also be justified.

2.1.4 *Acipenser ruthenus* Linnaeus, 1758

Acipenser ruthenus Linnaeus, 1758: 237 (based on Linnaeus [1746: 102, n. 272; **1754: 54, pl. 27 fig. 2, pl. 28 fig. 1**]; type locality: "Habitat in Rutheno; introductus a Rege Friderico I in Maelerum, Sveciae"; holotype: NRM 96)

Sterleta: Acipenser Gueldenstaedt, 1772: 533 (sometime listed in synonymy but not available because not binominal)

Acipenser pygmaeus Pallas, 1814: 102 (type locality: Black, Caspian and White seas, Arctic Ocean, rivers Danube, Mesen, Petschora, Volga, Kama, Yenissei, Ob, Irti and Tom, lakes Ladoga and Neva; syntypes: LU)

Acipenser Kostera Fitzinger, 1832: 340 (available by indication to Lepechin [**1771b: 161**, Schip-Kostera] and Marsili [1726: 37, pl. 12 fig. 1, Antaceus stellatus, river Danube]; type locality: river Danube at Wien [Vienna], Austria [by neotype designation; original locality: river Danube [Marsili, Fitzinger; restricted by Fitzinger & Heckel, 1836: 298)]; neotype: BMNH 1898.4.11:26, present designation)

Acipenser marsiglii Brandt & Ratzeburg, 1833: 352 (type locality not stated [river Ob ?, Siberia, according to Berg, 1911: 201]; holotype: ? ZISP 11825 [1], Berg, 1911: 201)

Acipenser Kamensis Lovetzky, 1834: 262, pl. 16 fig. 2 (type locality: river Kama, Russia; holotype: LU; spelt *A. camensis* on plate, spelling *A. kamensis* retained by Berg, 1911: 201 as first reviser)

Acipenser Gmelini Fitzinger, in Fitzinger & Heckel, 1836: 276, pl. 25 fig. 2, pl. 30 figs. 17–18 (type locality: "Black and Caspian Sea" [general distribution based on earlier records; actual type locality depends of holotype data once it can be located]; holotype: NMW [not yet located, B. Herzig, pers. comm., 1995])

? *Acipenser Aleutensis* Fitzinger, in Fitzinger & Heckel, 1836: 285 (based on Pallas [1814: 107, "*Acipenser rutheno affinis*"; actually "affinem *Acip. rutheno*"; type locality: island Canaga, Aleutian islands, Alaska; syntypes: LU)

Acipenser ruthenus var. *leucotica* Brandt, 1851: 13, pl. fig. 1 (infrasubspecific, name not available; locality: Nizhnyi-Novgorod, Russia)

Acipenser ruthenus var. *grisescens* Brandt, 1851: 16, pl. fig. 2 (infrasubspecific, name not available; locality: Nizhnyi-Novgorod, Russia)

Acipenser Lovetzkyi Duméril, 1870: 254 (type locality: Russia; syntypes: MNHN [2]))

Acipenser Kankreni Duméril, 1870: 256 (type locality: probably Russia; holotype: MNHN)

Sterledus ruthenus var. *sibiricus* Dybowski, 1874: 394 (type locality: middle and lower course of river Angara, Siberia; syntypes: IZPAN ?)

Acipenser Jenisensis Herzenstein, in Anonym, 1895: 79 (nomen nudum; locality: Turukhansk Province) from N. Bogutskaya, pers. comm., 1995

Acipenser ruthenicus Brusina, 1902: 63 (published in synonymy, name not available; author stated as Linnaeus, but reference not found)

Acipenser sterlet Brusina, 1902: 63 (published in synonymy, name not available; author stated as Daubenton, but reference not found)

Acipenser dubius Brusina, 1902: 63 (published in synonymy, name not available; author stated as Heckel, but reference not found)

Acipenser ruthenus var. *albinea* Brusina, 1902: 64 (infrasubspecific, name not available; localities: river Sava at Rugvica, river Kupa at Sisak, Croatia)

Acipenser ruthenus var. *birostrata* Brusina, 1902: 65 (infrasubspecific, name not available; locality: Croatia)

Acipenser ruthenus var. *obtusirostris* Brusina, 1902: 66 (infrasubspecific, name not available; locality: river Una, Croatia)

Acipenser ruthenus var. *septemcarinata* Brusina, 1902: 66 (infrasubspecific, name not available; locality: Budapest, Hungary)

Acipenser ruthenus var. *alba* Antipa, 1909: 249, pl. 31 fig. 93a (infrasubspecific, name not available)

Acipenser ruthenus var. *erytraea* Antipa, 1909: 250, pl. 31 fig. 93 (infrasubspecific, name not available)

Acipenser ruthenus var. *brevirostris* Antipa, 1909: 250, fig. 94 (infrasubspecific, name not available)

Acipenser ruthenus ruzskyi Ioganzen, **1946: 171** (Novosibirsk-Baturino, river Ob basin, Siberia) from Berg, 1949: 1318

Acipenser ruthenus ruzskyi natio *baschmakovae* Ioganzen, **1946: 173** (Narym, river Ob basin, Siberia) from Berg, 1949: 1318

Nomenclatural notes. Some authors (e.g., Fowler, 1972: 169) considered *Acipenser sturio* var. *kostera* as available from Pallas (1814: 96). Pallas's uses of the name *kostera* was as a vernacular name, not as a scientific name. The name appears in the phrase "*β*. *Varietas* nondum adulta, *Kosterâ* Rossorum" (*β*. Variety non adult, the kosterâ of the Russians).

"*Acipenser rutheno affinis* Pallas, 1814: 107" is sometime listed in synonymies. This name is not binominal and thus is not available. It is actually part of a phrase meaning "*A.* aff. *ruthenus*"; actual phrase is "Affinem *Acip. rutheno* in sinu maris etc..."

Specimen BMNH 1898.4.11:26, 250 mm SL, from the Danube in Wien (Vienna), Austria, is designated as neotype for *A. kostera* Fitzinger, 1832. Fitzinger's original material cannot be located in NMW. The name is available by indication to Lepechin (**1771b**) and Marsili (1726) and material of these authors is not known to exist. The original description is ambiguous and the nominal species could possibly be interpreted as a senior synonym of *A. gueldenstaedtii*, threatening a well established name for an endangered species listed in several national and international legal instruments. The present neotype designation definitively rules out this possibility. Marsili's material was from the Danube. The neotype conforms to the description of *A. ruthenus* by Sokolov & Vasiljev (in Holčík, 1989: 227).

Berg (1911: 202) lists specimen ZISP 13549 as holotype of *Acipenser ruthenus* var. *leucotica* Brandt, 1851. As the name is infrasubspecific and not available, this specimen has no type status.

2.1.5 *Acipenser stellatus* Pallas, 1771

Acipenser stellatus Pallas, 1771: 460 (type locality: Caspian Sea and tributary streams; syntypes: LU)

Seuruga: Acipenser Gueldenstaedt, 1772: 533 (not binominal, name not available)

Acipenser Seuruga Bonnaterre, 1788: 17 (after Güldenstädt, 1772: 533; type locality: Caspian Sea; type material: NT ?)

Acipenser Helops Pallas, 1814: 97 (type locality:

Black, Caspian and Aral Seas, rivers Danube, Dnieper, Don, Volga, Ural and Arax; syntypes: LU)

Acipenser ratzeburgii Brandt & Ratzeburg, 1833: 351, pl. 1a fig. 3 (description based on Lepechin [1795: 35, pl. A, *Acipenser stellatus* var.]; type locality: Caspian Sea at the mouth of river Emba; holotype: ZISP 11760 [1], Berg, 1911: 291)

? *Acipenser rostratus* Brandt & Ratzeburg, 1833: 29 (published in synonymy, name not available; author stated as Fischer, but reference not found)

Acipenser stellatus donensis Lovetzki, 1834: 263, pl. 19 fig. 1 (type locality: river Don, Ukraine; holotype: LU)

Acipenser stellatus danubialis Brusina, 1902: 59, fig. 3 (type locality: river Danube; syntypes: LU)

Acipenser stellatus illyricus Brusina, 1902: 60, figs. 1–2 (type locality: Dalmatia, Montenegro, Albania; syntypes: LU)

Acipenser stellatus stellatus natio *cyrensis* Berg, 1932c: 65 (infrasubspecific, name not available; locality: river Kura, Azerbaidjan [Berg, 1948: 100])

2.1.6 *Acipenser sturio* Linnaeus, 1758

Acipenser Sturio Linnaeus, 1758: 237 (based on Linnaeus [1746: 101, n. 271, Acipenser corpore tuberculis ...; **1754: 54, pl. 18 fig. 2; 1751: 187**, Acipenser], Artedi [1738: gen. 65 [–] syn. 91 [descr. 65], Acipenser corpore tuberculis ...], Gronovius [1756: 42, idem]; type locality: "in mari Europaeo"; syntypes: BMNH 1853.11.12:210 [1], NRM LP uncat., Wheeler, 1958: 206, Fernholm & Wheeler, 1983: 209)

Sturio accipenser Strøm, 1784: 129 (type locality: Eger [in Boskerud District, south west of Oslo], Norway; type material: NT)

Acipenser lichtensteinii Bloch, in Schneider, 1801: 348, pl. 69 (type locality: "habitat in mari germanico"; holotype ?: ZMB 4411)

Accipenser attilus Rafinesque, 1820: 79 (nomen nudum; locality: Old Continent); Bonaparte, 1846: 21 (listed in synonymy, name not available)

Acipenser latirostris Parnell 1838b: 405, pl. 39 (type locality: near Alloa, Firth of Forth and river Tay, Scotland; syntypes: LU [probably only one head preserved]); also 1839a: 137, pl. 4

Acipenser attilus Gray, 1851: 13 (unnecessary replacement name for *Acipenser sturio* Linnaeus, 1758)

Acipenser Thompsonii Ball, in Thompson, 1856: 245 (published as a junior synonym, name not available [ICZN art. 11(c)]; locality: Corelaine, Donaghadee, Belfast, Cushendall, Dundrum, Dundalk, Carrick-on-Suir, Wexford, rivers Blackwater and Bandon, and Dublin, Ireland)

Acipenser hospitus Kröyer, 1852: 780 (type locality: northern Öresund [sound between Sweden and Seeland, Denmark]; holotype: LU)

Acipenser sturioides Malm, 1861: 618 (type locality: Göta Elf near Göteborg, Sweden; holotype: GNM)

Acipenser Yarrellii Duméril, 1867: 164 (type locality: no data; holotype: MNHN)

Acipenser Fitzingeri Duméril, 1870: 97, pl. 20 fig. 4 (type locality: Russia; holotype: MNHN)

Acipenser ducissae Duméril, 1870: 98, pl. 20 fig. 5 (type locality: Russia; holotype: MNHN)

Acipenser Nehelae Duméril, 1870: 100, pl. 20 fig. 6 (type locality: Russia; holotype: MNHN)

Acipenser podapos Duméril, 1870: 102 (no locality data; syntypes: MNHN [2])

Acipenser Valenciennii Duméril, 1870: 180 (type locality: Atlantic Ocean at Sables-d'Olonne and mouth of river Seine, France; syntypes: MNHN [2])

Acipenser europaeus Brusina, 1902: 54 (published in synonymy, name not available; author stated as Linnaeus, reference not found)

Sturio vulgaris Brusina, 1902: 54 (published in synonymy, name not available; author stated as Rafinesque, reference not found)

Systematic notes. See family introduction for general comments. Seasonal, migratory and non-migratory 'races' are known. Holčík et al. (in Holčík, 1989: 298–305) report differences between various populations and a detailed comparison is needed. The Baltic Sea population is noteworthy as it differs from the Atlantic and Mediterranean populations in having significantly fewer dorsal and lateral scutes; future research may show that they represent distinct species.

Nomenclatural notes. Rafinesque (1820: 79) listed *Acipenser attilus* without description and Bonaparte (1846: 21) listed it in synonymy, indicating Rafinesque as author, but without giving references. I could not find other uses of this name in Rafinesque's papers available to me and therefore list the name as nomen nudum; it may have been used in some overlooked Rafinesque's paper. The earliest use of the name making it available is by Gray (1851).

2.2.1 *Huso huso* (Linnaeus, 1758)

Acipenser Huso Linnaeus, 1758: 238 (based on Artedi [1738: gen. 65 [–], syn. 92 [descr. 65], Acipenser tuberculis carens]; type locality: "Habitat in Danubio, fluviisque Imperii Ruthenici"; type material: NT)

Acipenser Beluga Forster, 1767: 354 (type locality: rivers Volga and Yaiki, Russia; type material: NT)

Acipenser Albula Forster, 1767: 354 (type locality: rivers Volga and Yaiki, Russia; type material: NT; listed as an alternative name to *A. beluga* Forster, 1767)

Acipenser Shyp Forster, 1767: 353 (type locality: Bosphore or Sea of Marmara, Turkey, by neotype designation; neotype: NRM 8946, present designation)

? *Acipenser Schypa* Gmelin, 1788: 1484 (type locality: Bosphore or Sea of Marmara, Turkey, by neotype designation; neotype: NRM 8946, present designation)

? *Acipenser Schypa* Bonnaterre, 1788: 16 (type locality: Bosphore or Sea of Marmara, Turkey, by neotype designation; neotype: NRM 8946, present designation)

Huso ichthyocolla Bonaparte, 1846: 22 (unnecessary replacement name for *Acipenser huso* Linnaeus, 1758)

Acipenser Vallisnerii Molin, 1853: 366 (type locality: Adriatic Sea, Italy; holotype: LU)

Huso huso maeoticus Sal'nikov & Malyatskii, **1934: 44** (Azov Sea) from Berg, 1948: 61

Huso huso ponticus Sal'nikov & Malyatskii, **1934: 44** (Black Sea) from Berg, 1948: 61

Huso huso ponticus natio *occidentalis* Sal'nikov & Malyatskii, **1934: 45** (infrasubspecific, name not available; locality: western part of Black Sea) from Berg, 1948: 61

Huso huso ponticus natio *orientalis* Sal'nikov & Malyatskii, **1934: 45** (infrasubspecific, name not available; locality: Caucasian coast of Black Sea) from Berg, 1948: 61

Huso huso caspicus Babushkin, **1942: 131** (Caspian Sea) from Berg, 1948: 61

Huso huso caspicus natio *curensis* Babushkin, **1942: 131** (infrasubspecific, name not available; river Kura, Caspian Sea basin) from Berg, 1948: 65

Huso huso orientalis Lelek, 1987: 55 (available by indication to Sal'nikov & Malyatskii [**1934**]; type locality: Caucasian coast of Black Sea; syntypes: LU)

Systematic notes. See family introduction for general comments. Pirogovskii et al. (in Holčík, 1989: 298–305) report differences between various stocks. Two seasonal races were known from the Danube basin.

Nomenclatural notes. Specimen NRM 8946, 320 mm SL, from the Bosphore or the Sea of Marmara, Turkey, is designated as neotype for *A. shyp* Forster, 1767, *A. schypa* Gmelin, 1788 and *A. schypa* Bonnaterre, 1788. Forster's original material cannot be located. Gmelin and Bonnaterre's names are based on different literature accounts (Gueldenstaedt, 1772: 532; Gmelin, 1774: 238; Lepechin. 1771b: 54) and the material of these authors is not known to have been preserved (N. Bogutskaya, pers. comm.). The original descriptions are ambiguous and these nominal species could possibly be interpreted as senior synonyms of *A. nudiventris*, threatening a well established name for an endangered species listed in several national and international legal instruments. The present neotype designation definitively rules out this possibility. Material on which Forster's, Gmelin's and Bonnaterre's accounts are based was from the Caspian Sea; no Caspian Sea material could be located in museum collections accessible to me and the present neotype comes from as close as possible. It conforms to the description of *Huso huso* by Pirogovskii et al. (in Holčík, 1989: 157).

Acipenser schypa is available from both Gmelin (1788) and Bonnaterre (1788). No precise publication date is available and both have to be considered as published on 31 December 1788 (ICZN art. 21(c)(ii)) and they are simultaneous homonyms. As first reviser I retain *A. schypa* Gmelin, 1788 as having priority. Bonnaterre's account is based on the same source as Gmelin and his species is an objective synonym of Gmelin's species.

Anguillidae

3.1.1 *Anguilla anguilla* (Linnaeus, 1758)

Muraena Anguilla Linnaeus, 1758: 245 (based on Artedi [1738: spec. 66 [24], gen. 24 [66], syn. 39, Muraena unicolor], Linnaeus [1746: 109, n. 290, idem], Fahlberg [**1750: 194**]; type locality: "Habitat in Europa; maxima in lacu Cornachio

Ferrariensi"; type material: NT)

Anguilla Vulgaris Shaw, 1803: vol. 4 (1): 15, pl. 1 (unnecessary replacement name for *Muraena anguilla* Linnaeus, 1758)

Anguilla vulgaris var. *marina* Rafinesque Schmaltz, 1810b: 38 (nomen nudum; locality: Sicilia)

Anguilla vulgaris var. *fluviatilis* Rafinesque Schmaltz, 1810b: 38 (nomen nudum; locality: Sicilia)

Anguilla vulgaris var. *lacustus* Rafinesque Schmaltz, 1810b: 38 (nomen nudum; locality: Sicilia)

Anguilla acutirostris Risso, 1826: 198 (type locality: not stated, probably around Nice, France; type material: NT)

Anguilla latirostris Risso, 1826: 199 (type locality: not stated, probably around Nice, France; type material: NT)

Anguilla mediorostris Risso, 1826: 199 (type locality: not stated, probably around Nice, France; type material: NT)

Anguilla fluviatilis Anslijn, 1828: 226, pl. 93 (unnecessary replacement name for *Muraena anguilla* Linnaeus, 1758)

Muraena oxyrhina Ekström, 1832: 287 (type locality: Mörkö Island [near Stockholm], Sweden; syntypes: LU)

Muraena platyrhina Ekström, 1832: 287 (type locality: Mörkö Island [near Stockholm], Sweden; syntypes: LU)

Muraena [*anguilla*] var. *macrocephala* De la Pylaie, 1835: 529 (type locality: shores of Atlantic Ocean, France; type material: NT ?)

Muraena [*anguilla*] var. *ornithorhyncha* De la Pylaie, 1835: 529 (type locality: shores of Atlantic Ocean, France; type material: NT ?)

Muraena [*anguilla*] var. *oxycephala* De la Pylaie, 1835: 529 (type locality: shores of Atlantic Ocean, France; type material: NT ?)

Muraena [*anguilla*] var. *platyura* De la Pylaie, 1835: 529 (type locality: shores of Atlantic Ocean, France; type material: NT ?)

Anguilla canariensis Valenciennes, 1843: 88, pl. 20 fig. 1 (type locality: barrancos or deep ravines of Teneriffa, Canaria Is., Atlantic Ocean; holotype: MNHN 3783, Bauchot et al., 1993: 94)

Anguilla septembrina Bonaparte, 1846: 38 (nomen nudum)

Anguilla cloacina Bonaparte, 1846: 38 (available by indication to Cuvier [1829: 349, pimperneaux]; type locality: France; type material: NT ?)

Muraena Anguilla maculata Chiereghini, in Nardo, 1847: 115 (nomen nudum)

Anguilla marina Nardo, 1860: 73 (nomen nudum)

Anguilla migratoria Kröyer, 1849: 616 (type locality: all over Denmark; syntypes: LU)

Anguilla platyrhynchus Costa, 1850: 50, pl. 58, pl. 60 fig. 3 (type locality: lake Ligola, Italy; syntypes: LU)

Anguilla callensis Guichenot, 1850: 111, pl. 7 fig. 1 (type locality: La Calle, Algeria; syntypes: MNHN 3160 [1], 3220 [1], 3774 [4], Bauchot et al., 1993: 93)

Anguilla Kieneri Kaup, 1856a: 54 (type locality: Toulon, France; holotype: MNHN 3757, Bauchot et al., 1993: 95)

Anguilla Cuvieri Kaup, 1856a: 54 (type locality: Abbeville, France; syntypes: MNHN 3758 [2], 3759 [7], Bauchot et al., 1993: 94)

Anguilla Bibroni Kaup, 1856a: 54 (type locality: Sicilia, Italy; syntypes: MNHN 3760 [1], 3779 [3], Bauchot et al., 1993: 93)

Anguilla Savignyi Kaup, 1856a: 55 (type locality: Napoli, Italy; holotype: MNHN 3131, Bauchot et al., 1993: 97)

Anguilla platycephala Kaup, 1856a: 55 (available by indication to Cuvier [1829: 349, Anguille plat-bec], type locality: Abbeville, France; holotype: MNHN 3210, Bauchot et al., 1993: 97)

Anguilla capitone Kaup, 1857: 34, pl. 3 fig. 17 (type locality: Napoli, Italy; holotype: MNHN 3762, Bauchot et al., 1993: 94)

Anguilla morena Kaup, 1857: 35, pl. 3 fig. 18 (type locality: Napoli, Italy; holotype: MNHN 3763, Bauchot et al., 1993: 96)

Anguilla melanochir Kaup, 1857: 35, pl. 4 fig. 19 (type locality: river Tibre [Tevere], Italy; holotype: MNHN 3764, Bauchot et al., 1993: 96)

Anguilla marginata Kaup, 1857: 36, pl. 4 fig. 20 (type locality: Valencia, Spain; holotype: MNHN 3765, Bauchot et al., 1993: 95)

Anguilla microptera Kaup, 1857: 36, pl. 4 fig. 21 (type locality: Bay of Algesiras, Spain; holotype: MNHN 3766, Bauchot et al., 1993: 96)

Anguilla ancidda Kaup, 1857: 37, pl. 4 fig. 22 (type locality: Sicilia, Italy; syntypes: MNHN 3767 [1], 3780 [1], Bauchot et al., 1993: 93)

Anguilla altirostris Kaup, 1857: 37, pl. 4 fig. 24 (type locality: estuary of river Seine, France; holotype: MNHN 3768, Bauchot et al., 1993: 93)

Anguilla nilotica Kaup, 1857: 40, pl. 5 fig. 28 (type locality: river Nile, Egypt; syntypes: MNHN 3769 [1], 3770 [1], 3771 [1], Bauchot et al., 1993: 96 [Kaup explicitly mentions only two specimens])

Anguilla aegyptiaca Kaup, 1857: 40 (type locality: river Nile, Egypt; holotype: MNHN 3772 [1] or 3773 [1], Bauchot et al., 1993: 93 [Kaup explicitly mentions only one specimen])

Leptocephalus brevirostris Kaup, 1857: 150, pl. 18 fig. 15 (type locality: Messina, Sicilia; holotype: MNHN)

Anguilla fluviatilis Heckel & Kner, 1858: 319, fig. 167 (unnecessary replacement name for *Muraena anguilla* Linnaeus, 1758; junior homonym of *Anguilla fluviatilis* Anslijn, 1828)

Anguilla eurystoma Heckel & Kner, 1858: 325, fig. 168 (type locality: Dalmatia; holotype: NMW 9284-5 ?)

Anguilla Hibernica Couch, 1865: 328, pl. 235 (type locality: river Liffey, Ireland; syntypes: LU)

Anguilla oblongirostris Blanchard, 1866: 496 (type locality: stream Huveaune near Marseille, river Lot, and lake Bourget, France; syntypes: MNHN 1880-343 [5], 9985 [1], Bauchot et al., 1993: 96)

Muraena anguilla var. *maculata* Chiereghini, in Ninni, 1872: 50 (type locality not stated, probably Adriatic Sea; syntypes: LU)

Anguilla Linnéi Malm, 1877: 590 (unnecessary replacement name for *Muraena anguilla* Linnaeus, 1758)

Anguilla brevirostris Cisternas, 1877: 108 (type locality: Valencia, Spain; syntypes: LU)

Systematic notes. See Smith (in Böhlke, 1989: 41–46) for discussion of status of American (*A. rostrata* Lesueur, 1817) and European eels.

Nomenclatural notes. Linnaeus (1758: 245) used both spellings *angvilla* (line 1) and *anguilla* (line 3 of *Muraena caeca* account). As first reviser, I retain *anguilla* as the correct spelling.

Clupeidae

4.1.1 *Alosa agone* (Scopoli, 1786)

Ciprinus [sic] *agone* Scopoli, 1786: 71 (type locality: lake Lugano, Switzerland, by neotype designation [originally: "Lacuum insubricorum" (lakes of northern Italy), especially lakes Verbano (Maggiore) and Lario (Como)]; neotype: MHNG 656.48, present designation; description repeated by Vallot, 1837: 279)

Clupea Alosa major Pollini, 1816: 21 (nomen nudum)

Clupea Alosa minor Pollini, 1816: 21 (nomen nudum)

Clupea Alosa parvula Pollini, 1816: 21 (nomen nudum)

Alosa Finta var. *lacustris* Fatio, 1890: 51 (type locality: lake Lugano, Switzerland, by lectotype designation [originally: lakes of Ticino, Switzerland and Lombardia, Italy]; lectotype: MHNG 656.48, present designation)

Alosa lacustris forma *ceresio-verbana* Barbieri, 1907: 140, pl. 1 fig. 4 (type locality: lakes Maggiore and Lugano, Italy and Switzerland; syntypes: MSNM ?)

Alosa lacustris forma *lariana* Barbieri, 1907: 140, pl. 1 fig. 3 (type locality: lake Como, Italy; syntypes: MSNM ?)

Alosa lacustris forma *benacensis* Barbieri, 1907: 140, pl. 1 fig. 5 (type locality: lake Garda, Italy; syntypes: MSNM ?)

Alosa finta gracilis Regan, 1916: 10 (type locality: lake Garda, Italy; syntypes: BMNH [3])

Systematic notes. This species has usually been treated as a subspecies or variety of *A. fallax* by earlier authors (e.g., Ferrero, 1951). The differences in morphology, habitat, life history, and ontogeny (compare figures by Chiappi, **1933**, reproduced in Hoestlandt, 1991: 263, 287) are strongly indicative that it is a distinct species.

Localities of this species in Sardegna in Quignard & Douchement's map (in Hoestlandt, 1991: 260) actually are their *rhodanensis*, part of it tentatively treated here as *A. algeriensis*.

Nomenclatural notes. The earliest available name for this species is *Cyprinus agone* Scopoli, 1786. Although the format used by Scopoli is rather unusual, it is clearly binominal. The original citation is in the following format and fonts: "CIPRINUS (Agone) *lanceolatus, quinque-uncialis, compressus; pinna dorsalis*" etc. A comparison of the other fish and bird species described in the same volume clearly shows that Scopoli used the generic names in capital letters followed by the specific name in brackets, and the diagnosis in italics. This is clear by his use of *Gadus lota* p. 71, *Cyprinus phoxinus*, *C. rutilus* p. 72, *C. leuciscus*, *C. barbus* p. 73, *Perca fluviatilis*, *Esox lucius*, *Salmo trutta*, and *Muraena anguilla* p. 74, all species named by Linnaeus (1758). In earlier pages, he clearly used the same format, under a more classical heading; e.g., p. 68, under the heading *Turbo obtusus*, he also has "TURBO (obtusus) *testa turrita* etc." The description and discussion may not be very accurate (e.g., his placement of the present fish in the genus *Cyprinus*, or the contradictions in his dorsal-fin ray counts), but his colour pattern description seems unambiguous. As no material of Scopoli is known to be extant, specimen MHNG 656.48 is designated as neotype; this specimen is also the lectotype of *Alosa finta lacustris* Fatio, 1890 and the two names are objective synonyms.

Svetovidov (1952) lists Pirola as author of '*Alosa finta lariana*' without giving a reference; I located a paper by Pirola (**1930**) dealing with this fish, but published after Barbieri's (1907) original description of *A. l. lariana*.

4.1.2 ? *Alosa algeriensis* Regan, 1916

Alosa finta algeriensis Regan, 1916: 10 (type locality: Algeria and Mogadore [now Essaouira], Morocco; syntypes: BMNH [2])

Alosa africana Regan, 1916: 8 (type locality: Algeria and Mogadore [now Essaouira], Morocco; syntypes: BMNH [2])

Alosa fallax bolivari Lozano Rey, 1929: 660, pl. 30 fig. 3 (type locality: Melilla, Spanish enclave in Morocco; syntypes: LU)

Systematic notes. This taxon was treated as a subspecies of *A. fallax* by Quignard, Douchement and Kartas (in Hoestlandt, 1991: 210–224). It is apparently distinguished from *A. fallax* (as recognised here) by more gill-rakers on the first gill arch (p. 212): 42–54 in *A. algeriensis* (but 40–60 on p. 213), vs. 31–46 in *A. fallax* (but 28–60 in other parts of the text, see account of *A. fallax* below). I tentatively recognise it as distinct from *A. fallax*.

Kartas (in Hoestlandt, 1991: 217) considered it to be restricted to the Mediterranean coast of Algeria and Tunisia, but the species seems to be present in Sardegna. Quignard & Douchement (in Hoestlandt, 1991: 277) considered that "the populations [of their *rhodanensis*] on Sardegna have affinities with those of North Africa, and they probably constitute an independent insular group. Nevertheless, these populations are included in this [account of *rhodanensis*] because they live within the range of [*rhodanensis*], which is the northern part of western Mediterranean". They quote data from Cottiglia (1963a-b, **1968, 1970**) reporting gill-raker counts on the first arch of 38–54, which seems to be in agreement with those of *A. algeriensis*.

Admitting that *A. algeriensis* is a distinct species, I cannot follow them in considering Sardegna as "within the range of [*rhodanensis*]", their *rhodanensis* being restricted to the coast of Italy, France, north-eastern Spain, and Corsica. Sardegna is definitively at the edge of this range, and adjacent to the range of *A. algeriensis*. The mentioned Sardegna populations are geographically almost closer to Tunisia than to the nearest *rhodanensis* population (if a direct distance has a biological meaning). In this context, information on Corsican populations would be of interest.

Nomenclatural notes. *Alosa algeriensis* and *A. africana* are possibly simultaneous synonyms and Kartas's treatment (in Hoestlandt, 1991: 213) can be considered to be a first reviser's action to determine priority of *A. algeriensis*. Furnestin & Vincent (1958: 3378) considered *Alosa africana* to be an hybrid between *A. alosa* and *A. fallax*.

4.1.3 *Alosa alosa* (Linnaeus, 1758)

Clupea Alosa Linnaeus, 1758: 318 (based on Artedi [1738: gen. 7 [34], syn. 15, spec. 34 [7], Clupea apice maxillae ...], Gronovius [1754: 6, n. 23, idem], and Hasselqvist [**1757: 388**, idem]; type locality: "Habitat in Oceano Europaeo"; syntypes: LSL 48 [1], BMNH 1853.11.12:179 [1], Wheeler, 1958: 207; 1985: 24)

Alosa communis Yarrell, 1836: vol. 2: 136 (type locality: rivers Thames and Severn, U.K.; syntypes: LU)

Alausa vulgaris Valenciennes, in Cuvier & Valenciennes, 1847: 391 (type locality: "Halles de Paris" [central market of Paris], France; lectotype: MNHN 3676, designated by Whitehead, 1967: 78)

Alosa rusa Mauduyt, 1848: 49 (type locality: river Vienne at Châtellerault, France; syntypes: Musée de Poitiers ?)

Alosa Cuvierii Malm, 1877: 654 (unnecessary replacement name for *Clupea alosa* Linnaeus, 1758; localities: Hjärbek at Limfjorden, Denmark / Bordeaux, France)

Systematic notes. Boisneau et al. (1992) found no electrophoretic differentiation between *A. alosa* and *A. fallax* and discussed the possibility that the two are conspecific. Their "morphological analysis" actually considered only gill-raker counts. Their alternative explanation (p. 737) that they are two "species derived from a nearly [electrophoretically] monomorphic" ancestor seems more likely, judging from the differences in distribution, habitat, spawning areas, seasons and mode which they report and the morphological differences reported by earlier authors. There is no theory to request that species have to differ electrophoretically or that stocks not distinguishable electrophoretically are conspecific (see also Mayden & Wood, 1995: 85). The number of characters (and character states) which can be observed, measured or counted by electrophoretic techniques is much smaller than those which are accessible through morphological or anatomical examination. Thus the probability of having related species indistinguishable electrophoretically is greater than of having them indistinguishable morphologically.

Nomenclatural notes. The specimen listed as lectotype of *Clupea alosa* by Quignard & Douchement (in Hoestlandt, 1991: 89) is actually the lectotype of *Alausa vulgaris*.

4.1.4 *Alosa fallax* (La Cepède, 1803)

Alosa ficta Duhamel du Monceau, **1772: 320** (not binominal, suppressed, ICZN, Opinion 859, 1968a: 92)

Clupea fallax La Cepède, 1803: 424, 452 (type locality: river Seine at Rouen, France; neotype: MNHN 3188, designated by Whitehead, 1967: 79)

Clupea rufa La Cepède, 1803: 452 (type locality: river Seine between Pointe du Hode to Aisiers, France; type material: NT ?)

Clupea nilotica Geoffroy Saint-Hilaire, 1808: pl. 10 (type locality: river Nile, Egypt; holotype: LU)

Clupea finta Cuvier, 1829: 320 (type locality: not stated; also available by indication to *Clupea ficta* [sic, probable lapsus for *C. fallax*] La Cepède, 1803; syntypes: ? MNHN)

? *Clupea Alosa* var. *elongata* De la Pylaie, 1835: 533 (infrasubspecific, name not available; locality: shores of Atlantic Ocean, France)

Clupea sardinella Vallot, 1837: 277 (type locality: lakes of Savoie, France [by present restriction; original type locality included also: Dauphiné, France / lakes Garda, Lugano, Como and Maggiore, Italy]; available by very short diagnosis and indication to numerous earlier authors; type material: NT)

? *Alosa minor* Bonaparte, 1846: 34 (cited in synonymy, name not available; author given as Risso, but Risso apparently never published this name)

Alosa finta rhodanensis Roule, 1924: 266 (type locality: river Rhône, France; syntypes: MNHN ?)

Systematic notes. The latest synopsis of *A. fallax* is by Quignard, Douchement and Kartas (in Hoestlandt, 1991: 211–296) who recognised six subspecies. Three of them (*A. f. fallax, A. f. nilotica, A. f. rhodanensis*) are anadromous and widely distributed, one (*A. f. algeriensis*) is anadromous with a restricted distribution and the remaining two (*A. f. lacustris* [here *A. agone*], *A. f. killarnensis*) have a more restricted distribution in freshwaters. The last three taxa are morphologically distinct, have different ecology and inhabit widely disjunct areas and are here treated as species.

The remaining subspecies are reported to differ in gill-raker counts as follow (p. 212): *fallax* 33–46 gill-rakers on the first arch (but 35–60 on p. 230), *rhodanensis* 31–43(46) (but 30–49 on p. 275), and *nilotica* 31–40 (but 28–40 on p. 265). The only other difference explicitly stated is: "members of [*rhodanensis*] seem to have less numerous, thicker, and coarser gill-rakers than *fallax*" (p. 274). Awaiting unambiguous and explicit data, it seems reasonable to consider that a single species is involved.

The northern Italian landlocked populations of *A. f. nilotica* on Quignard & Douchement's map (p. 268) are not mentioned in the text but seem to be their *A. f. lacustris*, here treated as a distinct species (*A. agone*). The northern Italian landlocked populations of *A. f. rhodanensis* on their map (p. 279) are not mentioned in the text, but appear to be the same *A. agone* populations. Those from Sardegna, also appearing on their map of *A. f. lacustris* (p. 260), are probably those mentioned in the text as *A. f. rhodanensis* (p. 277) and discussed here under *A. algeriensis*.

4.1.5 *Alosa immaculata* Bennett, 1835

Alosa immaculata Bennett, 1835: 92 (type locality: Black Sea at Trebizond, Turkey; holotype: LU)

Clupea pontica Eichwald, 1838: 135 (type locality: Black Sea near Odessa, Ukraine; type material: NT)

Clupea Eichwaldii Grimm, 1901: 67 (type locality: Kerch Strait, river Don at Rostow, Kalmius, Russia; syntypes: LU)

Alosa pontica var. *nigrescens* Antipa, 1904: 300 (type locality: Romanian coast of Black Sea and Danube delta; syntypes: NMW 92939 ? [3]); also Antipa, 1905: 21, pl. 1 figs. 1–3

Alosa pontica var. *Danubii* Antipa, 1904: 300 (type locality: several localities in western Black Sea and Danube [as far upriver as Braila, Antipa, 1906: 17] and Constantza, Romania; syntypes: NMW 4239 ? [4]); also Antipa, 1905: 17, pl. 1 figs. 4–8

Alosa pontica var. *Russac* Antipa, 1904: 301 (type locality: Romanian coast of Black Sea and limans at mouth of Danube [lake Razim, Antipa, 1905: 22], Romania; syntypes: NMW 4247 ? [1]); also Antipa, 1905: 22, pl. 2 figs. 1–5

Caspialosa pontica var. *chtamalocephala* Isachenko, **1925: 110** (delta of river Dnieper, Ochakov) from Berg, 1948: 124 (probably infrasubspecific; if so, name is available from Fowler, **1973: 235**; from Costa Pereira, in litt.)

Caspialosa pontica var. *hypselocephala* Isachenko, **1925: 112** (delta of river Dnieper, Ochakov) from Berg, 1948: 124 (probably infrasubspecific; if so, name is available from Fowler, **1973: 236**; from Costa Pereira, in litt.)

Alosa kessleri pontica natio *borysthenis* Pavlov, **1959: 18** (infrasubspecific, name not available; locality: river Dnieper, Ukraine) from Kolarov, in Hoestlandt, 1991: 337

Alosa kessleri pontica natio *issatschenkovi* Pavlov, **1959: 38** (infrasubspecific, name not available; locality: river Dnieper, Ukraine) from Kolarov, in Hoestlandt, 1991: 337

Alosa kessleri pontica natio *moriac* Pavlov, **1959** (infrasubspecific, name not available; locality: rivers Danube and Dnieper, Ukraine and Romania) from Kolarov, in Hoestlandt, 1991: 343

Systematic notes. Hoestlandt, Heckman and Kolarov (in Hoestlandt, 1991: 321–387) recognised three subspecies in *A. pontica*. Nowhere do they provide an argument to justify this status. Different habitats, disjunct distribution and morphological differences suggest that three species are involved: *A. pontica* in the Black Sea basin and *A. kessleri* (Grimm, 1887) and *A. volgensis* (Berg, 1913) in the Caspian Sea basin.

Nomenclatural notes. Kolarov (in Hoestlandt, 1991: 337) listed *A. immaculata* in the synonymy of *A. pontica* and Whitehead (1985: 204) included it with a question mark. If the synonymy is true, then the correct name of the species is *A. immaculata* which has priority. Bennett's (1835) material is apparently no longer extant and a neotype designation is needed.

The publication date of Antipa's subspecies is usually given as 1905 or 1906, but an abstract of this monograph appeared in 1904, making the names available from this date.

Kolarov (in Hoestlandt, 1991: 342) lists an "*A. p.* var. *moreac* (Antipa, 1936)". Antipa (1936: 165) never created such a name. After listing the 3 varieties which he described earlier, he states that he has a fourth one which the local fishermen call moreac. This does not make *moreac* an available scientific name.

4.1.6 *Alosa killarnensis* Regan, 1916

Alosa finta killarnensis Regan, 1916: 9 (type locality: Killarney, Ireland; syntypes: BMNH [3])

Systematic notes. Considered as a subspecies of *A. fallax* by earlier authors. Its discrete distribution, particular ecology and morphological distinctiveness seem to justify that it be considered as a distinct species. It is reported to be distinguished from the adjacent *A. fallax* populations by size, coloration, and gill-raker counts: 43–53 gill-rakers on the first gill arch in *A. killarnensis* (Quignard & Douchement, in Hoestlandt, 1991: 212), vs. 33–46 in *A. fallax* from the Atlantic basin (but see above account of *A. fallax* for different values given by the same authors).

O'Maoileidigh et al. (1988) found no overlap in gill-raker counts between *A. killarnensis* and an adjacent *A. fallax* populations, but found a high degree of genetic similarity (but still slight differences). They commented that the differences between the two (size and number of gill-rakers) are "thought to be due to environmental selection" and that "retention of the subspecific name deserves serious consideration" but did nor argue further. Under the PSC, *A. killarnensis* is a distinct species. That selection may have played a role seems a truism under any species concepts and is irrelevant in the present context.

4.1.7 *Alosa macedonica* (Vinciguerra, 1921)

Clupea macedonica Vinciguerra, 1921: 323, pl. 4 fig. 2 (type locality: lake Besikia [Volvi], Macedonia, Greece; syntypes: MSNG 11571 [5], Tortonese, 1961: 181)

4.1.8 *Alosa maeotica* (Grimm, 1901)

Clupea maeotica Grimm, 1901: 67 (type locality: Black Sea, Kerch Strait [along Caucasus shores]; neotype: ZISP 32230, designated by Svetovidov, 1952: 254 ?)

Caspialosa brauneri Nikolski, **1923: 5** (Akkerman and Ovidiopol, liman of river Dniester) from Berg, 1948: 119

Caspialosa brauneri m. *elongata* Issachenko, **1925: 128** (infrasubspecific, name not available; locality: Ochakov) from Berg, 1948: 119

Nomenclatural notes. Kolarov (in Hoestlandt, 1991: 309) reported that Svetovidov (1952: 254) considered a specimen collected on 8–10 December 1948 as the holotype of *A. maeotica*. This is obviously not possible, the species having been originally described in 1901. I could not check Svetovidov (1952), but in the 1963 translation, he clearly states that Grimm's material is lost and that specimen ZISP 32230 should be regarded as type. Formally, this specimen cannot be the holotype, but is here considered as a neotype designation, even though the word neotype is not used (at least in the translation), as it fulfils the conditions of a neotype designation and as ICZN art. 75(a) allows for the use of both the words type or neotype.

4.1.9 *Alosa tanaica* (Grimm, 1901)

Clupea tanaica Grimm, 1901: 67 (type locality: lower reaches of river Don near Rostow, Ukraine; neotype: ZISP 16125, designated by Svetovidov, 1952: 235)

Alosa Nordmanni Antipa, 1904: 301 (type locality: Black Sea and lower Danube [as far upriver as the Iron Gate; Antipa, 1906: 28], Romania; syntypes: NMW 88576 ? [6] [invalid neotype: ZISP 15497, designated by Svetovidov, 1952: 233; locality: river Danube near Vilkov]); also Antipa, 1905: 28, pl. 2 figs. 6–10

Caspialosa tanaica palaeostomi Sadovskii, **1934: 135** (type locality: lake Paleostom, Georgia; syntypes: 4, apparently not preserved; neotype: ZISP 31470, designated by Svetovidov, 1952: 231)

Caspialosa palaeostomica Maiorova, **1934: 22** (lake Paleostom, river Moltakva and Black Sea off Poti, Georgia) from Berg, 1948: 136

Alosa bulgarica Drensky, 1934: 79, fig. 1 (type locality: river Resovska south of Burgas, Bulgaria; lectotype: NMNHS 300/2, designated by Karapetkova, in Hoestlandt, 1991: 129 [see comment below])

? *Caspialosa tanaica etemi* Battalgil, 1941: 171 (type locality: lake Manyas, Turkey; syntypes: LU)

Alosa caspia tanaica natio *asovi* Pavlov, **1959: 106** (infrasubspecific, name not available; locality: Azov Sea) from Mogilchenko, in Hoestlandt, 1991: 180

Systematic notes. Various authors in Hoestlandt (1991) recognise eight subspecies of *A. caspia* (Eichwald, 1838) [although, Kolarov (p. 156) seems to imply that he recognises only three]. Nowhere do they present arguments to justify recognition of these subspecies or to explain why they are given that rank. There is also no evidence that the different authors are referring to the same fish by the same name. There is no general treatment of the species presenting the relationships between the different 'subspecies'. As the Caspian and Black Sea taxa seem morphologically distinct and occur in disjunct areas, I consider here that *C. caspia* is restricted to the Caspian Sea; I have not investigated the status of the three Caspian 'subspecies' because the data available to me do not allow it.

The *A. c. nordmanni* and *A. c. tanaica* 'subspecies' seem very close and indeed have been considered identical by some authors (e.g., Borcea, 1934: 383, 1936: 26). Kolarov (in Hoestlandt, 1991: 158) stated by which characters they differ, but did not give the character states of both taxa. His table gives values for *A. c. nordmanni* but nowhere in that volume are there similar data for *A. c. tanaica*. Interestingly, the characters used in the key are different, and the character states supposed to distinguish the two taxa almost completely overlap. In addition, the supposedly diagnostic eye diameter is given as 22–27% of head length in the key (p. 128) while in the species account it is 18–30% (p. 157) or 18.0–26.5% (p. 158) for *A. c. nordmanni*. Gill-rakers on first gill arch are given as 62–85 in the key (p. 128) and as 62–85 (p. 182) and 58–93 (p. 185) in the text for *A. c. tanaica*, as 66–88 in the key (p. 128), 66–96 (p. 156) in the text and 60–97 (p. 160) in the table for *A. c. nordmanni*. Morphometric data cannot be compared because they are given in places as percentages of body length (= standard length or length to last scales on caudal fin ?), fork length and total length. *Alosa c. tanaica* occurs in the eastern Black Sea, east of the Crimean Peninsula and *A. c. nordmanni* west of the Crimean Peninsula; their ranges are adjacent and contiguous. Under these circumstances, I doubt that the two taxa can be distinguished and I consider them as a single species. *Alosa tanaica*, being the oldest name, has priority.

The 'subspecies' *A. c. palaeostomi* is supposed to be distinguished from *A. tanaica* by a body depth of 25–31% of "standard body length" [= SL ?] (vs. 20.5–27 in *A. tanaica*) (key in Hoestlandt, 1991: 128). But data by Mogilchenko (in Hoestlandt, 1991) are 18.6–21.3% of "body length" [= SL ?] on p. 172, 24.5–30.7 and 25.2–30.8 on p. 173; figure 42 shows a body depth of about 30% of SL or about 24% of total length. The number of gill-rakers on the first arch is 73–87 according to the key (p. 128) and 61–90 according to the text (p. 172). *Alosa c. palaeostomi* is sympatric with *A. c. tanaica* in most of its range (Mogilchenko, in Hoestlandt, 1991: 186, fig. 51). Much good faith is required to admit the distinctness of the two nominal taxa and awaiting the presentation of coherent and conclusive data, I do not see how they could be distinguished.

Similarly, *A. c. bulgarica* has a distribution restricted to the Black Sea coast of Bulgaria (Karapetkova, in Hoestlandt, 1991: 132). According to the key (p. 128), it is distinguished from the pair *A. c. tanaica* – *A. c. nordmanni* by a deeper body (25–31, vs. 24–28.5% of "standard body length" [= SL ?]). According to the text, body depth is 25.7–31.7% of "fork length" in *A. c. bulgarica* (p.

130) and 20.4–28.3% of "fork length" in *A. c. nordmanni* (p. 157) and maximum 24.2% of "body length" in *A. c. tanaica* (p. 183). The gill-raker count is reported to be critical in the key (p. 128): 87–107 in *A. c. bulgarica* vs. 62–88 in *A. c. tanaica* - *A. c. nordmanni*. Again the text data are somewhat different: 81–107, 72–102 and 87–102 in *A. c. bulgarica* (p. 130), 62–85 (p. 182) and 58–93 (p. 185) in *A. c. tanaica*, 66–96 (p. 156) and 60–97 (p. 160) in *A. c. nordmanni*. It seems that the number of gill-rakers is somewhat higher in *bulgarica*, but again the supporting data (and their presentation) is so ambiguous that for the time being it seems justified to consider it as a synonym of *A. tanaica*.

The accounts in Hoestlandt (1991) are very confusing and often not compatible. Most seem to rely heavily (in some cases apparently exclusively) on data compiled from other sources, themselves possibly not even first-hand and compatible. Clearly, the status of all these forms deserves a careful and critical review, based on the actual examination of specimens of all of them by the same researcher, and not by an exploration of the literature.

Data in Economidis & Sinis (1986) seem to indicate that *A. vistonica* has a distribution disjunct from other *A. caspia* 'subspecies', a different biology and is morphologically distinct. It is therefore treated as a valid species.

Nomenclatural notes. The publication date of Antipa's *Alosa nordmanni* is usually given as 1905 or 1906, but an abstract of this monograph appeared in 1904, making the names available from this date.

Svetovidov (1952: 233) designated what appears to be a neotype for *A. nordmanni* (see *A. maeotica* for similar discussion). He does not discuss the whereabouts of Antipa's specimens; 6 specimens (NMW 88576) still exist and are likely to be syntypes; therefore Svetovidov's designation seems invalid.

Karapetkova (in Hoestlandt, 1991: 129) designated a lectotype for *A. bulgarica*. The specimen was collected by Drensky on 15 May 1934 while Drensky (1934) explicitly states that he collected material in 1930 and his figure 1 shows a specimen collected on 15 May 1931. I assume that 1934 is a lapsus for 1931 and tentatively consider the lectotype designation as valid, but this requires confirmation.

4.1.10 *Alosa vistonica* Economidis & Sinis, 1986

Alosa caspia vistonica Economidis & Sinis, 1986: 729, fig. 3 (type locality: lake Vistonis, Greece; holotype: DZAUT D-351)

Systematic notes. See *Alosa tanaica* for a general discussion of taxa earlier considered to be subspecies of *A. caspia*.

4.2.1 *Clupeonella cultriventris* (Nordmann, 1840)

Clupea cultriventris Nordmann, 1840: 522 (type locality: Pont-Euxin [Black Sea]; syntypes: MNHN 3681 [3, Odessa], Whitehead & Bauchot, 1985: 10)

Clupea delicatula Nordmann, 1840: 524 (type locality: market in Odessa [probably from Black Sea]; lectotype: ZISP 2254, designated by Svetovidov, 1952: 194; junior homonym of *Clupea delicatula* Bennett, 1831)

Clupeonella delicatula azovi Vladimirov, 1950: 126 (type locality: Azov Sea at Berdyansk Spit; syntypes: LU)

Systematic notes. Kozlovsky and Heckman (in Hoestlandt, 1991: 55, 67, 71) considered *C. cultriventris* to consist of two subspecies and one "morph". Nowhere do they present a clear argument to justify these status and ranks and their accounts are quite confusing. In addition to the two subspecies and the morph, several "forms" (precoastal, marine, common, lake forms) are mentioned (e.g., p. 58) and it is difficult to make taxonomic sense of much of their data. They seem to present data suggesting that the Black Sea and Caspian populations are morphologically and genetically distinct and that they have discrete and disjunct distribution. Although confusingly presented, the electrophoretic data seem to suggest that the two subspecies are not even each other's closest relatives.

Given this confusing situation, the only objective statement seems to be that the two population are morphologically distinct and occur in different areas. There is no evidence that they are more closely related to each other than to any other species of the genus. In such circumstances, the proposal of a subspecific nomenclature is misleading and it seems justified to consider them as different species. *Clupeonella cultriventris* is the Black Sea species and *C. caspia* (Svetovidov, 1941) is the Caspian Sea species; their respective status should be further investigated.

The "morph" *tscharchalensis* from the Volga basin is distinct from *C. caspia* by morphological and life history characters, habitat and distribution, and considering the available data it seems to actually be a distinct species. As the name *tscharchalensis* was originally proposed for a variety by Borodin (1896: 82), it is available with that author and date, despite the fact of having subsequently been treated as an infrasubspecific name.

Cyprinidae

Many of the genera commonly recognised among European Cyprinidae (*Abramis*, *Leuciscus*, *Rutilus*, *Scardinius*, to cite only the main ones) are very poorly established. To simplify, these genera are not properly defined and are justified more because of tradition than as real phylogenetic entities (see, e.g., Bogutskaya, 1994: 618, 1995: 153). Most of these genera remained more or less untouched since the beginning of the 19th century. In the absence of critical phylogenetic studies it is not possible to propose a better classification at this stage and this system is followed here.

It seems obvious that several large genera are composite assemblages, while the recognition of others is artificial. For example, the '*Leuciscus souffia* group' could possibly be recognised as a genus distinct from *Leuciscus*. But the situation is not that simple, and several species occasionally placed in *Rutilus*, *Phoxinellus* and *Iberocypris* have been suggested to be closely related or to belong to this lineage (Bianco, 1988b: 9), but a formal definition has not been proposed. Similarly, the distinction between *Scardinius* and *Rutilus* relies on few characters of arguable value; it might well be that *Scardinius* and some *Rutilus* are congeneric, but as there are also indications that *Rutilus* itself might be polyphyletic, there does not seem to be advantages at placing the few species of *Scardinius* in the presently poorly defined *Rutilus*.

5.1.1 *Abramis ballerus* (Linnaeus, 1758)

Cyprinus Ballerus Linnaeus, 1758: 326 (based on Linnaeus [1746: 122, n. 323, Cyprinus ... radiis 40] and Artedi [1738: gen. 3 [23], syn. 12, spec. 23 [3], Cyprinus admodum latus ...; "in Melaro et aliis Uplandiae lacubus"]; type locality: "in Europae lacubus"; type material: NT)

Cyprinus Farenus Linnaeus, 1758: 316 (based on Artedi [1738: spec. [gen.] 23, Cyprinus ... radiis 37 (27 in title, 37 in text)] and Linnaeus [1746: 123, n. 327, idem]; type locality: "in Sveciae Lacu Maelero"; type material: NT)

Systematic notes. Hensel (1978) considers the present species and *A. sapa* to constitute a distinct genus *Ballerus*.

Nomenclatural notes. *Cyprinus ballerus* and *C. farenus* are subjective simultaneous synonyms. The first reviser action to determine respective priority apparently is Smitt (1895: 819) who retained *C. ballerus*. Earlier authors considered *C. farenus* as a synonym of *Abramis brama*.

5.1.2 *Abramis bjoerkna* (Linnaeus, 1758)

Cyprinus Bjoerkna Linnaeus, 1758: 326 (based on Linnaeus [1746: 124, n. 328, Cyprinus .. radiis 35] and Artedi [1738: gen. 3 [20], syn. 13, spec. 20 [3], Cyprinus quincuncialis ...]; type locality: "in Sveciae lacubus"; type material: NT)

Cyprinus gieben Wulff, 1765: 50 (type locality: Borussia [Prussia]; syntypes: NT)

Cyprinus Plestya Leske, 1774: 69 (type locality: Leipzig, Germany; type material: possibly LSL 72 ?; Wheeler, 1985: 5, 29)

Cyprinus Blicca Bloch, 1782: 65, pl. 10 (type locality: "in allen unsern Landseen" [in all our interior lakes, thus Germany]; syntypes: ZMB, lost H.-J. Paepke, in litt., 1995)

Cyprinus latus Gmelin, 1788: 1438 (available by description [apparently compiled] and indication to earlier authors, especially Bloch [1782: 65, pl. 10, *Cyprinus blicca*]; type locality: Germany, Borussia [Prussia], Silesia, Belgium and France; syntypes: ZMB, lost [Bloch's material])

Cyprinus meckel Hermann, 1804: 328 (type locality: Strasbourg, France; type material: NT ?)

Cyprinus gibbosus Pallas, 1814: 324 (type locality: rivers Sura and Volga, Russia; syntypes: LU)

Cyprinus Laskyr Pallas,1814: 326 (type locality: "Tanaï inferiore et fl. Lipewiza regionis Voronicensis [river Don and Seim, a tributary of the Desna; Berg, 1949: 763]; syntypes: LU)

Abramis micropteryx Agassiz, 1835b: 39 (nomen nudum)

Abramis erythropterus Agassiz, 1835b: 39 (nomen nudum)

Abramis micropteryx Valenciennes, in Cuvier & Valenciennes, 1844: 44 (type locality: not stated; type material: based on a drawing sent by Agassiz; material on which the drawing is based is possibly MHNN 1080 [1, river Rhine ?], 1081 [1, river Rhine ?])

Abramis erythropterus Valenciennes, in Cuvier & Valenciennes, 1844: 58 (type locality: not stated; type material: based on a drawing sent by Agassiz; material on which the drawing is based is possibly MHNN 1079-B [1, river Rhine ?])

Blicca argyroleuca Heckel, 1843: 1007, pl. 1 (available by indication [ICZN arts. 12(b)(7), 14(b)]; no locality data; syntypes: ? NMW [used as a replacement name for *Cyprinus blicca* Bloch, 1782 by Heckel & Kner, 1858: 120])

? *Blicca intermedia* Fatio, 1882: 355 (type locality: river Rhône in Lyon, France; holotype: MHNG 656.16)

Blicca bjoerkna transcaucasica Berg, 1916a: 306 (type locality: lower reaches of the Kura, Araks, Lenkoran district [from Berg, 1949: 767]; syntypes: ZISP ?)

Blicca bjoerkna derjavini Dadikyan, 1970: 550 [of translation] (type locality: river Sevdzhur, basin of river Araks, Armenia; syntypes: LU [30])

Systematic notes. This species was previously considered to belong to a distinct genus, *Blicca*. Generic position follows Shutov (1969), Hensel (1978) and Howes (1981: 46).

Nomenclatural notes. *Abramis micropteryx* and *A. erythropterus* as used by Agassiz (1835b) are nomina nuda. Valenciennes (in Cuvier & Valenciennes, 1844) described them on the basis of drawings sent by Agassiz. The specimens used as models for the drawings are the types of these species. Specimens identified by Agassiz under these names are in MHNN and are potential types; this could be established by comparing them with Agassiz's drawings which possibly are in Cuvier & Valenciennes's files in MNHN (Pietsch, 1985; Bauchot et al., 1990).

5.1.3 *Abramis brama* (Linnaeus, 1758)

Cyprinus Brama Linnaeus, 1758: 326 (based on Linnaeus [1746: 121, n. 318, Cyprinus ... radiis 27], Artedi [1738: gen. 6 [20], syn. 4, spec. 22 [6], Cyprinus pinnis omnibus nigrescentibus ...; "lacus et stagna pleraque in Suecia"], Gronovius [1754: 3, n. 14, idem]; type locality: "in Europae lacubus"; syntypes: NRM 48 [1], BMNH 1853.11.12:147 [1], Wheeler, 1958: 211)

Abramis microlepidotus Agassiz 1835b: 39 (nomen nudum)

Abramis argyreus Agassiz 1835b: 39 (nomen nudum)

Abramis melaenus Agassiz, 1835b: 39 (nomen nudum)

Abramis vetula Heckel, 1836: 230, pl. 20 fig. 6 (type locality: lake Neusiedler, Austria; syntypes: NMW 55259 [1], 55260 [2], 91131 ? [1])

? *Abramis media* Koch, in Koch, Herrich-Schäffer & Forster, 1840: 40 (type locality: stream Naab, Regensburg, Germany; type material: NT ?)

Abramis microlepidotus Valenciennes, in Cuvier & Valenciennes, 1844: 43 (type locality: river Danube; type material: based on a drawing sent by Agassiz, material on which the drawing is based is possibly MHNN 1060 [1, river Rhine ?])

Abramis argyreus Valenciennes, in Cuvier & Valenciennes, 1844: 45 (type locality not stated; type material: based on a drawing sent by Agassiz, material on which the drawing is based is possibly MHNN 1061 [2, river Rhine ?])

Abramis vulgaris Mauduyt, 1848: 30 (unnecessary replacement name for *Cyprinus brama* Linnaeus, 1758)

Abramis gehini Blanchard, 1866: 355, fig. 74 (type locality: river Moselle at Metz, France; lectotype: MNHN 3927, Bertin & Estève, 1948: 61)

Abramis brama var. *sinegorensis* Lukash, **1925** (locality: river Kobra, tributary of river Vyatka, Volga basin, Russia) from Hensel, 1978: 137

Abramis brama bergi Grib & Vernidub, **1935: 112** (type locality: Aral Sea at Muinak / lake Yaskhan in Uzboi / river Sary-su; syntypes: LU; junior primary homonym of *Abramis sapa bergi* Belyaev, **1929**) from Berg, 1949: 774

Abramis brama orientalis Berg, 1949: 774 (replacement name for *Abramis brama bergi* Grib & Vernidub, 1935)

Abramis brama danubii Pavlov, 1956: 894 (type locality: limans Yalpug and Khitay, Ukraine; syntypes: LU [at least 63])

Nomenclatural notes. *Abramis microlepidotus* and *A. argyreus* as used by Agassiz (1835b) are nomina nuda. Valenciennes (in Cuvier & Valenciennes, 1844) described them on the basis of drawings sent by Agassiz. The specimens used as models for the drawings are the types of these species. Specimens identified by Agassiz under these names are in MHNN and are potential types; this could be established by comparing them with Agassiz's drawings which possibly are in Cuvier & Valenciennes's files in MNHN (Pietsch, 1985; Bauchot et al., 1990). Valenciennes indicated that *A. microlepidotus* is from the Danube, but the MHNN specimen is labelled as possibly from the Rhine.

Bertin & Estève (1948: 61) list a specimen which they claim to be the holotype of *Abramis gehini* Blanchard, 1866. As Blanchard has not explicitly stated that he had a single specimen, and as it seems possible that he had more than one specimen (although he does not state so) the specimen has to be treated as the lectotype (ICZN art. 74(b)) [I refer to the French version of Art. 74, which is not equivalent to the English version; "même si un autre" does not mean "should another" but "even if another"].

5.1.4 *Abramis sapa* (Pallas, 1814)

Cyprinus Kleweza Güldenstädt, 1791: 86 (nomen nudum)

Cyprinus Sapà Pallas, 1814: 328 (type locality: streams Sura, Samara, Kinel [tributaries of river

Volga], Russia; syntypes: LU)

Cyprinus Cleveza Pallas, 1814: 329 (type locality: "in alveo Tanaïs versus Maeoticam" [mouth of river Don; Berg, 1949: 780], Russia; syntypes: LU)

Abramis balleropsis Agassiz, 1835b: 39 (nomen nudum)

Abramis schreibersii Heckel, 1836: 227, pl. 20 fig. 4 (type locality: rivers Danube downriver of Wien and March, Austria; syntypes: NMW 16584 [1], 79462 [1], 79463 [1])

Abramis sapa bergi Belyaev, **1929: 80** (river Kura, Caspian Sea basin) from Berg, 1949: 783

Abramis sapa aralensis Tyapkin, **1939: 144** (Aral Sea) from Berg, 1949: 784

Abramis sapa bergi natio *ferganensis* Maksunov, **1961** (infrasubspecific, name not available; Farkhad reservoir [near Fergana], Uzbekistan) from Opalatenko, 1967: 33

5.2.1 *Alburnoides bipunctatus* (Bloch, 1782)

Cyprinus bipunctatus Bloch, 1782: 50, pl. 8 fig. 1 (type locality: Minden, Germany; holotype: ZMB 3357 [1])

Cyprinus Blochii Nau, 1791: 33 (unnecessary replacement name for *Cyprinus bipunctatus* Bloch, 1792)

Cyprinus Annoni Walbaum, 1792: 32, 705 (description based Gronovius [1763: 108 n. 341]; type locality: river Rhine in Basel, Switzerland; type material: NT ? [Gronovius's material])

? *Cyprinus tinca notha* Walbaum, 1792: 33 (type locality: river Rhine; syntypes: material of Sander [1784: 252])

? *Cyprinus sanderi* Bloch, in Schneider, 1801: 445 (type locality: river Rhine; syntypes: material of Sander [1784: 252])

? *Cyprinus gronovii* Bloch, in Schneider, 1801: 446 (type locality: river Rhine in Basel, Switzerland; syntypes: material of Gronovius [1763: 108, n. 341])

Cyprinus spirlin La Cepède, 1803: 499, 588, 595 (unnecessary replacement name for *Cyprinus bipunctatus* Bloch, 1782: 50, pl. 8 fig. 1)

Cyprinus Punctatus Shaw, 1804: vol. 5 (1): 220 (unnecessary replacement name for *Cyprinus bipunctatus* Bloch, 1782)

Cyprinus Riemling Hermann, 1804: 320 (type locality not stated [Strasbourg, France ?]; type material: NT ?)

Aspius fasciatus Nordmann, 1840: 497, pl. 23 fig. 2 (type locality: rivers of the east coast of the Black Sea ["torrents et rivières des pays situés le long de la côte orientale du Pont-Euxin et habités par les Tcherkesses, les Chapsoughes, les Abases et les Mingréliens"]; syntypes: MNHN 3897 [4], Bertin & Estève, 1948: 79)

Leuciscus Baldneri Valenciennes, in Cuvier & Valenciennes, 1844: 262, pl. 497 (type locality: based on specimens from lake Genève at Genève, Switzerland, and tentatively on several published and unpublished accounts and figures; syntypes: MNHN 1969 [2], Bertin & Estève, 1948: 79)

? *Alburnus maculatus* Kessler, 1859a: 535 (type locality: small streams of Crimea, especially near Salghir / market in Simpheropol, Crimea, Ukraine; syntypes: LU [10])

Alburnus Eichwaldii Filippi, 1863: 392 (type locality: river Kur near Tiflis [Tbilisi], Georgia; syntypes: MZUT 677 [4], Tortonese, 1940: 140)

Alburnoides bipunctatus rossicus Berg, **1924: 56** (river Kama basin, a tributary of the Volga, Russia) from Berg, 1949: 757

Alburnus bipunctatus var. *prespensis* Karaman, 1924b: 54 (type locality: lake Prespa and its tributaries, FYROM and Greece; syntypes: LU)

Alburnus bipunctatus ohridanus Karaman, 1928: 153 (type locality: lake Ohrid, FYROM; syntypes: LU); repeated in 1929: 172

Alburnoides bipunctatus var. *smyrnaea* Pellegrin, 1927: 37 (type locality: stream Mélès near Smyrna, Turkey; syntypes: MNHN 27-64 [16], Bertin & Estève, 1948: 80, MSNM 4412 [1], Conci & Michelangeli, 1974: 223))

Alburnoides bipunctatus rossicus natio *kubanicus* Berg, 1932a: 150 (infrasubspecific, name not available; river Kuban); has priority over Berg, 1932c: 493

Alburnoides bipunctatus tzanevi Chichkoff, 1934: 375, fig. 1 (type locality: river Riesova, entering Black Sea at 42°N, Bulgaria; syntypes: LU [at least 96])

Alburnoides bipunctatus strymonicus Chichkoff, 1940: 113, 141, pl. 1 fig. 3, pl. 2 fig. 6 (type locality: river Toplitza, a tributary of river Mesta / river Struma, Bulgaria; syntypes: LU [45])

Alburnoides bipunctatus v[ar]. *thessalicus* Stephanidis, 1950: 204 (type locality: rivers Pinios and Sperchios, Greece; syntypes: lost ?)

Alburnoides bipunctatus armeniensis Dadikyan, 1972: 520 [of translation] (type locality: rivers Arpa, Vorotan, Vedi, Marmarik, Kasakh and their tributaries, basin of river Araks, Armenia; syntypes [total 434]: ZISP 37502)

Systematic notes. Economidis & Bănărescu (1991: 261, 264) consider *A. b. tzanevi*, *A. b. strymonicus* and *A. b. thessalicus* as valid subspecies. The canonical analysis by Daget et al. (1977) suggests that two groups can be distinguished among Greek populations. Their data (p. 22) indicate an almost complete overlap (but with different means) for those characters they consider as most useful to distinguish their subspecies, but it is not clear whether they are diagnosable. So, with the available data, it does not seem that they can be recognised as species under the PSC.

5.3.1 *Alburnus albidus* (Costa, 1838)

Leuciscus albidus Costa, 1838: fasc. 19: 16, pl. 14 (type locality: river Alento near Fasana (SA), Campania, Italy; neotype: IZA 7899, designated by Bianco, 1980: 32)

Leuciscus Vulturius Costa, 1838: fasc. 19: 17, pl. 15 (type locality: lakes Vulture and Monticchio, Italy; syntype: MNHN 195 [1], Bertin & Estève, 1948: 79)

? *Leuciscus cordilla* Valenciennes, in Cuvier & Valenciennes, 1844: 291 (type locality: Italy; holotype: MNHN)

Systematic notes. See Bianco (1980: 33) for discussion of synonymy.

5.3.2 *Alburnus alburnus* (Linnaeus, 1758)

Cyprinus Alburnus Linnaeus, 1758: 325 (based on Linnaeus [1746: 134, n. 330, Cyprinus ... radiis 30], Artedi [1738: gen. 6 [17], syn. 10, spec. 17 [6], Cyprinus quincuncialis pinna ...; Sweden], Gronovius [1754: 3, n. 10, idem; 1746: 75, n. 58, Cyprinus Koning van Asterling; river Rhine]; type locality: "in Europae aquis dulcibus"; type material: NT)

Cyprinus Albor Scopoli, 1786: 73 (type locality: lakes of Insubria, northern Italy [particularly lake Como]; type material: NT)

Cyprinus lanceolatus Bloch, in Schneider, 1801: 446 (type locality: lakes of Insubria, northern Italy [particularly lake Como]; type material: NT [material of Scopoli, 1786: 73, *Cyprinus albor*])

Aspius ochrodon Fitzinger, 1832: 335 (nomen nudum; locality: river Danube, Austria)

Aspius arborella Bonaparte, 1841: [fasc. 30, p. 253], pl. 116 fig. 5 (type locality: lakes of northern Italy; syntypes: ANSP 6075-6076 [11], Bianco, pers. comm., 1985)

Aspius alburnoides Selys-Longchamps, 1842: 214 (type locality: rivers Vesdre, Ourthe, Moselle and tributaries, Bruxelles, river Escaut, Belgium; syntypes: ISNB 109 [31], MHNN 1087 [2], Kottelat, 1984: 147)

Alburnus alborella Filippi, 1844: 402 (type locality: Verbano [lake Maggiore] and Lario [lake Como], Italy; syntypes: LU)

Alburnus lucidus Bonaparte, 1844: 437 (nomen nudum)

Alburnus Ausonii Bonaparte, 1844: 437 (nomen nudum)

Alburnus avola Bonaparte, 1844: 437 (nomen nudum)

Alburnus strigio Bonaparte, 1844: 437 (type locality: Italy; syntypes: LU)

Alburnus obtusus Bonaparte, 1845: 12 (type locality: "Pannonia"; syntypes: LU)

Alburnus acutus Bonaparte, 1845: 12 (type locality: "Pannonia"; syntypes: LU)

Alburnus scoranza Bonaparte, 1845: 12 (type locality: Montenegro; syntypes: LU)

Alburnus avola Bonaparte, 1845: 12 (type locality: northern Italy; syntypes: ANSP 6066-6073 [8], Böhlke, 1984: 69)

Alburnus gracilis Bonaparte, 1845: 12 (listed in synonymy, name not available); 1846: 33 (nomen nudum)

Alburnus fracchia Bonaparte, 1845: 12 (listed in synonymy, name not available); 1846: 33 (nomen nudum)

Alburnus lucidus Heckel, 1853: 30 (nomen nudum; locality: river Danube, Hungary)

Leuciscus alburnellus Martens, 1857: 179, pl. 9 fig. 6 (unjustified emendation of *Alburnus alborella* Filippi, 1844)

Alburnus lucidus Heckel & Kner, 1858: 131, figs. 67–68 (type locality: river Danube near Wien, Aspern and Achau, river Salzach, river Mur near Czakaturn, rivers Sala, Teufelsbach and Czerna, river Stry in Galicia, Siebenbürgen, Mehadia, Krakau, river Töpel near Eger, lake Balaton, Augsburg, river Ocker, Breslau, Pommern, Bergen and Serbia; syntypes: NMW 20701-20708 [8], 55536 [1], 55538 [2], 55540 [2], 55543 ? [2], 55549 [1], 55551 [11], 55564 [1], 55565 [6], 55566 [1], 55567 [3], 55568 [1], 55569 [6], 55601 [1], 55615 [3], 55616 [1], 55736 ? [1], 78073 [2])

Alburnus lucidus var. *lacustris* Heckel & Kner, 1858: 134 (type locality: lakes Neusiedler and Balaton, Austria and Hungary; syntypes: NMW 55530 [3], 55531 [3], 55532 [3], 55533 [3], 55534 [2], 55535 [3])

Alburnus breviceps Heckel & Kner, 1858: 134, fig. 69 (type locality: river Danube [in Wien, Austria]; holotype: NMW 55539)

Alburnus fracchia Heckel & Kner, 1858: 138, fig. 72 (type locality: Treviso, Italy; holotype: NMW 55522)

Alburnus scoranza Heckel & Kner, 1858: 138 (type locality: lake Scutari, Montenegro and Albania; syntypes: NMW 55700 [2]; junior homonym of

Alburnus scoranza Bonaparte, 1845: 12)

Alburnus scoranzoides Heckel & Kner, 1858: 139 (type locality: Montenegro; syntypes: NMW 55702 [2])

Alburnus lucidus var. *angustior* Walecki, 1863: 358 (infrasubspecific, name not available; spelt *augustior* in Walecki, 1864: 53)

Alburnus lucidus var. *latior* Walecki, 1863: 358 (infrasubspecific, name not available)

Alburnus mirandella Blanchard, 1866: 369, fig. 80 (type locality: lake Genève, France and Switzerland / lake Bourget, France; syntypes: ? MNHN)

Alburnus fabraei Blanchard, 1866: 370, fig. 81 (type locality: river Rhône near Avignon, France; syntypes: MNHN ?)

Alburnus alborella var. *lateristriga* Canestrini, 1864: 103 (type locality: Castelfranco, Bolognese, Italy; syntypes: LU [minimum 6])

Alburnus Linnéi Malm, 1877: 568 (unnecessary replacement name for *Cyprinus alburnus* Linnaeus, 1758)

Alburnus arquatus Fatio, 1882: 433 (proposed in synonymy, name not available; locality: river Rhine, Basel, Switzerland)

Alburnus lucidus var. *elata* Fatio, 1882: 429 (infrasubspecific, name not available)

Alburnus lucidus var. *elongata* Fatio, 1882: 429 (infrasubspecific, name not available)

Alburnus lucidus var. *oxycephala* Fatio, 1882: 429 (infrasubspecific, name not available)

Alburnus lucidus var. *colobocephala* Fatio, 1882: 429 (infrasubspecific, name not available)

Alborella maxima Fatio, 1882: 449 (type locality: lake Lugano, Switzerland; holotype: MHNG 815.80)

Alburnus lucidus var. *ilmenensis* Warpachowski, **1886b: 63, fig.** (lake Ilmen, Russia) from Berg, 1949: 746

Alburnus alburnus macedonicus Karaman, 1928: 151 (type locality: lake Dojran and river Vardar until downriver of Skopje, FYROM; syntypes: LU); repeated in 1929: 171

Alburnus alburnus [charusini] natio *dagestanicus* Petrov, 1930: 146, 149 (infrasubspecific, name not available; locality: Caucasus shore of the Caspian Sea)

Alburnus alburnus thessalicus Stephanidis, 1950: 205 (type locality: basin of river Pinios and lakes Viviis and Xiniada, Greece; syntypes: lost ?)

Alburnus alburnus strumicae Karaman, 1955: 184 (type locality: river Strumica, FYROM; syntypes: LU)

Systematic notes. See Bianco (1980: 36) for discussion of synonymy of Italian and Balkan populations.

Nomenclatural notes. Contrary to the opinion of Gandolfi & Zerunian (1990: 298) and Gandolfi et al. (1991: 173) and as correctly pointed out by Bianco (1988a: 151), the name *Aspius arborella* Bonaparte, 1841 is available and has priority over *Alburnus alborella* Filippi, 1844. The Code is clear on this matter (see ICZN art. 52) and the case is straightforward. Bonaparte described Italian specimens identified as *A. alburnus*. At the beginning of the account, he stated that he was not sure whether this Italian material was conspecific with the northern European species or should be treated as a distinct species under the name [*A.*] *arborella*. The fact that the name was proposed conditionally does not make it unavailable (only names proposed conditionally after 1960 are unavailable; ICZN arts. 11(d)(i), 15). Clearly, it refers to the Italian material just described by Bonaparte and thus the name is available.

If the Italian stock is considered as a species distinct from the northern European one, the earliest available name is *Cyprinus albor* Scopoli, 1786.

Böhlke (1984: 69) listed syntypes of *Alburnus avola* Bonaparte, 1846 (a name actually available from Bonaparte, 1845). Bonaparte indicated the distribution as "Ital. s.", that is Italia septentrionalis [northern Italy], while the assumed syntypes are from "southern Italy", possibly a translation lapsus.

5.4.1 *Anaecypris hispanica* (Steindachner, 1866)

Phoxinus hispanicus Steindachner, 1866d: 268, pl. 1 fig. 1 (type locality: creek entering river Guadiana near Merida, Spain; syntypes: NMW 51168 [4; 3 according to original description])

5.5.1 *Aspius aspius* (Linnaeus, 1758)

Cyprinus Aspius Linnaeus, 1758: 325 (based on Linnaeus [1746: 121, n. 319, Cyprinus ... radiis 16] and Artedi [1738: gen. 6 [14], syn. 14, spec. 14 [6], Cyprinus maxilla inferiore longiore ...; "lacus Melerus in Uplandia"]; type locality: "in Sveciae lacubus"; type material: NT)

Cyprinus Rapax Leske, 1774: 56 (type locality: Leipzig, Germany; type material: NT ?)

Cyprinus taeniatus Eichwald, 1831: 102 (type locality: "in fluvio Cyro prope Mingischaur" [river Kura at Mingetschaur, Azerbaidjan; Berg, 1949: 606]; syntypes: LU)

Aspius vulgaris Leiblein, 1853: 122 (unnecessary replacement name for *Cyprinus aspius* Linnaeus, 1758)

Alburnus iblioides Kessler, 1872: 63, pl. 6 fig. 27 (type locality: springs at Jany-kurgan, Syr-darja basin, Kazakhstan; syntypes: LU)

Aspius rapax var. *jaxartensis* Kessler, **1874a: 27** (type locality: Syr-darja, Kazakhstan; syntypes: LU) from Berg, 1912: 319, 1949: 607

Aspius Linnéi Malm, 1877: 567 (unnecessary replacement name for *Cyprinus aspius* Linnaeus, 1758)

Aspius erytrostomus Kessler, 1877a: 143 (type locality: river Kura, Caspian Sea, restricted by Berg, 1949: 606; syntypes: LU)

Aspius transcaucasicus Warpachovski, **1895: 29** (river Lenkoranka and lake Bussadagny in Lenkoran district, Azerbaidjan; syntypes: ZISP 10497 [5], 10498 [2], 10488 [2], Berg, 1912: 316) from Berg, 1949: 606

Aspius aspius taeniatus natio *iblioides* morpha *phragmiteti* Berg, 1932c: 382 (infrasubspecific, name not available)

Nomenclatural notes. Bertin & Estève (1948: 78) lists 7 syntypes of "*Leuciscus aspius* Cuv. Val.". Valenciennes (1844: 265), under the heading "*Leuciscus aspius*, nob.", did not describe a new species but merely made a new combination of *Cyprinus aspius* Linnaeus, 1758, which is explicitly mentioned p. 266. Thus the material listed by Bertin & Estève has no type status.

5.6.1 *Aulopyge huegelii* Heckel, 1842

Aulopyge Huegelii Heckel, 1842: 74 (type locality: Dalmatia, Croatia; syntypes: NMW 55723 [11], MHNN 946 [1], Kottelat, 1984: 148)

Systematic notes. See Howes (1987) for a discussion of anatomy and phylogeny.

Nomenclatural notes. Although the generic name *Aulopyge* is available from Heckel (1841a: 384 [published 30 April 1841]; also 1841b: 523 [published 1842 according to Eschmeyer, 1990]), the species name *A. huegelii* is only available from his 1842 description. In the 1841 paper, Heckel only mentioned that the species would be named for Hügel, but did not use the name *huegelii*. The description is repeated in Heckel (1843: 1021).

5.7.1 *Barbus albanicus* Steindachner, 1870

Barbus albanicus Steindachner, 1870: 630, pl. 3 fig. 1 (type locality: lake Scutari, Albania; syntypes: NMW 53651 [2], MSNG 9043 [2])

Nomenclatural notes. The type locality is indicated as lake Scutari in the original description, but later assumed to be a mistake and corrected to lake Janina by Steindachner (1896: 184).

5.7.2 *Barbus barbus* (Linnaeus, 1758)

Cyprinus Barbus Linnaeus, 1758: 320 (based on Artedi [1738: gen. [spec.] 4, syn. 8, Cyprinus maxilla superiore longiore ...] and Gronovius [1754: 5, n. 20. idem; 1756: 3, n. 20, idem]; type locality: river Ijssel at Deventer, Netherlands [by lectotype designation; original locality: "in Europa australis"]; lectotype: BMNH 1853.11.12:144, by present designation)

Barbus vulgaris Fleming, 1828: 185 (type locality: "English rivers"; available by description and by indication to earlier sources; type material: NT ?)

Barbus communis Perty, 1832: 718 (unnecessary replacement name for *Cyprinus barbus* Linnaeus, 1758)

Barbus fluviatilis Fitzinger, 1832: 333 (unnecessary replacement name for *Cyprinus barbus* Linnaeus, 1758; author indicated as Agassiz, but Fitzinger is actual author)

Barbus communis Nordmann, 1840: 472 (unnecessary replacement name for *Cyprinus barbus* Linnaeus, 1758; junior homonym of *Barbus communis* Perty, 1832; authorship indicated as Pallas, 1814: 291, but Pallas used *Cyprinus barbus*)

Barbus Mayori Valenciennes, in Cuvier & Valenciennes, 1842: 138, pl. 461 (type locality: lake Zug, Switzerland; holotype: MNHN 3822, Almaça, 1969: 1130)

Barbus microphthalmus Bonaparte, 1846: 27 (listed in synonymy, name not available; Heckel is indicated as author, but it is a manuscript name and Bonaparte is actual author)

Barbus fluviatilis var. *tyrasensis* Dybowski, 1862: 77 (type locality: river Dniester, Ukraine; available by description and by indication to Kessler, **1856a: 30**; syntypes: IZPAN ?)

Barbus fluviatilis var. *borysthenicus* Dybowski, 1862: 77 (type locality: river Dnieper, Ukraine; available by description and by indication to Kessler, **1856a: 30**; syntypes: IZPAN ?)

Barbus fluviatilis var. *aurata* Fatio, 1882: 249 (infrasubspecific, name not available; locality: confluence of rivers Sarine and Aar, Switzerland)

Barbus fluviatilis var. *alba* Krauss, 1882: 346 (type locality: river Enz at Lomersheim, Baden-Württemberg, Germany; holotype: SMNS 14332, Fricke, 1995: 11; could possibly be treated as infrasubspecific)

Barbus fluviatilis var. *aurata* Veesenmayer, 1884: 325 (type locality: river Danube at Rottenacker, 5 km SSW of Ehingen, Germany; holotype: SMNS 14331, Fricke, 1995: 11; could possibly be treated as infrasubspecific)

Barbus barbus gallicus Karaman, 1971: 194 (type locality: Toulouse, France; holotype: NMW 54112)

Nomenclatural notes. See Wheeler (1958: 212) and Fernholm & Wheeler (1983: 217) for a discussion of the syntypes of *B. barbus* and associated problems. The specimen examined by Linnaeus (1758) is from Spain and those examined by Gronovius (1754: 5), on which Linnaeus's description is also based and one of which is still extant, are from the river Ijssel at Deventer, Netherlands and they are unlikely to be conspecific. Gronovius's specimen BMNH 1853.11.12:144 is here designated as lectotype.

5.7.3 *Barbus bocagei* Steindachner, 1865

Barbus Bocagei Steindachner, 1865: 3 (type locality: river Mondego in Coimbra, river Collares in Cintra, river Tejo in Lisboa, Portugal; syntypes: MB ?, NMW 3362-3368 [7], 5311 [1], 5876 [1], 18580 [2], 53763 [2], 53779-788 [18], 53791-797 [19], 53799-823 [more than 47], 53825-838 [more than 21], 53840-844 [11], 53846-849 [11], 53876-876 [3], 53903-904 [6], 53906-907 [5], 53913-915 [6], 53924-932 [11], 53936-938 [13], 79069 [2], 80119 [2], 80152 ? [1], MSNM 4657 [1], Conci & Michelangeli, 1974: 223)

5.7.4 *Barbus caninus* Bonaparte, 1839

Barbus caninus Cuvier, 1829: 273 (nomen nudum); repeated by Valenciennes, in Cuvier, 1842: 217 (nomen nudum)

Barbus Caninus Bonaparte, 1839: [fasc. 25, p. 217], pl. 110bis fig. 2 (type locality: Piemont, Po basin, Italy; lectotype: ANSP 6142, designated by Bianco, 1995b: 318)

Barbus caninus Valenciennes, in Cuvier & Valenciennes, 1842: 142, pl. 464 (type locality: lake Maggiore, Switzerland & Italy; lectotype: MNHN 1408, present designation; junior homonym of *Barbus caninus* Bonaparte, 1839)

Systematic notes. *Barbus caninus* was earlier considered as a synonym of *B. meridionalis*. Genetic data (Berrebi, 1995: 244) show that French and northern Italian material are genetically well separated; Bianco (1995b) treats them as distinct species.

Nomenclatural notes. Almaça (1969: 1132, 1133) designated two different specimens as "lectotype" for *B. caninus* Valenciennes (in Cuvier & Valenciennes, 1842: 142); as there can be only one lectotype for any nominal species, as first reviser I retain MNHN 1408 as lectotype.

5.7.5 *Barbus comizo* Steindachner, 1865

Barbus comizo Steindachner, 1865: 4 (type locality: river Tejo [Portugal and Spain]; syntypes: MB ?, NMW 5306 [1], 54062-066 [6], 54070 [2], MSNM 4658 [1], Conci & Michelangeli, 1974: 223); see Steindachner, 1866c: pl. 2 for illustration of a possible syntype

Nomenclatural notes. Note that correct original spelling is *B. comizo* and not *B. comiza*; *B. comiza* is an incorrect subsequent spelling (by Steindachner, 1866c: 8) and cannot be used (ICZN art. 33(c)).

5.7.6 *Barbus cyclolepis* Heckel, 1837

Barbus communis var. *cyclolepis* Heckel, 1837: 155 (type locality: river Marizza near Philippoli in Rumelia [southern Bulgaria]; syntypes: NMW 54734 [1], 54736 [5]; on the same page, Heckel also uses the combination *Barbus cyclolepis*)

? *Barbus barbus bergi* Chichkoff, 1935: 305, pl. 1 (type locality: river Riesova Rieca, Bulgaria; syntypes: LU)

Barbus tauricus polylepis Battalgil, 1941: 177 (type locality: creek entering the Bosphorus (Keçe suyu) near Eyub, European Turkey; syntypes: LU)

Barbus euboicus sperchiensis Stephanidis, 1950: 202 (type locality: river Sperchios, Greece; syntypes: lost ?)

Barbus cyclolepis strumicae Karaman, 1955: 187 (type locality: Monospitovo swamp and river Strumica, FYROM; syntypes: LU)

Barbus plebejus pergamonensis Karaman, 1971: 203 (type locality: Bergama, Turkey; syntypes: ZMH 3602 [8], 3898 [4], see below)

Barbus cyclolepis cholorematicus Stephanidis, 1971b: 223, fig. 4 (type locality: river Cholorema north of Almyros, Thessaly, Greece; syntypes: lost ? [24])

Systematic and nomenclatural notes. The position of *Barbus plebejus pergamonensis* follows Bogutskaya (pers. comm.), who also points to discrepancies between catalogue and published data of the type series. Karaman (1971: 203) listed 12 syntypes as ZMH 3602 (8) and 3889 (4). Fourteen specimens are labelled as types in ZMH: 3602 (9), 4207 (1) and 3898 (not 3889) (4). As specimen ZMH 4207 is not mentioned in the original description, it does not seem to be part of the type series. The discrepancy in number of specimens in ZMH 3602 is not explained, and one of the specimens may not be part of the type series. Specimen ZMH 4207 is labelled as holotype, but as no holotype is mentioned in the original publication it cannot have this status and the type series includes only syntypes.

The *B. plebejus escherichi* Steindachner, 1897 (p. 688, pl. 2 fig. 1) reported from European Turkey (e.g. Geldiay & Balik, 1988: 328) is apparently the present species.

5.7.7 *Barbus euboicus* Stephanidis, 1950

Barbus euboicus Stephanidis, 1950: 202 (type locality: small streams on island Evia, Greece; syntypes: lost ?)

5.7.8 *Barbus graecus* Steindachner, 1896

Barbus graecus Steindachner, 1896: 187, pl. 2 fig. 4 (type locality: river Aspropotamos (Acheloos) and lake of Wrachori [Trichonis], Greece; syntypes: NMW 10702 [1])

5.7.9 *Barbus graellsii* Steindachner, 1866

Barbus graellsii Steindachner, 1866b: 198 (type locality: river Ebro near Tortosa, Zaragoza and Logrono, creeks near Arenas north of Bilbao, Nervion near Bilbao, Spain; syntypes: NMW 5295-5298 [4], 5340 [1], 5359-5366 [8], 52394 [1], 54112 [1], 54139-141 [3], 54143-143 [3], 54146 [10], 54148-157 [33], 54159 [2], 79353 [5]); see Steindachner (1866c: pl. 3 fig 1) for illustration of one of the syntypes

5.7.10 *Barbus guiraonis* Steindachner, 1866

Barbus guiraonis Steindachner, 1866c: 11, pl. 5 (type locality: river Jucar near Cuenca which enter the sea near Alcira south of lake Albufera, Spain; syntypes: NMW 5291 [1], 5307-5310 [4], 54124-54133 [18])

Systematic notes. Valid species according to Doadrio (1990: 270) and Machordom et al. (1995: 231).

5.7.11 *Barbus haasi* Mertens, 1924

Barbus haasi Mertens, 1924: 1 (type locality: stream Noguera Pallaresa near Pobla de Segur, Prov. Lérida, Spain; holotype: SMF 3254)

Systematic notes. Valid species according to Doadrio & Garzon (1987) and Machordom et al. (1995: 231).

5.7.12 *Barbus macedonicus* Karaman, 1928

Barbus barbus macedonicus Karaman, 1928: 151 (type locality: river Vardar, FYROM; syntypes: LU); repeated in 1929: 171

Barbus barbus thessalus Stephanidis, 1971b: 213, fig. 1 (type locality: river Pinios, Thessaly, Greece; syntypes: lost ? [14 ?])

Systematic notes. Mitochondrial DNA data (Tsigenopoulos, 1996) and morphological comparison show that this species is distinct from *B. barbus*.

5.7.13 *Barbus meridionalis* Risso, 1826

Barbus meridionalis Risso, 1826: 437 (type locality: river Var and Département des Alpes Maritimes, France; lectotype: MNHN 70, designated by Bianco, 1995b: 319)

Systematic notes. As recognised here this species is restricted to southern France and north-eastern Spain. Material from Italy formerly referred to it represents a distinct species, *B. caninus* (Bianco, 1995b).

5.7.14 *Barbus microcephalus* Almaça, 1967

Barbus microcephalus Almaça, 1967: 321, figs. 1–2 (type locality: Rio Guadiana, about 4 km from Moura, Portugal; holotype: MB B.m.1)

5.7.15 *Barbus peloponnesius* Valenciennes, 1842

Barbus Peloponnesius Valenciennes, in Cuvier & Valenciennes, 1842:143 (type locality: Morée [Peloponnese], Greece; holotype: MNHN 3824, Almaça, 1969: 1134)

Barbus Petenyii Heckel, 1848: 194 (nomen nudum; localities: rivers Maros [Mures], Szamos [Samos], Czerna [Cerna], Hungary [now Romania])

Barbus Petenyi Heckel, 1852c: 29 (type locality: river Maros [Mures] in Siebenbürgen [now Romania], as restricted by Bănărescu (1957: 72); tentative syntypes: NMW 5318-5324 [7], 10875-876 [2], 54436 [2], 54440 [1], 54442 [2], 54446-448 [4], 54450 [9])

Pseudobarbus Leonhardi Bielz, 1853: 179 [? pl. 3 fig. 1, missing in examined copy] (type locality: Marosch [Mures], Alt [Oltul], Samosch [Samos], streams Tscherna [Cerna] and Zibin [Sibiu], Siebenbürgen [now Romania]; syntypes: LU)

Barbus Rebeli Koller, 1926a: 178 (type locality: creek Fandi Vogelj in Miriditen area, Albania; syntypes [total 3]: NMW 5333-5334 [2])

Barbus cyclolepis waleckii Rolik, 1970: 401 (type locality: stream Oslawa, a tributary of river San, near Zagorz, district Sanok, Poland; holotype: IZPAN 25(66)3)

Systematic notes. Synonymy tentatively follows Karakousis et al. (1993). Mitochondrial DNA data (Tsigenopoulos, 1996) suggest that more work is needed on the nominal species included in the synonymy of *P. peloponnesius* before final conclusions can be reached.

Nomenclatural notes. Koller published two papers in 1926 with the description of *B. rebeli*, once as a species (1926a), once as a variety (1926b). The description of the species appeared first, as seems to be indicated by the 1926b paper which refers to the earlier one (although with incorrect bibliographic data), but does not mention 'new species' and lists an additional specimen received in between. In a third paper, Koller (1926c: 175) refers only to the 1926b paper.

The first use of the name *Barbus petenyi* by Heckel in 1848 is a nomen nudum. His 1852 diagnosis is very brief but makes the name available. Although the title page is dated 1853, it is explicitly stated to be the volume for 1852. Heckel's paper was presented at a meeting of 5 May 1852 and appeared in the first fascicle of the volume. No exact publication date is available, but it is reasonable to assume that the fascicle appeared in 1852 and that the last fascicle(s) and cover page appeared in 1853. In any case, they seem to predate Bielz's paper which appeared in September 1853.

5.7.16 *Barbus plebejus* Bonaparte, 1839

Barbus plebeius Cuvier, 1829: 273 (nomen nudum), repeated by Valenciennes, in Cuvier, 1842: 217 (nomen nudum)

Barbus Plebejus Bonaparte, 1839: [fasc. 25, p. 216], pl. 110 fig. 1 (type locality: lake Como, Italy; lectotype: ANSP 6183, designated by Bianco, 1995b: 307)

Barbus Eques Bonaparte, 1839: [fasc. 25, p. 215], pl. 110 fig. 2 (type locality: river Arno, Italy; lectotype: ANSP 6145, designated by Bianco, 1995b: 307)

Barbus plebeius Valenciennes, in Cuvier & Valenciennes, 1842: 139, pl. 462 (type locality: river Po, Italy; lectotype: MNHN A.3825, designated by Almaça, 1969: 1130; junior homonym of *Barbus plebejus* Bonaparte, 1839, ICZN art. 58 (3))

? *Barbus plebejus ercisianus* Karaman, 1971: 204 (type locality: Ercis, lake Van, and road from Ercis to Patnos, Turkey; syntypes: ZMH 3566 [13], 3567 [13])

? *Barbus plebejus kosswigi* Karaman, 1971: 206 (type locality: creek Hamann, Beytüssebap, Hakkari Prov., Tigris basin, Turkey; syntypes: ZMH 1159 [6])

Systematic notes. Bianco (1995b: 312) considers that *B. plebejus* is restricted to the Adriatic drainage of Italy and Croatia and that the material reported from the Vistula basin (Krupka & Holčík, 1976) is possibly *B. cyclolepis*. Stratil et al. (1983) showed that these Slovakian "*B. plebejus*" are possibly hybrids between *B. barbus* and "*B. meridionalis petenyi*". The status of these individuals or stocks is still open to question, but zoogeography would suggest that none is likely to be conspecific with *B. plebejus*.

The two nominal subspecies from Turkey tentatively listed above are unlikely to be conspecific with *B. plebejus* but their status is unresolved; a third one (*B. p. pergamonensis*) is a synonym of *B. cyclolepis* (Bogutskaya, pers. comm.). Similarly, I doubt that *B. scincus* Heckel, 1843 (p. 1049; type locality: Aleppo, Syria) is conspecific with *B. plebejus* as proposed by Almaça (1991: 70); Coad (1991: 14) tentatively treats it as a synonym of *B. lacerta* Heckel, 1843 (p. 1045, pl. 2 fig. 1; type locality: stream Kueik near Aleppo, Syria).

Nomenclatural notes. *Barbus plebejus kosswigi* Karaman, 1971 is a secondary homonym of *Cyclocheilichthys kosswigi* Ladiges, 1960 (p. 135, fig. 7), placed in *Barbus* by Coad (1982: 263, 1991: 14).

5.7.17 *Barbus prespensis* Karaman, 1924

Barbus graecus var. *prespensis* Karaman, 1924b: 32 (type locality: lake Prespa and its tributaries, FYROM and Greece; syntypes: LU)

5.7.18 *Barbus sclateri* Günther, 1868

Barbus sclateri Günther, 1868: 93 (type locality: Guadalquivir [Spain] and Portugal; syntypes: BMNH [6]).

Systematic notes. According to Doadrio (1990: 271), this is a polytypic species consisting of three very distinct populations; further study may show that they are different species.

5.7.19 *Barbus steindachneri* Almaça, 1967

Barbus steindachneri Almaça, 1967: 263, figs. 1–2 (type locality: rio Guadiana, 4 km from Moura, Portugal; holotype: MB B.s.1)

Systematic notes. Doadrio (1988b: 26) considers *B. steindachneri* to be a synonym of *B. comizo*, while Almaça (1990: 590) and Costa Pereira (1995: 487) consider it a distinct species.

5.7.20 *Barbus tyberinus* Bonaparte, 1839

? *Barbus Eques* Cuvier, 1829: 273 (nomen nudum), repeated by Valenciennes, in Cuvier, 1842: 217 (nomen nudum)

Barbus Fluviatilis Tyberinus Bonaparte, 1839: [fasc. 25], pl. 110 fig. 3 (type locality: river Tevere near Roma, Italy; lectotype: ANSP 6152, designated by Bianco, 1995b: 313)

Barbus eques Valenciennes, in Cuvier & Valenciennes, 1842: 141, pl. 463 (type locality: Firenze, Italy; lectotype: MNHN A.6913, designated by

Almaça, 1969: 1131; junior homonym of *Barbus eques* Bonaparte, 1839)

Barbus Canalii Valenciennes, in Cuvier & Valenciennes, 1842: 143 (type locality: rivers Topico [Topino] and Tevere near Perugia, Italy; lectotype: MNHN 1412, designated by Almaça, 1969: 1132)

Barbus fucini Costa, 1853: fasc. 79: index to plates p. 4, pl. 11 (type locality: lake Fucino, Italy; syntypes: ? MNHN 192, Bianco, 1995b: 313, ? NMW 54799 [1])

Systematic notes. Valid according to Bianco (1994a, 1995b).

Nomenclatural notes. Bianco (1994a) used *B. fucini* Costa, 1838 as the name of the species, but the name did not appear in 1838. Costa only used it in the captions of the plates (Spiegazioni delle tavole che accompagnano la parte prima) which appeared in 1853 (Sherborn, 1937: 36–37; Bianco, 1995b: 313). Thus the earliest available name is *B. tyberinus*.

5.8.1 *Carassius auratus* (Linnaeus, 1758) introduced

Carassius encobia Bonaparte, 1845: 3 (listed in synonymy, name not available)

Leuciscus auratus Mauduyt, 1848: 32 (type locality: Vienne, France, introduced from southern China; syntypes: Musée de Poitiers ?; a secondary homonym of *Cyprinus auratus* Linnaeus, 1758)

5.8.2 *Carassius carassius* (Linnaeus, 1758)

Cyprinus Carassius Linnaeus, 1758: 321 (based on Artedi [1738: gen. 4 [29], syn. 5, spec. 29 [4], Cyprinus pinnae dorsi ...], Linnaeus [1746: 122, n. 322, idem], Gronovius [1754: 3, n. 11, idem; 1746: 75, n. 55, Cyprinus hamburger; Wawerveen, Belgium]; type locality: "in Europae stagnis"; type material: NT)

Cyprinus moles Agassiz, 1835b: 37 (nomen nudum)

Carassius humilis Heckel, 1837: 156, pl. 9 fig. 4 (type locality: Lago nella Piana della Stippa near Palermo, Sicilia, Italy; syntypes [total 15]: NMW 56108 [8])

C[arassius] charax Lesniewski, 1837: 53 (type locality: Poland; syntypes: LU)

Carassius vulgaris Nordmann, 1840: 479 (unnecessary replacement name for *Cyprinus carassius* Linnaeus, 1758)

Carassius moles Nordmann, 1840: 480 (nomen nudum; locality: Danube basin)

Cyprinus moles Valenciennes, in Cuvier & Valenciennes, 1842 [August]: 89 (type locality: river Danube; syntypes: MNHN 3406 [1], MNHN B.2591 [1], Almaça, 1969: 1142)

Cyprinus moles Selys-Longchamps, 1842 [December]: 200 (type locality: Longchamps, Belgium; syntypes: ? ISNB [not found])

Carassius linnaei Bonaparte, 1845: 3, 1846: 27 (unnecessary replacement name for *Cyprinus carassius* Linnaeus, 1758)

Carassius oblongus Heckel & Kner, 1858: 73, fig. 33 (type locality: Lemberg, Galicia [now Lvov, Ukraine] and river Stry near Podhoroce, Carpathes, Ukraine; syntypes: NMW 56103 [2], 56133 ? [1])

Carassius gibelio var. *minutus* Kessler, **1856a: 42** (type locality: ponds near Kiew, Ukraine; syntypes: ZISP 7192, Berg, 1932b: 18) from Berg, 1932b: 18

Carassius vulgaris var. *gibbosus* Walecki, 1863: 358 (infrasubspecific, name not available)

Carassius vulgaris var. *subventrosus* Walecki, 1863: 358 (infrasubspecific, name not available)

Carassius Linnéi Malm, 1877: 556 (unnecessary replacement name for *Cyprinus carassius* Linnaeus, 1758)

Carassius Linnéi forma *lacustris* Malm, 1877: 556 (infrasubspecific, name not available; locality: river Goeta Elf near Göteborg, Tingstad, Göteborg, Sweden)

Carassius Linnéi forma *piscinarum* Malm, 1877: 556 (infrasubspecific, name not available; locality: Göteborg, Sweden and København, Denmark)

? *Carassius carassius jacuticus* Kirillov, **1956** (locality: Yakutia, Siberia) from Kirillov, 1962: 52

Nomenclatural notes. *Carassius* Nilsson and *Cyprinopsis* Fitzinger were both published in 1832. The exact publication dates are not known and in the absence of contrary evidences they have to be considered as simultaneously published on 31 December 1832 (ICZN art. 21(c)(ii)) and as first reviser I retain *Carassius* as having priority. The authorship of *Carassius* is sometime attributed to Jarocki (**1822: 54, 71**), but it is considered as not being available from that publication by Eschmeyer (1990: 76).

The first use of *C. moles* by Agassiz (1835b) is a nomen nudum, as is also Nordmann's (1840) use. The species is made available independently twice, by Valenciennes (in Cuvier & Valenciennes, August 1842) and Selys-Longchamps (1842). The exact publication date of Selys-Longchamps's work is not known, so the date to be adopted is 31 December 1842 (ICZN art. 21(c)(ii)). Valenciennes's description appeared first and has priority. *Cyprinus moles* Selys-Longchamps is a primary junior homonym and is not available.

Almaça (1969: 1142) considered Agassiz as author of *C. moles* in Valenciennes (1842) and commented that only one of the two specimens mentioned by Valenciennes is a syntype because it was received from Agassiz. According to ICZN art. 50(a), the author of the name is Valenciennes and the two specimens are syntypes because he used both for his discussion.

5.8.3 *Carassius gibelio* (Bloch, 1782)

Cyprinus Gibelio Bloch, 1782: 71, pl. 12 (type locality: Churmark, Pommern, Schlesien, Preussen (Prussia, now Germany and Poland); syntypes: ZMB 3203 [2])

? *Carassius bucephalus* Heckel, 1837: 157 (type locality: warm springs near Salonik, Macedonia, Greece; syntypes: NMW [2])

? *Cyprinus amarus* Koch, in Koch, Herrich-Schäffer & Forster, 1840: 39 (type locality: Regensburg, Germany; type material: NT ?; junior homonym of *Cyprinus amarus* Bloch, 1782)

Carassius ellipticus Heckel, 1848: 194 (nomen nudum; locality: Hungary; possibly a lapsus for *Carassius bucephalus*)

Carassius vulgaris var. *ventrosus* Walecki, 1863: 358 (infrasubspecific, name not available)

Carassius vulgaris var. *kolenty* Dybowski, **1877: 11** (river Amur basin) from Berg, 1949: 826

Carassius auratus gibelio morpha *vovkii* Ioganzen, 1945: 12 (infrasubspecific, name not available; locality: lakes of Baraba steppe and Narym region, Siberia)

Systematic notes. The status of this species has long been discussed, several authors just considering it as a wild form, native to Europe or introduced, of the well known goldfish *C. auratus*, or as feral stock of introduced goldfishes, or as a result of hybridisation. Available data lead me to tentatively conclude that it is native to eastern Central Europe from where it has been reported before the introduction of the goldfish into European waters; it can possibly be equated with a stock from northern Asia extending eastwards to northeastern China, but with none of the East Asian domesticated cyprinids; awaiting resolution of the systematics of the Chinese and Japanese *Carassius* species, we are left with no choice but to treat it as a distinct species.

Valenciennes (1842: 108) summarised the history of the introduction of *Carassius auratus* to Europe. He states that some authors (but does not say which ones) consider that it was introduced to Europe as early as 1611 or 1691 and that Yarrell reports that it had been introduced by the Portuguese from Java [in which case, might Yarrell's account in part be based on the Javanese long-finned *Cyprinus* sp. bred in Java ?] to South Africa and from there to Lisboa. The first introduction to England dates to 1691 (Pennant, 1812: 490) and to France to 1755 (Hervey & Hems, **1968**, cited by Scott & Crossman, 1973). It was bred in northern Europe for the first time in Holland in 1728 according to Sterba (1987: 272). Prior to this date, all those goldfishes existing in Europe had to be imported by boat from Asia (or some port between Asia and Europe where they could have been already acclimatised) and they were thus imported in limited numbers and must have been very expensive. It seems thus unlikely that before 1728 their owners would have willingly released them into European waters and if this happened accidentally [some of them were kept in outside pools], probably only very few individuals were concerned.

The earliest published record of *C. gibelio* apparently dates from Gesner (1560: 298) as 'Klein Karas (Chiblichen)' from river Elbe, Germany (but Gesner's figure of 'Klein Karas' p. 298 likely shows *C. carassius*). Gesner's account is based on Kentmann's codex (1549; see Hertel, 1978: 92). “Cyprinus tertius” (a pre-Linnaean, thus unavailable name) in Marsili (1726: 61; reproduced in Hensel, 1971: 188, pl. 1) from the Danube is apparently the present species. There are several reports of it in the 17–18th centuries literature from central Europe (see references in Bloch, 1782: 71) suggesting that it was relatively well known and distributed. Thus, its supposed origin as feral goldfish seems to have no sound base. Admittedly, the earliest records are quite vague and could apply to *C. carassius* as well.

As its distribution includes areas where no population of *Cyprinus carpio*, *Carassius carassius* or introduced *C. auratus* exist, the theory that *C. gibelio* individuals are mere hybrids, has no support (Heuschmann, 1957: 75). *Carassius gibelio* seems to be a gynogenetic (all-female) triploid species (Pelz, 1987: 125). The species may have an hybrid origin, but as it consitutes a distinct lineage and is diagnosable, it is a distinct species under the PSC (for brief review of other fish species of hybrid origin, see Stauffer et al., in press).

The systematics of the genus *Carassius* in East Asia is confusing. The ancestor of today's domesticated goldfishes was introduced to Japan from China at a date between 1502 and 1748 (Okada, 1959–60: 531). Available data show that at least five genetically and morphologically distinct stocks are known in Japan which are considered as distinct species or subspecies (Teitler &

Fujita, 1993; Hosoya, in Nakabo, 1994: 212–213) and are treated as species here under the PSC. At present the European species can possibly be considered as conspecific only with a stock extending eastwards to northeastern China (see, e.g., Kimura et al., 1992: 95, pl. 3) which is definitively not feral.

Bănărescu (1993: 95) "believes that [*C. gibelio*, as a subspecies of *C. auratus*] has been introduced as culture fish from China, possibly during the Middle Age, first in the Middle Asian moslim countries, later in eastern Europe". No supporting data is given.

5.9.1 *Chalcalburnus belvica* (Karaman, 1924)

Alburnus alburnus belvica Karaman, 1924b: 50 (type locality: lake Prespa, FYROM and Greece; syntypes: LU)

Systematic notes. Valid species (see Economidis, 1986).

5.9.2 *Chalcalburnus chalcoides* (Gueldenstaedt, 1772)

Cyprinus chalcoides Gueldenstaedt, 1772: 540, pl. 16 (type locality: river Terek, Caspian Sea basin, Russia [restricted by Berg, 1949: 733]; syntypes: LU)

Cyprinus clupeoides Pallas, 1776: 704 (available by indication to Gueldenstaedt, 1772: 540; type locality: river Terek, Caspian Sea basin, Russia; syntypes: LU)

Aspius Mento Perty, 1832: 720 (nomen nudum)

Aspius Heckelii Fitzinger, 1832: 335 (nomen nudum; locality: stream Traun, upper Austria)

Aspius mento Heckel, 1836: 225, pl. 19 fig. 3 (type locality: stream Traun near Gmunden, upper Austria / München, Germany / river Danube near Wien, Austria; syntypes: NMW 16441 [1], 16261 [1], 50440 ? [1], 55629 [4], 55630 [1], 55650 [2], 55652 [1], MNHN [1]; author given as Agassiz, but actually is Heckel)

Alburnus mentoides Kessler, 1859a: 531 (type locality: Salghir and Alma rivers, market in Simpheropol, Crimea, Ukraine; syntypes: ZISP ? [17])

Alburnus longissimus Warpachovski, **1892: 154** (Lenkoran District, Caspian Sea basin) from Berg, 1949: 734

Alburnus latissimus Kamensky, 1901: 120, 191 (type locality: mouth of river Kura, Caspian Sea basin; syntypes: ZMT ?)

Alburnus chalcoides var. *danubicus* Antipa, 1909, fig. 64: 162 (type locality: lakes Razim, Zaton and Sinoe-Liman in river Danube delta and river Danube at Chernavody, Romania; syntypes: LU)

Alburnus chalcoides derjugini Berg, **1923: 272** (river Coruh basin, Transcaucasia) from Berg, 1949: 740

Chalcalburnus chalcoides aralensis Berg, **1923: 272, 506** (Vozrozhdenie island, Aral Sea) from Berg, 1949: 742

Chalcalburnus chalcoides mentoides natio *longicephala* Tseeb, **1930: 163** (infrasubspecific, name not available; river Chernaya, Crimea) from Berg, 1949: 741

Alburnus chalcoides sapancae Battalgil, 1941: 179 (type locality: lake Sapanca, Turkey; syntypes: LU)

Alburnus chalcoides nicaeensis Battalgil, 1941: 179 (type locality: lake Iznik, Turkey; syntypes: LU)

Alburnus chalcoides carinatus Battalgil, 1941: 179 (type locality: lake Manyas, Turkey; syntypes: LU)

Alburnus chalcoides istanbulensis Battalgil, 1941: 180 (type locality: stream Kâathane, draining to the Bosphorus near Istanbul, Turkey [European part]; syntypes: LU)

Chalcalburnus chalcoides mandrensis Drensky, 1943: 349 (type locality: lake Burgas near Burgas, Bulgaria; syntypes: LU)

Chalcalburnus chalcoides schischkovi Drensky, 1943: 353, fig. 1 (type locality: mouth of the rivers Resowska and Weleka, Bulgaria; syntypes: LU)

Chalcalburnus chalcoides iranicus Svetovidov, 1945: 142 (type locality: vicinity of town Shakhi, basin of river Talar, entering the Caspian Sea west of Gorgan Bay, Iran; holotype: ZISP)

Chalcalburnus chalcoides macedonicus Stephanidis, 1971b: 224, fig. 5 (type locality: lake Volvi, Macedonia, Greece; syntypes: lost ? [18])

Systematic notes. *Chalcalburnus* is greatly in need of a critical revision and it seems likely that several species might be recognised. I tentatively consider that the material from the Danube basin is conspecific with that from the Volga basin, where the type locality of *C. chalcoides* is located. Berg (1949: 737) and Bănărescu (1964: 367) treat them as distinct subspecies. If future studies show that they are distinct species, the name *C. mento* (Heckel, 1836) should be used for the Danube species. Among the names listed above, *heckelii* and *danubicus* would be synonyms of *C. mento*. Bănărescu (1961a) discussed the status of *Alburnus chalcoides* var. *danubicus*.

Berg (1949: 738), Bănărescu (1964: 368) and Economidis & Bănărescu (1991: 261) consider *C. c. schischkovi* and *C. c. mandrensis* as valid subspecies. Meristic data in Drensky (1943: 357) show them obviously diagnosable from material of the Danube basin and this would suggest that they are specifically distinct, but data of Danube material in Bănărescu (1961a: 1490) differ from those of Drensky and show some overlap with those of *schichkovi* and *mandrensis* and I retain them as conspecific awaiting a critical revision.

Economidis & Bănărescu (1991: 261) consider *C. c. macedonicus* as a valid subspecies (as part of a list of subspecies, "some of which [unspecified] ... however questionable"). Stephanidis (1971b: 240) distinguished it from *C. chalcoides* (unspecified locality; apparently based on literature) by having more gill-rakers on the first gill arch (26–30, vs. 19–25). Comparative data for other populations/species are not available and in their absence it is not possible to reach a decision.

The status of the four nominal subspecies described by Battalgil (1941) will remain in limbo until material from their respective type localities is carefully described.

Nomenclatural notes. The author of *Aspius mento* is often given as Agassiz, 1832 or Agassiz in Perty, 1832. Perty (1832: 720) listed '*Aspius Mento* Agassiz' but there is no indication that Agassiz should be considered as author. A footnote (p. 716) indicates that he had only read the manuscript. Anyway, the 'description' of the species reads as follows (my translation): "In [lake] Chiemsee. Is deceptively sold as Renke [*Coregonus*] and most commonly comes to our market (if I am not mistaken) packed in barrels, that is, dead, in November". I do not think that there is anything in this 'description' which can make a name available. The name is first made available by Heckel (1836).

Bertin & Estève (1948: 78) list a holotype of *Aspius mento* Agassiz (1839: "pl. 28 fig. 2") (MNHN 3894, river Danube in Austria, 190 mm); I could not find this plate in Agassiz (1839) which includes only 27 plates (see also Surdez, 1971). Bertin & Estève may have seen proofs of an unpublished plate [Agassiz frequently distributed such proofs]. I do not consider this specimen as having type status.

5.10.1 *Chondrostoma arrigonis* (Steindachner, 1866)

Leuciscus Arrigonis Steindachner, 1866c: 16, pl. 4 fig. 1 (type locality: Rio Jucar near Cuenca and Laguna of Una, Spain; syntypes: NMW 52162-207 [more than 128], 52209-232 [179], 53409 [5])

? *Chondrostoma toxostoma turiensis* Elvira, 1987: 133 (type locality: river Turia, Chulilla, Valencia, Spain; holotype: UZA 1983.12.06.01)

Systematic notes. Collares-Pereira (1980a) considers *C. arrigonis* as a valid species, while Elvira (1987: 131) considers it a subspecies of *C. toxostoma*. Collares-Pereira's data (1980a: 276) show them quite distinct in number of lateral-line scales and gill-raker counts and her data are in agreement with those of Elvira for material from the same areas. Elvira considers them to be the two extremities of a clinal variation, but his data are condensed in such a way that I cannot reach a conclusion. From his data, *C. arrigonis* inhabits a separate basin and is morphologically diagnosable and I treat it as a valid species; I tentatively consider *C. toxostoma turiensis* as conspecific: the two seem to be very similar, differing only slightly in gill-raker and pharyngeal teeth counts. The characters distinguishing *C. t. turiensis* from *C. t. miegii* (sensu Elvira) are roughly those distinguishing *C. t. arrigonis* from *C. t. miegii*; *C. t. miegii* seems to be in general agreement with *C. t. toxostoma* and is considered conspecific with it.

See Costa Pereira (1995: 492) for a potential, alternative interpretation.

5.10.2 *Chondrostoma genei* (Bonaparte, 1839)

Leuciscus Genei Bonaparte, 1839: [fasc. 24, p. 243], pl. 114 fig. 2 (type locality: lakes of Piemont, Italy; syntypes: ANSP 6110-6115 [6], Böhlke, 1984: 77)

Chondrostoma jaculum Filippi, 1844: 397 (type locality: rivers Ticino and Po, Italy; syntypes: NMW 52244 [4])

Chondrostoma Genei var. *albicans* Gatti, 1896: 215 (type locality: river Vomano near Fontanelle, Italy; syntypes: LU)

5.10.3 *Chondrostoma knerii* Heckel, 1843

Chondrostomus Knerii Heckel, 1843: 1030 (type locality: river Narenta, Dalmatia; syntypes: NMW 52265 [2], 52269-52271 [6], 52280-281 [4])

5.10.4 *Chondrostoma nasus* (Linnaeus, 1758)

Cyprinus Nasus Linnaeus, 1758: 325 (based on Artedi [1738: gen. [spec.] 5, syn. 6, Cyprinus ... pinnae ani radiis 14] and Gronovius [1756: 2, n. 147, idem]; type locality: "in Rheno fluvio" [river Rhine]; type material: NT)

Chondrostomus Nasus auratus Schäfer, 1844: 305 (type locality: river Moselle in Trier, Germany; syntypes: LU; proposed as a trinominal name, but treated as a variety in the text; could be treated as an infrasubspecific name, thus not available)

Chondrostoma nasus var. *hernadiensis* Jeitteles, 1862: 306 (type locality: river Hernad [Hornád], Kaschau [Košice], Slovakia; syntypes: NMW 52475 [4])

Chondrostoma caerulescens Blanchard, 1866: 416, fig. 104 (type locality: rivers Doubs and Ognon, France; syntypes: MNHN ?)

Chondrostoma nasus var. *taeniata* Fatio, 1882: 691 (infrasubspecific, name not available; locality: river Rhine in Basel, Switzerland)

Chondrostoma Nasus var. *macrolepidotus* Veesenmayer, 1884: 325 (nomen nudum; locality: river Danube near Ulm, Germany)

? *Chondrostoma nasus* var. *borysthenica* Dybowski, in Sinitzyn, **1900: 46** (nomen nudum; locality: river Dnieper, Ukraine) from Berg, 1914: 369

? *Chondrostoma nasus borysthenicum* Berg, 1914: 373, fig. 33 (type locality: river Dnieper near Neyasit, Ukraine; syntypes: ZISP 11985 [2])

Chondrostoma nasus ohridanum Karaman, 1924b: 71 (type locality: lake Ohrid and its tributaries, FYROM; syntypes: LU)

? *Chondrostoma nasus lumi* Poljakov, Filipi & Basho, 1958: 88 (type locality: Pogradec, Albania; syntypes: LU)

? *Chondrostoma nasus angorensis* Elvira, 1987: 117, fig. 3a (type locality: Eskishir [Eskisehir], Turkey; holotype: NMW 52234:1)

Systematic notes. Under the PSC, the subspecies *C. n. angorensis* Elvira (1987) from Turkey probably has to be recognised as a valid species.

Nomenclatural notes. Although *Chondrostoma* is a neutral name, the specific name *nasus* does not have to agree in grammatical gender: it is a noun in apposition, thus invariable [ICZN art. 31 (b) (ii)].

Fricke (1995: 11) listed *Chondrostoma nasus* var. *macrolepidotus* Krauss, in Veesenmayer (1884: 325) as an available name. As used in in Veesenmayer (1884: 325), the name is not accompanied by a description or an indication and it is a nomen nudum, thus not available. Fricke stated that the name is based on the description by Krauss (1879: 348); indeed, the specimen described by Krauss most likely is the specimen referred to by Veesenmayer, but as there is no bibliographic reference (ICZN art. 13(a)(ii)) to Krauss's paper, the name is not available. An infrasubspecific rank is explicitely meant and the name would not be available anyway (ICZN art. 45(g)(ii)(1)). As the name is not available, authorship of the name is not relevant. (If the name were available, Veesenmayer would have to be considered as only author by virtue of ICZN art. 50(a)).

5.10.5 *Chondrostoma phoxinus* Heckel, 1843

Chondrostomus Phoxinus Heckel, 1843: 1031 (type locality: creeks around Livno, Bosnia; syntypes: NMW 52481 [10], MHNN 1045 [1], Kottelat, 1984: 148)

5.10.6 *Chondrostoma polylepis* Steindachner, 1865

Chondrostoma polylepis Steindachner, 1865: 5 (type locality: Crato, Portugal; syntypes: MB, NMW 52589 [2])

Chondrostoma polylepis duriensis Coelho, 1985: 33, fig. 1c (type locality: rivers Tambre and Douro basins, Portugal; syntypes: MB [33])

Systematic notes. Elvira (1987: 124) does not consider *C. p. duriensis* as distinct from *C. p. polylepis* and mentions that both forms occur in the Douro basin. As pointed out by Costa Pereira (1995: 490) the published information does not allow to rule out the possibility of two distinct species occurring in the Douro basin. See also data on genetic differentiation in Coelho (1992).

5.10.7 *Chondrostoma prespense* Karaman, 1924

Chondrostoma nasus prespensis Karaman, 1924b: 73 (type locality: lake Prespa, FYROM and Greece; syntypes: LU)

5.10.8 *Chondrostoma scodrense* Elvira, 1987

Chondrostoma scodrensis Elvira, 1987: 129 (type locality: Scutari, Montenegro; holotype: NMW 52099:1)

Remarks. Extinct (Crivelli & Rosecci, 1994: 14).

5.10.9 *Chondrostoma soetta* Bonaparte, 1840

Chondrostoma Soetta Bonaparte, 1840: [fasc. 28, p. 251], pl. 115 fig. 3 (type locality: rivers of Lombardy, Italy; syntypes: ANSP 6424-6426 [3], Bianco, pers. comm., 1985)

Chondrochylus nasicus Heckel, 1843: 1031 (type locality: lake Garda, Italy; syntypes: NMW 52638 [4], 52639 [3])

Chondrostoma seva Valenciennes, in Cuvier & Valenciennes, 1844: 396 (type locality: river Po in Torino, Italy; holotype: MNHN 3147, Elvira, 1987: 130, Almaça, 1969: 1128)

Nomenclatural notes. The heading of Bonaparte's (1840) account is *Chondrostoma rysela* and the subheading is "Condrostoma soetta". Throughout the work, subheadings consistently are the Italian names. In the text, Bonaparte says that he doubts that the Italian stock is conspecific with the *C. rysela* of northern Europe and that it should have the specific name *soetta* if it turns out specifically distinct. Although proposed conditionally, the name *C. soetta* is available because it was proposed before 1961 (ICZN arts. 11(d)(i), 15).

5.10.10 *Chondrostoma toxostoma* (Vallot, 1837)

Cyprinus toxostoma Vallot, 1837: 188 (type locality: villages on river Saône near Pontailler, France; syntypes: LU)

Chondrostoma dremaei Blanchard, 1866: 418, fig. 105 (type locality: river Lot near Cahors, France; lectotype: MNHN 3142, designated by Almaça, 1969: 1128)

Chondrostoma rhodanensis Blanchard, 1866: 420, fig. 108 (type locality: river Rhône near Avignon, France; lectotype: MNHN 3145, designated by Almaça, 1969: 1129)

Chondrostoma Miegii Steindachner, 1866b: 202 (type locality: river Ebro near Logrono and Zaragoza, river Nervion near Bilbao, stream near Arenas north of Bilbao, Laguna de Pulguer [Purguel, near Tudela; Elvira, 1987: 133], Spain; syntypes: NMW 52258, 52393-52414 [105])

Chondrostoma Peresi La Blanchère, 1872: 1632 (type locality: confluence of rivers Lot and Trueyre, near Entraygues / river Aveyron at Mouline, near Rodez, France; syntypes: LU [about 50])

Systematic notes. See *Chondrostoma arrigonis* for discussion.

5.10.11 *Chondrostoma vardarense* Karaman, 1928

Chondrostoma nasus vardarensis Karaman, 1928: 160, fig. 3a (type locality: river Vardar, FYROM; syntypes: LU); repeated in 1929: 172

5.10.12 *Chondrostoma willkommii* Steindachner, 1866

Chondrostoma Willkommii Steindachner, 1866d: 266, pl. 2 (type locality: river Guadiana and its tributaries near Merida and Mertola, river Guadalquivir near Sevilla and Cordova [Cordoba], rivers Guadaira, Genil and Guadalete, Spain; syntypes: NMW 52664-666 [6], 52668-707 [100], 79744 [2], Elvira, 1987: 125)

Systematic notes. Elvira (1987: 124-125) considers *Chondrostoma polylepis* and *C. willkommii* as conspecific while Coelho (1985) considers them to be distinct species. The data in Elvira are too summarised and their presentation in Coelho is too confusing (especially in the absence of raw data) to reach a conclusion. Coelho (1992) showed that they are genetically distinct and therefore I treat *C. willkommii* as a valid species.

Ctenopharyngodon idella (Valenciennes, 1844) introduced

5.11.1 *Cyprinus carpio* Linnaeus, 1758

Cyprinus Carpio Linnaeus, 1758: 320 (based on Artedi [1738: gen. 4 [25], syn. 3, spec. 25 [4], Cyprinus cirris quatuor ...], Linnaeus [1746: 120, n. 317, idem] and Gronovius [1754: 5, n. 19, idem.]; type locality: "in Europa"; syntype: BMNH 1853.11.12:139 [1], Wheeler, 1958: 212)

Cyprinus cirrosus Schaeffer, 1760: 18, figs. 1–3 (name not available because work is on Index of rejected works, ICZN, 1955, Opinion 345)

Cyprinus rex cyprinorum Bloch, 1782: 107, 193, pl. 17 (type locality: near Torgau, Dresden, Germany / Franken, Germany / Böhmen, Czech Republic; syntypes: ZMB 3195 [2])

Cyprinus nudus Bloch, 1784: 178 (type locality: Schlesien, Poland; type material: NT, H.-J. Paepke, in litt., 1995)

Cyprinus alepidotus Bloch, 1784: 178 (proposed in synonymy, name not available)

Cyprinus regius Nau, 1791: 29 (unnecessary replacement name for *Rex cyprinorum* Bloch, 1782)

Cyprinus carpio var. *caspicus* Walbaum, 1792: 17 (available by indication to Lepechin, **1771b: 321, pl. 23** and Güldenstaedt, 1778: 253; type locality: mouths of rivers Volga and Tanais [Don], Russia and Ukraine; type material: NT ?)

Cyprinus rex Walbaum, 1792: 24 (type locality: near Torgau, Dresden, Germany / Franken, Germany / Böhmen, Czech Republic [localities listed by Bloch, 1782: 107], probably Regensburg, Germany [material of Schaeffer, 1760]; syntypes: ZMB 3195 [2] [Bloch's material])

Cyprinus macrolepidotus Meidinger, 1794: iii, pl. 40 (type locality: river Danube in Austria; syntypes: LU)

Cyprinus specularis La Cepède, 1803: 528 (unnecessary replacement name for *Rex cyprinorum* Bloch, 1782)

Cyprinus coriaceus La Cepède, 1803: 528 (unnecessary replacement name for *Cyprinus nudus* Bloch, 1784)

Cyprinus viridescens La Cepède, 1803: 541, 543, pl. 17 fig. 1 (type locality: Rouen, France; holotype: LU)

Cyprinus Rondeletii Shaw, 1804: vol. 5 (1): 194, pl. 123 (type locality: Lyon, France; type material: NT)

Cyprinus macrolepidotus Hartmann, 1827: 183 (type locality: lake Konstanz, Switzerland; type material: NT ?; junior homonym of *Cyprinus macrolepidotus* Meidinger, 1794: pl. 41)

Cyprinus carpio var. *lacustris* Fitzinger, 1832: 333 (available by indication to Kramer [1756: 390, Cyprinus 1 var.]; type locality: lake Neusiedler [lacu Nischiteriensi, Kramer], Austria; syntypes: NMW ? [not yet located; B. Herzig, pers. comm., 1995]; junior primary homonym of *Cyprinus lacustris* Pallas, 1814)

Cyprinus Regina Bonaparte, 1836: [fasc. 17–18, p. 195], pl. 108 fig. 1 (type locality: rivers Arno, Tevere and Aniene, lakes Trasimeno and Bracciano, Italy; syntypes: MNHN 751 [1], Almaça, 1969: 1142, ANSP 6616-6623 [8], Böhlke, 1984: 88)

Cyprinus hungaricus Heckel, 1836: 222, pl. 19 fig. 1 (type locality: lake Neusiedler, Hungary; syntypes: NMW 10958-959 [2])

Cyprinus Elatus Bonaparte, 1836: [fasc. 17–18, p. 203], pl. 108 fig. 3 (type locality: lake Bracciano and lake Vico near Ronciglione and ditches leading to lake Trajano, Italy; holotype: ANSP 6614, Böhlke, 1984: 75)

Cyprinus Nordmannii Valenciennes, in Cuvier & Valenciennes, 1842: 66, pl. 456 (type locality: market in Odessa, from rivers Dniester and Bug, Ukraine; holotype: MNHN 3375, Almaça, 1969: 1141)

Cyprinus angulatus Heckel, 1843: 1013 (nomen nudum; locality: Hungary)

Cyprinus thermalis Heckel, 1843: 1013 (nomen nudum; locality: Hungary)

Cyprinus festetitzii Bonaparte, 1845: 3 (proposed in synonymy, name not available); 1846: 26 (proposed in synonymy, name not available)

Carpio vulgaris Rapp, 1854: 141 (type locality: lake Konstanz, Germany-Switzerland-Austria; syntypes: LU)

Cyprinus carpio var. *gibbosus* Kessler, 1856b: 357 (type locality: Ekaterinoslaw, Kiev, Ukraine; syntypes: ZISP ?; junior primary homonym of *Cyprinus gibbosus* Pallas, 1814)

Cyprinus Bithynicus Richardson, 1856: 372 (type locality: lake Apollonitis, Asia Minor; holotype: BMNH, Günther, 1868: 28)

Cyprinus acuminatus Heckel & Kner, 1858: 58, fig. 22 (type locality: river Danube and lakes Neusiedler and Balaton, Austria and Hungary; syntypes: NMW 52846 [2], 52854-855 [2], 52927-929 [3], 52950 [9], 53403 [2]; junior primary homonym of *C. acuminatus* Richardson, 1846: 289)

Cyprinus carpio var. *elongatus* Walecki, 1863: 359 (unnecessary replacement name for *Cyprinus hungaricus* Heckel, 1836)

Cyprinus carpio var. *monstrosus* Walecki, 1863: 359 (nomen nudum and infrasubspecific, name not available)

Cyprinus carpio var. *oblongus* Antipa, 1909: 117, pl. 8 fig. 36 (type locality: delta of river Danube, Romania; syntypes: LU)

Cyprinus carpio anatolicus Hanko, 1924: 150, pl. 3 fig. 10 (type locality: river Pursak near Eski-Chehir and Kötschke-Kissik, Turkey; syntypes: MNH ? [6])

Cyprinus carpio morpha *aralensis* Spiczakow, 1935: 428, fig. 7a (infrasubspecific, name not available; Aral Sea at St. Nikolaus and Lasarew islands)

Cyprinus carpio fluviatilis Pravdin, **1945: 11** (type locality: flood-plain lakes of river Volga near Saratov, Russia) from Berg, 1949: 1327

Cyprinus carpio morpha *brevicirri* Misik, 1958: 70 (infrasubspecific, name not available)

Cyprinus carpio morpha *longicirri* Misik, 1958: 70 (infrasubspecific, name not available)

Systematic notes. The above synonymy includes only nominal species based on European and western and central Asian material.

Balon (1974, 1995) discussed the origin of domesticated carps and concluded that the European ones originated from a rheophilic stock from the Danube. I agree with him and Hoffmann (1995) that it is unlikely to have been imported from China, as is often assumed. Balon (1995: 15) does not exclude the possibility that the Chinese carps are derived from introduced European carps and that the many species of *Cyprinus* recognised by Chinese authors are merely domesticated or feral forms. There is no evidence for this. The hypothesis of a radiation in southern China and adjacent areas (especially in lakes of Yunnan and Myanmar) accompanied by specialisation to occupy different feeding niches is at least as reasonable (ongoing DNA analysis could confirm or refute this phylogenetic hypothesis); a very similar zoogeographic pattern is observed in *Yunnanilus* and *Anabarilius* (Kottelat & Chu, 1988: 89; Chen, 1986). I doubt that the non-feral Chinese species reported as *C. carpio* really is conspecific with the European one and except for their treatment as two distinct subspecies by Berg (1949), I could not find evidence that the two have ever been the subject of a detailed comparison. Misik (1958) compiled data from different sources but did not compare actual material from the different geographic areas. Ivasik (1968) reports that the two stocks have different parasite faunae. See Zhou (1989), Zhou & Chu (1986) and Wang (1979) for recent revisions of Chinese species, but it does not seem that they compared them with actual specimens of the European species.

As noted by Balon, the assumed original wild population in the Danube is now seriously threatened, and the loss of the wild stock of such an economically important species would be a great loss of genetic material. The alternative possibility that additional original wild stocks exist(ed) in other European basins (e.g., Rhine) has apparently not been investigated but, a priori, cannot be excluded. Lelek (1987) reports on a 'feral' carp from the Rhine similar in shape to the Danube one, but explicitly did not exclude the possibility that it might be a native Rhine carp (Balon [1995: 31] considers that data in Köhler & Lelek [1992: 131] identifies it as feral; I see no data to support or refute this conclusion). If, as concluded by Balon, wild carps are only known from the Danube, considering this species as potentially threatened in areas or countries where only cultivated or introduced stocks exist (e.g., Switzerland; Pedroli et al., 1991: 65) is not justified and may even be prejudicial to the conservation of native species. Additional wild stocks exist in rivers draining to the Black, Caspian and Aral seas.

Nomenclatural notes. Spiczakov (1935) created the name *Cyprinus carpio* morpha *aralensis*. In the same paper the same fish is also called *C. aralensis*. The text and the context makes it clear that he considered this fish as a morph of *C. carpio* and that '*C. aralensis*' is just a convenient, short way of referring to *C. c.* morpha *aralensis*.

It is not clear yet which name should be used for the East Asian carp. The name *C. carpio haematopterus* Temminck & Schlegel, 1845: pl. 96 (type locality: Kiusin [Kyushu] island, Japan; type material: NT; text, p. 189, published in 1846; see Hureau & Monod, 1973: vol. 2: 149) has commonly been used, but as Nagasaki (on Kyushu island) was the earliest European settlement in Japan, that very population could have been introduced (Balon, 1995: 15). DNA analysis may be able to show the relationships between this material, East Asian and European carps. If *C. haematopterus* turns out as an invalid name for the East Asian carp, there are at least 10 other names which should be considered as the potential valid name (listed by Wu et al., 1977: 412–414). Several of these names actually are anterior to *C. haematopterus* and it seems there has never been a justification for the use of *C. haematopterus* rather than these older names.

5.12.1 *Eupallasella perenurus* (Pallas, 1814)

Cyprinus Perenurus Pallas, 1814: 299 (type locality: lakes and swamps around river Lena, Siberia; syntypes: LU)

Phoxinus jelskii Dybowski, 1869: 952 (type locality: lakes of Darasun, But-Durutaj, Ila and Makhojtowa valleys [river Onon basin], Siberia; syntypes: IZPAN, Oliva, 1963 327)

Leucaspius Fischeri Sabanejew, 1871: 277 (nomen nudum [conclusion also reached by Berg, 1912: 198]; locality: east slope of Ural range, Siberia)

Phoxinus perenurus var. *dauricus* Dybowski, **1877: 17** (lake in basin of river Onon, Siberia) from Berg, 1949: 574

Phoxinus laevis var. *punctatus* Benecke, 1881: 140 (original locality: Danzig [Gdansk], Poland; type locality: swampy lake Jasien near Gdansk, Poland [by neotype designation]; neotype: CUP 32106, present designation)

Phoxinus stagnalis Warpachowski, 1886a: 76, fig. (type locality: lake Schumjer [in basin of river Malaya Kokschaga, Berg, 1949: 578], Kazan prov., Russia; syntypes: ZISP 7782-7783 [8], Berg, 1912: 211)

Phoxinus Sabanejewi Warpachowski, 1887: 535 (type locality: lakes on eastern slope of Urals range [district Schadrinsk, Tscheljabinsk; Berg, 1912: 199]; syntypes: ZISP 7779 [2], Berg, 1912: 199)

Phoxinus altus Warpachowski, 1887: 535 (type locality: tributaries of river Yenissei, Siberia [lower Tunguska, Berg; 1912: 199]; syntypes: ZISP 3235 [6], Berg, 1912: 199)

Phoxinus variabilis Warpachowski, 1887: 535 (type locality: tributaries of river Ob, Siberia [river Tscharysch; Berg, 1912: 199]; syntypes: ZISP 7742-3, 3339 [20], Berg, 1912: 199)

Phoxinus percnurus mantschuricus Berg, 1907a: 204 (type locality: Da-tschu-an, a tributary of river Sungari, Amur basin, China; syntypes: ZISP 13890 [2])

Phoxinus Dybowskii Lorec & Wolski, 1910: 115 (type locality: Buchnik and Piaseczno, small lakes in Warsaw District, Poland [Berg, 1949: 579]; syntypes: IZPAN ? [20 ?])

Phoxinus percnurus sarykul Ruzskii, **1926: 112, fig.** (lake Sarykul south of Chelyabinsk, Siberia) from Berg, 1949: 575

Phoxinus percnurus gdaniensis Berg, 1932a: 140 (nomen nudum; locality: near Danzig [Gdansk], Poland)

Phoxinus percnurus posnaniensis Berg, 1932a: 140 (nomen nudum; locality: near Posen, river Oder basin, Poland)

Phoxinus percnurus gdaniensis Berg, 1932c: 359

(type locality: swampy lake Jasien near Gdansk, Poland; neotype: CUP 32106, present designation [designation by Oliva, 1963: 320 not valid; ICZN, art. 75(d)(3)])

Phoxinus czekanowskii posnaniensis Berg, 1932c: 362 (type locality: Poznan, basin of river Oder, Poland; holotype: ZISP ?)

Phoxinus percnurus occidentalis Kaj, 1953: 66, fig. 2 (type locality: Zlotkowo, Poznan district and Serock, near Bydgoszcz, Poland; syntypes: LU)

Systematic notes. Formerly placed in *Phoxinus*. Gasowska (1979) discussed the generic differences between *P. phoxinus* and *P. perenurus* and placed the second species in *Moroco* Jordan & Hubbs, 1925. Howes (1985: 61) agreed with her conclusion but showed that *Moroco* actually is a synonym of *Lagowskiella* Dybowski, 1916 (p. 101) and that *Eupallasella* Dybowski, 1916 (p. 101) is the correct generic name for the present species.

Oliva (1963) recognised three subspecies in Poland; *E. p. gdaniensis*, *E. p. occidentalis* and *E. p. dybowskii*, differing in details of morphometry and meristics showing a kind of mosaic distribution. All seem to have very restricted and broadly disjunct distributions. Data available to me do not allow to decide whether a single variable or several species are involved. Comparative data on detailed distribution and variability of Russian populations is especially badly needed.

The weak point in Oliva's data is that except for his original data on *E. p. gdanensis* all the data he tabulated and used apparently are compiled from six different sources. Among the characters which diagnose the subspecies are the number of branched anal and dorsal rays and the length of caudal peduncle, characters well known to have been counted and measured in very different and incompatible ways by different authors.

For the time being, it seems reasonable to consider that a single species is involved but obviously each of the European populations, if they are clearly isolated, deserves a detailed reexamination. Considering their stenotypic habitat requirements, their conservation deserves urgent attention.

Phoxinus percnurus sachalinensis Berg, 1907a: 204 (type locality: river Arakul near Tschepisan, southern Sachalin, Siberia; syntypes: ZISP 13879 [14]) is a synonym of *Rhynchocypris oxycephalus* Sauvage & Dabry de Thiersant, 1874 (Howes, 1985: 72).

Nomenclatural notes. Note that the correct spelling of the specific name is *perenurus* and not *percnurus* as used by most contemporary authors. Although *Eupallasella* is a feminine noun, *perenurus* does not have to agree in grammatical gender because it is a noun in apposition.

If different species were to be recognised among the Polish populations, it should be noted that *E. punctata* (Benecke, 1881) has priority over *E. gdaniensis* (Berg, 1932). Benecke (1881: 140) recognised a variety of *Phoxinus phoxinus* from Gdansk which he called "*punctatus* Zadd."). "Zadd." is probably Ernst Gustav Zaddach (1817–1881) and I could not find a publication by him making the name *punctatus* available. It was probably a personal communication to Benecke, and Benecke being responsible of the conditions making the name available, he alone is author of the name. Although the description is very brief, it does make the name available. The whereabouts of Benecke's material are not known. In order to remove any potential ambiguity, specimen CUP 32106 is designated as neotype of *Phoxinus phoxinus punctatus* Benecke, 1881; this specimen is also the neotype of *P. perenurus gdaniensis*.

Oliva (1963: 320) designated specimen CUP 32106 as neotype of *P. p. gdaniensis*. However, this designation is not valid because it does not fulfil all conditions of the Code, especially art. 75(c)(3) as Oliva did not state his reasons for believing that Berg's type material was lost and steps taken to trace it. This material is not present in ZISP and there is not even trace of it in ZISP registers and catalogues (N. Bogutskaya, pers. comm., 1995). In order to avoid future confusion, specimen CUP 32106 is here formally designated as neotype of *Phoxinus percnurus gdaniensis* Berg, 1932. See Oliva (1963) for diagnostic characters of the species, description of the neotype, and discussion of identity and locality.

5.13.1 *Gobio albipinnatus* Lukash, 1933

Gobio albipinnatus Lukash, 1933: 57, fig. 12 (type locality: river Vyatka, Volga basin, Russia; lectotype: ZISP 25069, designated by Bănărescu & Nalbant, 1973: 150)

Gobio Belingi Slastenenko, 1934: 350, pl. 1 figs. 2–3 (type locality: upper reaches and rapids of river Dnieper, Ukraine; syntypes: LU)

Gobio vladykovi Fang, 1943: 403 (type locality: liman Cahoul, Romania; holotype: MNHN 1925–4)

5.13.2 *Gobio banarescui* Dimovski & Grupče, 1974

Gobio kessleri banarescui Dimovski & Grupče, 1974: 83, fig. 1 (type locality: river Vardar south of Véles [from Nogaevtsi to Guevguélia] and stream Bregalnitsa from Solifari to confluence with Vardar, FYROM; syntypes: MMNHS [75]).

Systematic notes. Originally described as a subspecies of *G. kessleri*, *G. banarescui* constitutes an independant lineage, is diagnosable (Bănărescu, 1992a: 321) and is treated as a valid species under the PSC.

5.13.3 *Gobio benacensis* (Pollini, 1816)

Cyprinus benacensis Pollini, 1816: 21, pl. 1 fig. 2 (type locality: lake Garda, Italy; type material: NT)

Gobio Venatus Bonaparte, 1839: [fasc. 25, p. 218], pl. 110bis, fig. 5 (type locality: Piemonte / stream Savena near Bologna, Italy; syntypes: ANSP 6560-8564 [5], Böhlke, 1984: 94)

Gobio lutescens Filippi, 1844: 393 (type locality: Lombardia, Italy; syntypes: LU)

Gobio pollinii De Betta, 1862: 77 [of reprint] (type locality: lake Garda, Isola della Scala and Montorio, Italy; syntypes: LU)

Systematic notes. Data in Bianco & Taraborelli (1984) and Pizzul et al. (1993) provide evidence that the northern Italian *Gobio* constitutes an independent and diagnosable lineage and thus is a distinct species, as already treated by Bianco (1994b: 458, 1995: 166). The argument of Gandolfi & Zerunian (1987: 29) is not relevant under the PSC; in addition, as discussed under *Salvelinus* (p. 147; see also Mayden & Wood, 1995: 85), there is no theoretical basis for their requirement that a given magnitude of difference is necessary to be of historical or taxonomic value.

5.13.4 *Gobio elimeius* Kattoulas, Stephanidis & Economidis, 1973

Gobio albipinnatus elimeius Kattoulas, Stephanidis & Economidis, 1973: 179, fig. 2 (type locality: Aliakmon river by the bridge near Ammudara village (Kastoria), Greece; holotype: DZAUT ?)

Gobio persus stankoi Karaman, 1974b: 4 (type locality: river Vardar near Skopje, FYROM; syntypes: ? MMNHS [13])

Gobio uranoscopus stankoi Dimovski & Grupče, 1976: 82, 89, fig. 1 (type locality: upper course of streams Tsrna Reka and Bregalnitsa, streams Treska and Lepenets, and river Vardar from Gostivar to Skopje, FYROM; syntypes: MMNHS [79]; junior homonym of *Gobio persus stankoi* Karaman, 1974b: 4)

Systematic notes. This species has been considered as a subspecies of *G. uranoscopus* by Dimovski & Grupče (1976: 89) and Bănărescu (1992a: 320). As it constitutes an independent and diagnosable lineage, it is a distinct species under PSC.

5.13.5 *Gobio gobio* (Linnaeus, 1758)

Cyprinus Gobio Linnaeus, 1758: 320 (based on Artedi [1738: gen. 4 [13], syn. 11, spec. 13 [4], Cyprinus quinculialis maculosus ...] and Gronovius [1756: 2, n. 149. idem]; type locality: "in Anglia & adjacentibus"; type material: NT)

? *Cobitis fundulus* Wulff, 1765: 32 (type locality: Borussia [Prussia]; type material: NT ?)

Gobio fluviatilis Fleming, 1828: 186 (type locality: "gentle streams in England"; available by description and by indication to earlier sources; type material: NT ?)

Gobio Phoxinoïdes De la Pylaie, 1835: 533 (nomen nudum; locality: Yon and other streams of Vendée, France)

Gobio vulgaris Heckel 1836: pl. 21 (no stated locality; syntypes: NMW ?)

Gobio saxatilis Koch, in Koch, Herrich-Schäffer & Forster, 1840: 40 (unnecessary replacement name for *Cyprinus gobio* Linnaeus, 1758)

Gobio obtusirostris Valenciennes, in Cuvier & Valenciennes, 1842: 311 (type locality: München, Germany; syntypes: MNHN 8 [6], Bertin & Estève, 1948: 87)

? *Bungia nigrescens* Keyserling, 1861: 22, pl. 8 (type locality: river Heri-rud near Herat, Afghanistan; holotype not preserved)

Gobio fluviatilis var. *cynocephalus* Dybowski, 1869: 951 (type locality: rivers Onon and Ingoda, Amur basin, Siberia; syntypes: LU); synonymy follows Bogutskaya, pers. comm.

Gobio fluviatilis var. *lepidolaemus* Kessler, 1872: 59 (type locality: Ak-darja and Chodshaduk in Serafschan basin, Uzbekistan / Syr-darja at Chodshent [Leninabad], Tadzhikistan; syntypes: ZISP 2706 [25], Berg, 1914: 453)

Gobio lepidolaemus var. *caucasica* Kamensky, 1901: 6, 126, 142 (type locality: northern Caucasus in Podkumok and Sulak and in Transcaucasus near Choni [Sunzha near Groznyí / Podkumok near Georgijewsk / Choni, Tzchenistzchali basin, a tributary of river Rioni, Kutais district; Berg, 1914: 458, 459], Russia, restricted to Rion basin by Berg, 1949: 649; syntypes: ZMT 130c, Berg, 1914: 458, 469; primary simultaneous homonym of *Gobio uranoscopus* var. *caucasica* Kamensky, 1901: 9, 145)

Gobio latus Anikin, **1905: 18** (lake Issyk-Kul at mouth of river Ulachol, Kirghizistan) from Berg, 1914: 453

Gobio gobio morpha *brevicirris* Berg, 1914: 442, fig. 56 (infrasubspecific, name not available; various localities in Ukraine, Russia and Siberia)

Gobio gobio morpha *longicirris* Berg, 1914: 442 (infrasubspecific, name not available)

Gobio gobio morpha *prosopyga* Berg, 1914: 442 (infrasubspecific, name not available; various localities in Russia)

Gobio gobio morpha *katopyga* Berg, 1914: 446 (infrasubspecific, name not available; various localities in Russia and Siberia)

Gobio gobio lepidolaemus natio *holurus* Berg, 1914: 457, fig. 61 (infrasubspecific, name not available; locality: streams Martan and Tschernorjetschje [Chernorech'e], tributaries of river Sunzha near Groznyí, Chechnia, Russia)

Gobio gobio var. *ohridana* Karaman, 1924b: 39 (type locality: lake Ohrid, FYROM; syntypes: LU)

Gobio gobio carpathicus Vladykov, 1925a: 248 (type locality: upper river Theiss [Tisza] basin, Danube basin, Ukraine; syntypes [total: several hundreds]: MNHN 30-195, 30-196 [2], Bertin & Estève, 1948: 87)

Gobio gobio bulgarica Drensky, 1926: 131, fig. 2 (type locality: river Maritsa, Bulgaria; syntypes: NMNHS)

Gobio gobio carpathicus natio *sarmaticus* Slastenenko, 1934: 352, pl. 1 figs. 4–5 (infrasubspecific, name not available; locality: tributaries of rivers Dniester, southern Bug and Dnieper, Ukraine)

Gobio gobio lepidolaemus forma *skadarensis* Karaman, 1936: 60 (infrasubspecific, name not available; usage in Bănărescu & Nalbant, 1973: 117 makes name available as *G. g. skadarensis* Karaman, 1936 [ICZN art. 45(g)(ii)(1)]; type locality: lake Skutari, Drim basin, Montenegro and Albania; syntypes: LU)

Gobio gobio sibiricus Nikolsky, 1936: 470 (type locality: river Nura, Siberia; syntypes: LU)

Gobio gobio kovatschevi Chichkoff, 1937: 257 (type locality: river Provadiiska, entering the Black Sea near Varna, Bulgaria; syntypes: LU)

Gobio gobio carpathicus natio *krymensis* Delyamure, **1937** (infrasubspecific, name not available; locality: river Biyuk-Karassu, South Crimea, Ukraine) from Bănărescu & Nalbant, 1973: 119

Gobio gobio acutipinnatus Menschikov, **1938: 121** (lake Marka-Kul, river Irtysh basin, Altai, Siberia; syntypes: ZISP 26865 [6], Bănărescu & Nalbant, 1973: 126) from Berg, 1949: 645

Gobio gobio microlepidotus Battalgil, 1942: 294, fig. 5 (type locality: lake Beysehir, Turkey; syntypes: ZMH 1127 [2], Wilkens, 1977: 158)

Gobio gobio intermedius Battalgil, 1944: 130, fig. 3 (type locality: lake Eber, Vilâyet Afyon Karahisar; Turkey; syntypes: ZMH 1128, 1135 [2], Wilkens, 1977: 158)

Gobio gobio sarmaticus Berg, 1949: 643 (available by description and reference to *G. g. carpathicus* natio *sarmaticus* Slastenenko, 1934; type locality: rivers Dniester and Yuzhnyi Bug, Ukraine; syntypes: LU)

Gobio gobio muresia Jaszfalusi, 1951: 119, pl. 1 fig. 4 (type locality: river Maros [Mures] near Gödemesterháza and at confluence with creeks Zebrak and Göde, Hungary [now Romania]; syntypes: LU)

Gobio gobio lepidolaemus natio *lindbergi* Turdakov & Piskarev, **1955: 89** (infrasubspecific, name not available)

Gobio gobio nikolskyi Turdakov & Piskarev, **1955: 89** (Amu Darya basin)

Gobio gobio insuyanus Ladiges, 1960: 136, fig. 8 (type locality: creek Insuyu, Cihanbeyli, Turkey; holotype: ZMH 1133, missing, Wilkens, 1977: 157)

Gobio gobio gymnostethus Ladiges, 1960: 137, fig. 9 (type locality: creek Kizilcak, Nigde, Turkey; holotype: ZMH 1131, Wilkens, 1977: 157)

? *Gobio gobio magnicapitata* Gundrizer, **1967: 69** (lake Kara-khol, Kharnusovoe, Khamsari, Tadzhikistan) from Gundrizer, 1979: 9

Gobio gobio albanicus Oliva, 1961: 42, pl. 2 fig. 3 (type locality: river Kiri, Albania; holotype: CUP 30408)

Gobio gobio balcanicus Dimovski & Grupče, 1977: 95, fig. 1 (type locality: river Vardar and its tributaries, FYROM; syntypes: ? MMNHS [100])

Gobio gobio krymensis Bănărescu & Nalbant, 1973: 119 (type locality: rivers Alma and Kacha, Crimea [see below]; syntypes: LU [100])

Gobio gobio feraeensis Stephanidis, 1973: 192, fig. 1 (type locality: Kefalovrysson [fountain] of Velestinon, Thessaly, Greece; holotype: lost ?)

Gobio gobio brevicirris Fowler, 1976: 103 (available by indication to *Gobio gobio* morpha *brevicirris* Berg, 1932c: 407, fig. 317 [= 1914: 442]; type locality: various localities in Ukraine, Russia and Siberia; syntypes: ZISP)

Gobio gobio holurus Fowler, 1976: 104 (available by indication to *Gobio gobio lepidolaemus* natio *holurus* Berg, 1914: 457, fig. 61; type locality: streams Martan and Tschernorjetschje, tributaries of river Sunsha near Grosnyj, Chechnia, Russia; syntypes: ZISP)

Systematic notes. Bănărescu & Nalbant (1973: 110) recognise 19 subspecies and Bănărescu (1992a) later retained only 17, with *bulgaricus, gobio, obtusirostris, benacensis, feraeensis* and *ohridanus* in Europe, and 11 in Asia. It seems likely that future analysis could lead to recognition of several forms as distinct species. Wu et al. (1977), followed by Bănărescu (1992a: 319), recognised *G. soldatovi* Berg, 1914 as valid. Some of the nominal taxa from Turkey seem to represent distinct species. Bănărescu (1992a: 317) comments that there is a gradual and continuous transition between *G. g. obtusirostris* and *G. g. gobio* in the Baltic Sea and the Dnieper basins and between *G. g. gobio* and *G. g. bulgaricus* in the southern part of the Danube basin; although data are not provided, I tentatively accept this as evidence that a single species is involved. *Gobio gobio benacensis* is treated here as a valid species.

Nomenclatural notes. *Gobio gobio carpathicus* natio *krymensis* Delyamure, 1937 is not available because it is infrasubspecific. The use of this name as a subspecies by Bănărescu & Nalbant (1973: 119) makes this name available from this last publication and with Bănărescu & Nalbant as authors. Their description is exclusively based on Berg (1949: 643), itself apparently exclusively based on Delyamure (**1937**); the only locality mentioned by Berg is thus the type locality and the specimens mentioned are syntypes.

5.13.6 *Gobio kesslerii* Dybowski, 1862

Gobio Kesslerii Dybowski, 1862: 71 (type locality: river Dniester near Mohilew [Mogilev], Ukraine; available by brief diagnosis and indication to Kessler [**1856a: 30**, *Gobio uranoscopus* ?; repeated in Kessler, 1856b: 353]; syntypes: ZISP 3436 [5], Berg, 1914: 464)

Gobio uranoscopus carpathorossicus Vladykov, 1925a: 250 (type locality: river Theiss [Tisza] between Buštino and Velky Byčkiv villages, Ukraine; syntypes [total 10]: MNHN 30-197 [1], Bertin & Estève, 1948: 88)

Gobio similis Chichkoff, 1929: 159, pl. 1 fig. 1 (type locality: river Isker, Danube basin, Bulgaria, restricted by Bănărescu & Nalbant, 1973: 158; syntypes: LU)

Gobio kessleri kessleri natio *banaticus* Bănărescu, 1953: 318, fig. 3 (infrasubspecific, name not available; locality: river Timis near Timisoara [between Albina and Urseni, Bănărescu, 1961b: 343], Banat, Romania; "holotype" MGAB 49913 listed by Mihai-Bardan, 1984: 456 has no nomenclatural status and thus is not holotype)

Gobio kessleri antipai Bănărescu, 1953: 318, fig. 4 (type locality: mouth of river Danube at Sulina, Romania; syntypes [total 13]: MGAB 49908 [1], Mihai-Bardan, 1984: 456)

Gobio kessleri banaticus Bănărescu, 1960: 121 (available by indication to Bănărescu, 1953; type locality: river Bega at Timisoara and lower Arges basin, Romania; syntypes [total 13]: MGAB 49913 [1])

Systematic notes. Bănărescu & Nalbant (1973: 157) recognise 3 subspecies "connected by intergrades". Bănărescu (1992a: 321, 1994a: 53) considers that *G. antipai* might be a distinct species "reproductively isolated from the true riverine *G. kessleri.*" Awaiting supporting evidence, I treat them as conspecific; it might be too late to clear this problem as *G. antipai* might be extinct (Bănărescu, 1994b: 12).

Nomenclatural notes. Mihai-Bardan (1984: 456) lists specimen MGAB 49908 as holotype of *G. k. antipai*. Bănărescu (1953) based his description on 12 specimens from Sulina and one from the lower Arges; he did not designate a holotype and all 13 specimens are syntypes. The type locality is explicitly restricted to Sulina by Bănărescu (1953: 319); it should be confirmed by a lectotype designation, maybe MGAB 49908, in order to avoid future possible confusion.

5.13.7 *Gobio uranoscopus* (Agassiz, 1828)

Cyprinus uranoscopus Agassiz, 1828: 1048, pl. 12 figs. 1a–d (type locality: river Isar in München, Germany; lectotype: MNHN 5825, designated by Bănărescu, 1970: 165)

Gobio frici Vladykov, 1925a: 249 (type locality: stream Teresovka, a tributary of river Teiss [Tisza], near Podplesa village, Ukraine; syntypes: LU [3])

Systematic notes. Bănărescu & Nalbant (1973: 138) recognise *G. frici* as a valid subspecies and Bănărescu (1992a: 320) recognises *G. u. elimeius* as a third subspecies. *Gobio elimeius* is considered here as a valid species.

Hypophthalmichthys molitrix (Valenciennes, 1844) introduced

Hypophthalmichthys nobilis (Richardson, 1845) introduced

5.14.1 *Iberocypris palaciosi* Doadrio, 1980

Iberocypris palaciosi Doadrio, 1980: 7 (type locality: Río Jándula, Lugar Nuevo, Andujár (Jaén), Spain; holotype: MNCN A 790413162).

Systematic notes. The generic position and relationships of this species deserve further studies. Bianco (1988b: 9) suggested that it might be a *Leuciscus* related to the *L. souffia* complex (genus or subgenus *Telestes* of earlier authors); I agree with him that too much weight has been given to the number of rows of pharyngeal teeth in the definition of genera of European cyprinids.

5.15.1 *Ladigesocypris ghigii* (Gianferrari, 1927)

Leucaspius Ghigii Gianferrari, 1927: 123 (type locality: stream Mulini, Coschino [Coschinou], Rhodos Island, Greece; holotype: MSNM 4385, Conci & Michelangeli, 1974: 225); also in Gianferrari, 1929: 39, fig. 1

Leucaspius Prosperi Gianferrari, 1927: 124 (type locality: stream of Mulini, in Coschino [Coschinou], Rhodos Island, Greece; holotype: MSNM 4386); also in Gianferrari, 1929: 39, fig. 3

Systematic notes. Karaman (1972: 143) considers *L. prosperi*, *L. irideus* (Ladiges, 1960) and *L. mermere* (Ladiges, 1960) as synonyms or subspecies of *L. ghigii*. *Ladigesocypris irideus* and *L. mermere* from Turkey are apparently distinctive, geographically isolated forms and are not considered conspecific.

Leucaspius prosperi was placed in *Pseudophoxinus* by Bianco & Taraborelli (1988: 251).

Nomenclatural notes. Gianferrari clearly based her description of *L. prosperi* on a holotype; she mentions additional specimens which may be considered as paratypes. Specimens listed as syntypes by Bertin & Estève (1948: 78) and Kottelat & Sutter (1988: 53) are paratypes [additional paratypes have certainly been distributed to other museums]. Conci & Michelangeli (1974: 225) list two syntypes as MSNM 4386 while this is the number given by Gianferrari, apparently for the holotype. Hopefully her published data on the holotype should allow its identification; if not, then all specimens have to be treated as syntypes. Gianferrari (1927) lists the type locality of *L. prosperi* as stream Mulini, while in 1929 she reported it as Arghiro; Conci & Michelangeli merely report the locality of the 'syntypes' as Rhodos Island.

The original spelling of the name is *L. prosperi*. It has been emended by Gianferrari (1929) into *L. prosperoi*. As there is no explanation for this emendation, it has to be considered as an unjustified subsequent spelling and has no validity.

Leucaspius ghigii Gianferrari, 1927 and *L. prosperi* Gianferrari, 1927 are simultaneous synonyms. Karaman (1972: 143) acted as first reviser and retained *L. ghigii* as having priority over *L. prosperi*.

5.16.1 *Leucaspius delineatus* (Heckel, 1843)

Squalius delineatus Heckel, 1843: 1041 (type locality: Marchfelds near Wien and Mähren, Austria; syntypes: NMW 49783 [7], 50794 [6], 50796 [11])

Cyprinus Fischeri Valenciennes, in Cuvier & Valenciennes, 1844: 378 (nomen nudum; locality: creek Beresofka [Beresovka], tributary of river Ingoul, Cherson [Kherson] government, Russia; author stated to be Arendt, but Valenciennes is actual author)

Aspius Ovsianka Czernay, 1851: 281, pl. 7 (type locality: Charkowschen [Kharkov county], Russia; syntypes: LU)

Leucaspius abruptus Heckel & Kner, 1858: 145, fig. 76 (type locality: Lemberg [now Lviv], Ukraine; syntypes: NMW 49741 [2])

Cyprinus Pallasii Arendt, in Kessler, **1860: 121** (nomen nudum)

Leuciscus pigmeus Plater, **1861: 41, 66** (Dwina [Dvina], Latvia) from Berg, 1912: 326

Owsianka Czernayi Dybowski, 1862: 147, 148 (type locality: in rivers Dnieper, Dniester, Don, Weichsel [Vistula] and Düna [Dvina], Poland, Ukraine, Russia and Latvia; syntypes: LU)

Leucaspius relictus Warpachowsky, **1889b: 60, fig. 36** (lake Svetloyar at Svetlaya Lusha (Ozero) near Vladimirskoe in Makarevskii District, Niznyi Novgorod Prov., Russia; syntypes: ZISP 7956 [6], Berg, 1912: 328) from Berg, 1949: 610

Leucaspius delineatus dimorphus Ruzsky, in Gratzianow, 1907b: 132 (nomen nudum; locality: river Sura, Simbirsk Prov., Russia; Berg, 1912: 327)

Leucaspius delineatus dimorphus Ruzskii, **1914: 1** (lakes in river Sura basin, Kurmysh district, Russia) from Berg, 1949: 610

? *Phoxinellus thracicus* Battalgil, 1942: 301, fig. 9 (type locality: Kagithane Deresi, a creek entering the Bosphorus, Turkey [European side]; syntypes: LU)

Leucaspius delineatus natio *caucasicus* Berg, 1949: 612 (infrasubspecific, name not available; locality: North Caucasus and Transcaucasia)

Systematic notes. Ladiges (1960: 123) considered *Phoxinellus thracicus* as a synonym of *Leucaspius delineatus*. Bănărescu (1992b: 755) considered *P. thracicus* as distinct, placing it in "*Pseudophoxinus*" and commenting that it might "actually be a *Rutilus (Leucos)* and does perhaps not deserve specific rank". Its status can only be solved by examination of the types (apparently not extant) or fresh material from the type locality. The species is not mentionned by Geldiay & Balik (1988). It is not a *Phoxinellus* as defined by Bogutskaya (1992: 264) because it has too many branched anal rays (12–14, vs. 6–9).

5.17.1 *Leuciscus borysthenicus* (Kessler, 1859)

Squalius borysthenicus Kessler, 1859a: 545 (type locality: river Dnieper near Aleschki [Aleshki], Ukraine; syntypes: ZISP ?)

Telestes leucoides Filippi, 1863: 392 (type locality: Batum, Georgia; syntypes: MZUT 671 [2], Tortonese, 1940: 140)

Leuciscus heterandrius Battalgil, 1940: 74, figs. 1–2 (type locality: a swift flowing tributary of lake Iznik, Turkey; holotype: Zool. Mus. Istanbul 2500)

Systematic notes. *Leuciscus smyrnaeus* Boulenger, 1896 (p. 154; type locality: rivers and streams between the north coast of Smyrna and Troy, Turkey; syntypes: BMNH 1895.12.28: 19–28 [10]), sometimes listed as a synonym of *L. borysthenicus*, is a valid species according to Bogutskaya (1994: 600, 602).

Bogutskaya (1994: 618; 1995: 153) comments that *L. borysthenicus* and a few other species from southwest Asia stand apart from other species of *Leuciscus* and are possibly most closely related to *Ladigesocypris* and *Pseudophoxinus*.

5.17.2 *Leuciscus burdigalensis* Valenciennes, 1844

Leuciscus burdigalensis Valenciennes, in Cuvier & Valenciennes, 1844: 218 (type locality: river Gironde, France; lectotype: MNHN 3104, designated by Almaça, 1969: 1121)

Squalius bearnensis Blanchard, 1866: 400, fig. 95 (type locality: lake Mariscot, near Biarritz, France; lectotype: MNHN A.2265, designated by Almaça, 1969: 1117)

Squalius oxyrrhis La Blanchère, 1873: 662, fig. (type locality: rivers Aveyron, upper Lot, Trueyre, Argence and Viaur, France; syntypes: LU)

Aturius Dufourii Dubalen, 1878: 157, pl. (type locality: river Adour [St. Sever, Landes, according to manuscript note by Dubalen in reprint in MNHN, Laboratoire d'Ichtyologie], France; type material: NT ?)

Systematic notes. Spillmann (1961a: 146) mentions various populations of *L. leuciscus* from south-western France which differ morphologically (head shape, body shape, structure of gill-rakers) from other populations. His text is somewhat ambiguous about distribution; he seems to imply that in part of their range they co-exist with 'normal' *L. leuciscus* (p. 13), but at the same time he treats them as subspecies (p. 146); he also seems to imply that there is a correlation between habitat and morphology (he calls them ecological types, p. 140). If they were subspecies of a single species, then, by definition, two of them cannot occur in sympatry (the maps in Allardi & Keith, 1991: 115–116 also show two of them apparently in sympatry). The kind of morphological differences reported by Spillmann (especially the shape of the gill-rakers) seems to indicate that they are not conspecific with *L. leuciscus* and I tentatively recognise them here as valid species; judging from the data in Spillmann, it is even possible that more species should be recognised. If my hypothesis is correct, the supposed relation between habitat and "morphological types" would then be differences in preferred habitats of different species, a possibility not considered by Spillmann.

This is apparently the species recognised valid as *L. rostratus* by Roule (1925: 174).

5.17.3 *Leuciscus carolitertii* Doadrio, 1988

Leuciscus carolitertii Doadrio, 1988a: 302, fig. 1 (type locality: river Cega, Rebollo, Segovia, Spain; holotype: MNCN 82050157)

5.17.4 *Leuciscus cephalus* (Linnaeus, 1758)

Cyprinus Cephalus Linnaeus, 1758: 322 (based on Linnaeus [**1754: 77, pl. 30**, Cyprinus ... radiis 11], Artedi [1738: gen. [spec.] 5, syn. 7, Cyprinus oblongus macrolepidotus ...] and Gronovius [1754: 3, n. 12, idem; 1756: 3, n. 12, idem]; type locality: "in Europa meridionali"; type material: syntypes: NRM LP 81 [1, Fernholm & Wheeler, 1983: 212], UUZM 213 [Wheeler, 1991: 161])

? *Cyprinus Capito* Scopoli, 1786: 73 (type locality: lakes of Insubria, northern Italy; type material: NT; junior homonym of *Cyprinus capito* Gueldenstaedt, 1778: 248)

Cyprinus Chub Bonnaterre, 1788: 195, pl. 77 fig. 323; type locality: rivers of Europe [based on the chub of Pennant (edition not stated; see e.g., 1776: vol. 3: 222 n. 175, pl. 73; no stated locality)]; type material: NT)

Cyprinus Lugdunensis Walbaum, 1792: 29: 705 (type locality: river Rhine near Leiden, Netherlands; holotype: BMNH 1853.11.12:138, Wheeler, 1958: 212 [material of Gronovius, 1763: 106, n. 335])

Cyprinus orthonotus Hermann, 1804: 322 (type locality not stated [Strasbourg, France ?]; type material: NT ?)

Leuciscus cabeda Risso, 1826: 438 (type locality: Nice, France; lectotype: MNHN B.846, designated by Almaça, 1969: 1124)

Cyprinus Albula Nardo, 1827a: 482, 488 (type locality: France [original locality: Adriatic Sea basin / France]; available by description and by indication to Jonston [**1649: pl. 26 fig. 2**, Albula] and "Bell" [Belon, 1555: 315, chevesne, 319, rosse]; restricted here to 'chevesne' of Belon, 1555: 315; syntypes: some then in Nardo's collection in Chioggia, LU) or 1827b: 34, 40 (same data)

Cyprinus kietaibeli Reisinger, 1830: 77 (type locality: lake Balaton, Hungary; syntypes: LU)

Leuciscus Chub var. *Pictava* De la Pylaie, 1835: 533 (nomen nudum; locality: Napoléon, Vendée, France)

Cyprinus rufus Vallot, 1837: 185 (type locality: Dijon, Pontailler and Auxonne, France; syntypes: LU)

Leuciscus Squalus Bonaparte, 1837: [fasc. 19, p. 225], pl. 111 fig. 1, pl. 112 fig. 2 (type locality: rivers Tevere and Arno, almost all streams of Toscana, Stato Romano and Regno di Napoli, Italy; syntypes: ANSP 6273-6309 [37], Böhlke, 1984: 91, MNHN 5421 [4], Bertin & Estève, 1948: 61, NMW 48920 [1]; a secondary junior homonym of *Cyprinus squalus* Walbaum, 1792)

Leuciscus Albus Bonaparte, 1838: [fasc 22, p. 237], pl. 113 fig. 2 (type locality: lake Trasimeno, Italy; syntypes: ANSP 6335-6336 [2], Böhlke, 1984: 68, MNHN 3903 [1], Almaça, 1969: 1117)

Leuciscus Cavedanus Bonaparte, 1838: [fasc. 22, p. 239], pl. 113 fig. 3 (type locality: stream Piccolo Reno, Bolognese, Italy; syntypes: ANSP 6313-6318 [6], Böhlke, 1984: 72)

Leuciscus brutius Costa, 1838: fasc. 19: 22, pl. 18 (type locality: "river Crati which flows through Cosenza", Italy; lectotype: MNHN 198, designated by Almaça, 1969: 1126)

Leuciscus Rissoi Schinz, 1840: 326 (type locality: brooks around Nice, France; based on *Leuciscus bulatmai* [non Gmelin, 1784: 135] of Risso, 1810: 361; syntypes: MNHN ?)

Leuciscus orientalis Nordmann, 1840: 484 (type locality: Abasie [Abkhasia]; syntypes: LU)

Squalius tyberinus Bonaparte, 1841: [fasc. 30, introduction p. 5] (available by indication to *Leuciscus squalus* of [fasc. 19. p. 221] pl. 111 fig. 1, pl. 112 fig. 2; type locality: rivers Tevere and Arno, almost all streams of Toscana, Stato Romano and Regno di Napoli, Italy; syntypes: ANSP 6273-6309 [37], Böhlke, 1984: 91, MNHN 5421 [4], Bertin & Estève, 1948: 61, NMW 48920 [1])

Leuciscus Nothulus Bonaparte, 1841: [fasc. 30, introduction p. 5], pl. 112 fig. 2 (type locality: not stated [in text, part of *Leuciscus squalus*]; syntypes: LU)

Squalius Pareti Bonaparte, 1841: [fasc. 30, introduction p. 16] (type locality: Liguria, Italy; syntypes: LU); predates actual description in Bonaparte, 1842: 148 (locality: fish market of Scoglietto del Durazzo, Genova, Italy)

Squalius cephalopsis Heckel, 1843: 1080 (type locality: Aleppo, Syria; syntypes: NMW 49438 [3], 49440 [2])

Leuciscus squalius Valenciennes, in Cuvier & Valenciennes, 1844: 191 (type locality: Italy; lectotype: MNHN 3914, designated by Almaça, 1969: 1124)

Leuciscus Albiensis Valenciennes, in Cuvier & Valenciennes, 1844: 194 (type locality: river Elbe, Germany; holotype: MNHN)

Leuciscus peloponensis Valenciennes, in Cuvier & Valenciennes, 1844: 197 (type locality: Morée [Peloponnese], Greece; holotype: MNHN 3905, Almaça, 1969: 1127)

Leuciscus frigidus Valenciennes, in Cuvier & Valenciennes, 1844: 234 (type locality: "probably from Germany because our specimens has been received from the Vienna Museum"; holotype: MNHN)

Cyprinus salmoneus Gronow, 1854: 186 (type locality: river Rhine near Leiden, Netherlands; holotype: BMNH 1853.11.12: 138, Wheeler, 1958: 212)

Leuciscus latifrons Nilsson, 1855: 309 (type locality: river Helgeå at Broby and Glimåkra / Götheborg / Lake Hjelmaren, river Storå / Norrköping, Sweden / Finland [based on material in NRM; S. O. Kullander, in litt. 1995; syntypes: NRM)

Leuciscus Cii Richardson 1856: 375 (type locality: river Gemlek, anciently named Cius, entering the Propontis near the promontory of Posidium, Asia Minor; holotype: BMNH ?)

Squalius meunier Heckel, 1852b: 68 (available by indication to *Cyprinus jeses* of Jurine [1825: 207] and Valenciennes [in Cuvier & Valenciennes, 1836: 74], *Leuciscus dobula* of Selys-Longchamps [1842: 206], Valenciennes [in Cuvier & Valenciennes, 1844: 172] and Bonaparte [1846: 30]; syntypes: material used or listed by these authors)

Squalius turcicus Filippi, **1865: 359** (river Arax near Erzerum, Turkey) from Berg, 1912: 135

Squalius meridionalis Blanchard, 1866: 396, fig. 93 (type locality: river Sâve [Lot-et-Garonne] and river Sorgue near Avignon, France; lectotype: MNHN A.2257, designated by Bertin & Estève, 1948: 63)

Squalius clathratus Blanchard, 1866: 398, fig. 94 (type locality: river Lot in Cahors, France; lectotype: MNHN A.2260, designated by Almaça, 1969: 1125)

Squalius turcicus var. *platycephala* Kamenskii,

1897: 85, pl. 4 figs. 6–8 (lakes Toporovan [Paravani] and Tuman-Göl in upper Kura and Araks basins, Georgia) from Berg, 1949: 559

Squalius agdamicus Kamensky, 1901: 49, 160 (type locality: river Agdam, Shusha district, Azerbaidjan; hototype: ZMT ?)

Squalius cephalus var. *Athurensis* Roule & Cardaillac de Saint-Paul, 1903: 732 (type locality: river Adour, France; syntypes: LU)

Leuciscus cephalus orientalis natio *kaznakovi* Berg, 1912: 143, pl. 2 fig. 3 (infrasubspecific, name not available; locatity: lake Nour near Vandam, Tur'yan-chai basin [river Kura basin], Nuchinskii District, Elisavetopol'skaya Prov., Russia)

Squalius cephalus cavedanus var. *prespensis* Karaman, 1924b: 67 (infrasubspecific [ICZN art. 45 (f) (iii)], name not available; locality: lake Prespa and tributaries, FYROM and Greece)

Leuciscus orientalis var. *pursakensis* Hanko, 1924: 140, pl. 3 fig. 1 (type locality: Kara-Chehir, Kötschke-Kissik and Eski-Chehir, Turkey; syntypes: MNH ? [6])

Leuciscus cephalus var. *wjatkensis* Lukash, **1925: 9, 48** (type locality: river Vyatka near Mulino, Volga basin, Russia) from Costa Pereira, in litt.

Squalius cephalus vardarensis Karaman, 1928: 156 (type locality: basin of river Vardar, FYROM; syntypes: LU); repeated in 1929: 172

Leuciscus svallize zrmanjae natio *risae* Vladykov & Petit, 1930: 395 (infrasubspecific, name not available; locality: lake Risa, draining to southern shore of lake Butrinto, Albania)

Leuciscus cephalus orientalis natio *aralychensis* Barach, **1934: 109** (infrasubspecific, name not available; river Karasu at the foot of Mt. Ararat) from Berg, 1949: 557

Leuciscus cephalus orientalis natio *zangicus* Barach, **1934: 111** (infrasubspecific, name not available; river Zanga at Erivan [Yerevan], Armenia) from Berg, 1949: 557

Leuciscus cephalus orientalis natio *ardebilicus* Barach, **1934: 114** (infrasubspecific, name not available; river Balyk-chai near Ardebi [Ardabil], Iran) from Berg, 1949: 557

Leuciscus cabeda var. *pamvoticus* Stephanidis, 1939a: 30, pl. 6 (type locality: lake Pamvotis, central Greece; syntypes: lost ? [2])

Leuciscus cephalus orientalis natio *thracicus* Drensky, 1930: 672 (infrasubspecific, name not available; locality: river Maritza, Bulgaria)

Leuciscus cephalus macedonicus Karaman, 1955: 185 (type locality: river Strumica, FYROM; syntypes: LU; a primary junior homonym of *Leuciscus macedonicus* Steindachner, 1892)

Leuciscus cephalus moreoticus Stephanidis, 1971a: 197, fig. 8 (type locality: lake Stymphalia, Greece; syntypes: lost ? [11])

Leuciscus cephalus prespensis Fowler, 1977: 28 (available by indication to *Squalius cephalus cavedanus* var. *prespensis* Karaman, 1924b: 67; type locality: lake Prespa and tributaries, FYROM; syntypes: LU)

Leuciscus cephalus ruffoi Bianco & Recchia, 1983: 16 (type locality: river Savuto, Calabria, Italy; holotype: IZA 830a)

Systematic notes. Bianco & Recchia (1983) considers four valid subspecies in Italy: *L. c. cabeda*, *L. c. albus*, *L. c. brutius* and *L. c. ruffoi*; later, Bianco (1988a: 151) recognises a single taxon in Italy, *L. cephalus*. Additional work is needed to determine their status under the PSC, especially *L. c. albus* from lake Trasimeno which, according to Bianco & Recchia's data, seems to have a distinctive head shape.

Nomenclatural notes. Wheeler & Fernholm (1983: 212) and Wheeler (1991: 161) noted that Linnaeus's *Cyprinus cephalus* is based on literature accounts (Artedi, 1738; Gronovius, 1754, 1756) of the species now called *L. cephalus* and on specimens of the South American erythrinid *Hoplerythrinus unitaeniatus* (Agassiz, in Spix & Agassiz, 1829). This has apparently been noted by other authors, but as there is apparently no previous restriction of the use of the name, as first reviser I restrict *C. cephalus* to the species described by Artedi (1738).

The description of *Cyprinus kietaibeli* Reisinger, 1830 from lake Balaton is not very informative and the total size of the individuals on which it is based is not even indicated. His material is not present in NMW and Reisinger's specimens have not been reported from any other museum. Valenciennes (in Cuvier & Valenciennes, 1844: 380) considers that this taxon is probably a variety of *Leuciscus leuciscus*, but the species does not occur in lake Balaton (Bíró & Paulovits, 1994: 2165) while Reisinger described *C. kietaibeli* as abundant. Schinz (1840: 327) reports the size as 6–8 inches, but there is no evidence that he had seen specimens. The species has been sometime identified with *Leucaspius delineatus* (a name over which it would have priority). The size of Schinz's fish is apparently too large for being *L. delineatus*. Also, *Leucaspius delineatus* has a short, incomplete lateral line; Reisinger and Schinz mention only a curved lateral line. To remove ambiguity and threat on the name *L. delineatus*, a specimen of *L. cephalus* could be designated as neotype of *Cyprinus kietaibeli* Reisinger, 1830.

Böhlke (1984: 86) lists syntypes of "*Leuciscus* *pareti* Bonaparte, 1846". Bonaparte (1846: 31) provided neither description, diagnosis nor indication. This species is actually described by Bonaparte (1842), but the name was already made available in 1841.

Almaça (1969: 1129) lists a syntype MNHN 2623 from Roma for *Leuciscus cavedanus* Bonaparte, 1838. The type locality being explicitly stated as Piccolo Reno by Bonaparte, this specimen has no type status.

Bertin & Estève (1948: 63) list a holotype for *Squalus meridionalis* Blanchard. This specimen is a syntype; Blanchard (1866: 398) explicitly indicated that he had several specimens.

The name *L. cephalus albus* Bonaparte, 1838 is sometime used for a population from Greece (e.g., Economidis, 1991: 14). As this taxa has been originally described from lake Trasimeno, where a distinctive population occurs, it does not seem that the name can be used for a Greek fish. If one really wishes to use a subspecific name for this population, *L. c. pamvoticus* Stephanidis, 1939, is the earliest available name. The name *L. c. macedonicus* Karaman, 1955 cannot be used for a subspecies of *L cephalus* as the name is a primary homonym of *L. macedonicus* Steindachner, 1892, now *Pachychilon macedonicum*.

5.17.5 *Leuciscus idus* (Linnaeus, 1758)

Cyprinus Idus Linnaeus, 1758: 324 (based on Linnaeus [1746: 121, n. 320, Cyprinus ... radiis 13], Artedi [1738: gen. 5 [6], syn. 14, spec. 6 [5], Cyprinus iride sublutea ...] and Gronovius [1754: 3, n. 13, idem]; type locality: "in Europae aquis dulcibus"; type material: NT)

Cyprinus Jeses Linnaeus, 1758: 325 (based on Artedi [1738: syn. 7, Cyprinus cubitalis ...]; type locality: "in Germania"; type material: NT)

Cyprinus Orfus Linnaeus, 1758: 324 (based on Artedi [1738: syn. 6, Cyprinus orfus dictus], Ray [**1710: 118**, Rutilus latior ...] and Meyer [**1748-56: pl. 94**, Orf]; type locality: "in Rheno, Angliae fluviis, lacubus"; type material: NT)

Cyprinus idbarus Linnaeus, 1758: 324 (type locality: "in Sveciae lacubus"; type material: NT)

Cyprinus microlepidotus Ekström, 1835: 18, pl. 2 (type locality: "Scheeren von Mörkö"[Strait of Mörkö Island, near Stockholm], Sweden; syntypes: LU)

Leuciscus neglectus Selys-Longchamps, 1842: 208 (type locality: Bruxelles, Belgium; syntypes [total 4]: ? ISNB [not found], MHNN 1008 [1], Kottelat, 1984: 148)

Idus melanotus Heckel, 1843: 1008, pl. 1 (available by indication [ICZN art. 12(b)(7), 14(b)]; no locality data; syntypes: ? NMW [used as a replacement name for *Cyprinus idus* Linnaeus, 1758 by Heckel, 1852b: 49, 66])

Idus miniatus Bonaparte, 1845: 9 (type locality: eastern Europe; syntypes: NMW 53432 ?, probably based on information provided by Heckel, thus material subsequently listed by Heckel & Kner [1858: 151] could be syntypes)

Idus miniatus Heckel & Kner, 1858: 151 (type locality: Tirol, Austria; syntypes: NMW 53432 [1]; junior homonym of *Idus miniatus* Bonaparte, 1845: 9)

Leuciscus idus var. *lapponicus* Günther, 1868: 230 (type locality: river Munio, Sweden and Finland; syntypes: BMNH [6])

Squalius oxianus Kessler, 1877a: 124 (type locality: mouth of river Amu and Kunja-Urgentsch in delta of river Amu, Uzbekistan [Berg, 1949: 567]; syntypes: Univ. St Petersburg 463, Berg, 1912: 179)

Idus melanotus var. *orientalis* Sinitzyn, **1900: 45** (nomen nudum; lake Baikal, Siberia) from Berg, 1912: 166

Leuciscus idus var. *auratus* Bade, 1901: 128 (infrasubspecific, name not available)

Leuciscus idus idus natio *sibiricus* Kirillov, **1958** (infrasubspecific, name not available; locality: river Leny, Siberia) from Kirillov, 1962: 47

5.17.6 *Leuciscus illyricus* (Heckel & Kner, 1858)

Squalius illyricus Heckel & Kner, 1858: 195, fig. 108 (type locality: rivers Isonzo, Knin and Sign, Dalmatia; syntypes: NMW 49313 [7], 49315 [3], 49322 [1], 49324 [1], 49331 [1], 49339-341 [3, illustrated by Bianco & Knežević, 1987: 50, fig. 1])

Systematic notes. Bianco & Knežević (1987: 49) considered the validity of this species as doubtful.

5.17.7 *Leuciscus keadicus* Stephanidis, 1971

Leuciscus soufia keadicus Stephanidis, 1971a: 198, fig. 9 (type locality: river Eurotas near Sparta, and its small tributaries Kelefinas [Inous], Magoulitsas and Retzinas, Greece; syntypes: lost ? [21])

Systematic notes. Originally described as a subspecies of *L. souffia*, this taxon is considered as a valid species by Economidis (1991: 15), Economidis & Bănărescu (1991: 266) and Tsigenopoulos & Karakousis (1996), who, however, do not discuss its status. A direct comparison of both taxa shows that they are easily distinguished by body shape and colour pattern (details will be presented elsewhere).

5.17.8 *Leuciscus leuciscus* (Linnaeus, 1758)

Cyprinus Leuciscus Linnaeus, 1758: 323 (based on Artedi [1738: syn. 9, Cyprinus novem digitorum ...]; type locality: "in Europae media"; type material: NT)

Cyprinus Grislagine Linnaeus, 1758: 323 (based on Linnaeus [1746: 123, n. 325, Cyprinus ... radiis 11], Artedi [1738: gen. 5 [12], syn. 5, spec. 12 [5], Cyprinus oblongus ...] and Gronovius [1756: 2, n. 148, idem]; type locality: "in Europae lacubus"]; type material: NT)

Cyprinus Dobula Linnaeus, 1758: 323 (based on Artedi [1738: syn. 10, Cyprinus pedalis gracilis ...]; type locality: "in Europa media"; type material: NT)

Cyprinus squalus Walbaum, 1792: 28, 705 (type locality: river Rhine [Gronovius, 1763: 106, n. 334; see also Gronow, 1854: 185]; type material: NT)

Cyprinus graining Walbaum, 1792: 36 (type locality: river Mersey [near Warrington], U.K.; based on Pennant [**1769: vol. 3: 367** [1776: 331], Graining]; type material: NT); also Bloch, in Schneider, 1801: 450 (same data)

Cyprinus Umbra Walbaum, 1792: 30, 705 (based on Ausonius [**ca. 370: 90**, river Moselle], = *Thymallus thymallus* according to Valenciennes, in Cuvier & Valenciennes, 1848: 429] and Gronovius, 1763: 106, n. 337 [= *Cyprinus salax* Gronow, 1854: 186]; here restricted to Gronow's account; type locality: lakes of Europe; lectotype (present designation): BMNH 1853.11.12:157 [holotype of *C. salax*, Wheeler, 1958: 210])

Cyprinus Lancastriensis Shaw, 1804: vol. 5 (1): 234 (based on Pennant [edition not stated, e.g., 1776: 321, Grayning]; type locality: river Mersey near Warrington, U.K.; type material: NT)

Cyprinus simus Römer-Büchner, 1827: 68, pl. 2 (type locality: river Main near Frankfurt, Germany; syntypes: LU; junior primary homonym of *Cyprinus simus* Hermann, 1804)

Leuciscus vulgaris Fleming, 1828: 187 (type locality: "rivers in England"; available by description and by indication to earlier sources; type material: NT ?)

Leuciscus argenteus Fitzinger, 1832: 336 (unnecessary replacement name for *Cyprinus leuciscus* Linnaeus, 1758; author indicated as Agassiz, but Fitzinger is actual author)

Leuciscus rostratus Agassiz, 1835b: 38 (nomen nudum)

Leuciscus rodens Agassiz, 1835b: 39, pl. 1 figs. 1–2 (type locality: lake Neuchâtel, Switzerland; syntypes: MHNN 964 [2], Kottelat, 1984: 148, MNHN)

Leuciscus majalis Agassiz, 1835b: 38, pl. 1, figs. 3–7 (type locality: lake Neuchâtel, Switzerland; syntypes: MHNN 969 [4], 970 [1], 971 [1], Kottelat, 1984: 148, MNHN)

Cyprinus mugilis Vallot, 1837: 196 (type locality: river Saône, France; syntypes: LU)

Leuciscus rostratus Valenciennes, in Cuvier & Valenciennes, 1844: 201 (type locality not stated; syntypes: based on a drawing sent by Agassiz [based on specimen possibly in MHNN] and MNHN 256 [1] from river Meuse at Liège, Belgium [Bertin & Estève, 1948: 62])

Leuciscus saltator Bonaparte, 1845: 8 (type locality: western Europe; holotype: ANSP 6364, Böhlke, 1984: 90)

Squalius lepusculus Heckel, 1852b: 109, pl. 11 figs. 1–4 (type locality: small tributaries of river Danube near Wien, river Moldau [Vltava] near Budweis [České Budějovice], river Olsa [Olše] in Teschen [Těšín]/upper rivers Elbe [Czech Republic] and Oder [Odra] [Poland]; syntypes: NMW 49345 [2], 49347–348 [3], 49352 [2], 49393 [2])

Squalius chalybeius Heckel, 1852b: 111, pl. 12 figs. 1–4 (type locality: stream Kamp near Zwetl monastery, Austria; syntypes: NMW 49353–354 [2], 49382 [1], 49391 [1])

Cyprinus salax Gronow, 1854: 186 (type locality: lakes of Europe; holotype: BMNH 1853.11.12: 157, Wheeler, 1958: 210)

Squalius vulgaris var. *robustior* Walecki, 1863: 363 [line 5] (unnecessary replacement name for *Squalius chalybeius* Heckel, 1852b)

Squalius vulgaris var. *robustior* v. *nasutus* Walecki, 1863: 363 (infrasubspecific, name not available; unnecessary replacement name for *Squalius chalybeius* Heckel, 1852b)

Squalius vulgaris var. *minor* Walecki, 1863: 363 (infrasubspecific, name not available; unnecessary replacement name for *Squalius lepusculus* Heckel, 1852b)

Squalius vulgaris var. *argenteus* Walecki, 1863: 363 (infrasubspecific, name not available)

Squalius vulgaris var. *leptorhinus* Walecki, 1863: 342 (nomen nudum), 1864b: 50 (infrasubspecific, name not available)

Squalidus baicalensis Dybowsky, 1874: 388 (type locality: lake Baical [rare] and all its tributary streams, Siberia; syntypes: LU)

Squalius leuciscus var. *elongata* Fatio, 1882: 603 (infrasubspecific, name not available)

Squalius leuciscus var. *elata* Fatio, 1882: 603 (infrasubspecific, name not available)

Squalius leuciscus var. *lateristriga* Fatio, 1882: 603 (infrasubspecific, name not available)

Squalius suworzewi Warpachovski, **1889a: 17** (river Irtysh at Semipalatinsk, Siberia) from Berg, 1949: 546

Squalius mehdem Warpachovski, 1897: 255, pl. 12 fig. 1 (type locality: river Ob at Atlym, Siberia; holotype: ZISP 11295)

Leuciscus leuciscus baicalensis natio *kirgisorum* Berg, 1912: 112, pl. 1 fig. 3 (infrasubspecific, name not available; localities: rivers Chu and Nura, Kirghizistan)

Idus stagnalis Dubalen, 1913: 77 (type locality: Vendays, Cazaux, Sanguinet, Parentis, Léon, Pissos, France; syntypes: LU)

Leuciscus leuciscus natio *roulei* Vladykov, 1931: 311, fig. 18 (infrasubspecific, name not available; localities: lower course of rivers Tisza, Rieka, Borjava [Borzhava], Latorica, Ouge [Uh], and Laboretz [Laborec], Slovakia and Ukraine; specimen MNHN 30-206, designated as lectotype by Almaça, 1969: 1122 has no type status)

Leuciscus leuciscus baicalensis natio *teletzkensis* Ioganzen, 1945: 10 (infrasubspecific, name not available; locality: lake Teletzk, Siberia) from Berg, 1949: 546

Leuciscus leuciscus roulei Bertin & Estève, 1948: 63 (available by indication to *Leuciscus leuciscus* natio *roulei* Vladykov, 1931: 311; type locality: [river] Uh, Slovakia and Ukraine; lectotype: MNHN 30-206, present designation)

Nomenclatural notes. *Cyprinus leuciscus*, *C. grislagine* and *C. dobula* are simultaneous subjective synonyms. I could not find which first reviser formally established priority between these names; *C. leuciscus* seems to have been universally accepted as having priority. Linnaeus's description of *C. grislagine* is based on several earlier accounts which probably refer to different species (see Heckel, 1853: 32); grislagine is the vernacular name which Willughby (1686: 263, pl. Q.1) reports for *L. souffia* in Augsburg, Germany.

Bertin & Estève (1948: 62) list a paratype of "*Leuciscus argenteus* Selys-Longchamps, 1842". This name is actually an unnecessary replacement name for *Cyprinus leuciscus* introduced by Agassiz (1835b) and the specimen listed by Bertin & Estève has no type status.

5.17.9 *Leuciscus lucumonis* Bianco, 1983

Leuciscus lucumonis Bianco, 1983: 82, fig. 1 (type locality: Fosso delle Lene, stream between Campagnatico and Istia d'Ombrone, river Ombrone basin, Grosseto, Toscana, Italy; holotype: IZA 8238)

5.17.10 *Leuciscus microlepis* (Heckel, 1843)

Squalius microlepis Heckel, 1843: 1042 (type locality: Imosky, Croatia; syntypes: NMW 49414–416 [5], 49421 [1], MHNN 973 [1], Kottelat, 1984: 147)

Squalius tenellus Heckel, 1843: 1042 (type locality: waters around Livno, Bosnia; syntypes: NMW 16001–002 [3], 49613 [2])

5.17.11 *Leuciscus montenigrinus* Vukovic, 1963

Leuciscus souffia montenigrinus Vukovic, 1963: 206 (type locality: river Moraca near Titograd, Montenegro; syntypes: LU); repeated in Vukovic, 1965: 217

Systematic notes. Considered as a subspecies of *Leuciscus souffia* by Bănărescu (1992: 680). Data in Vukovic (1963) suggest that under the PSC *L. s. montenigrinus* is specifically distinct from the adjacent *L. souffia* populations. Lateral line scale counts (44–50 in *L. montenigrinus*, vs. 50–57 in *L. souffia*) and vertebrae counts (37–38, vs. 42–43) seem conspicuously diagnostic. Vukovic's morphometric data are uninformative.

Nomenclatural notes. Vukovic (1963) described the species as *L. s. montenigrinus* and in 1965 he published the diagnosis again as *L. s. montenegrinus*; the second spelling is an incorrect subsequent spelling and is not valid (ICZN art. 33(c)).

5.17.12 *Leuciscus muticellus* Bonaparte, 1837

Leuciscus Muticellus Bonaparte, 1837: [fasc. 20, p. 231], pl. 112 fig. 3 (type locality: streams of Viterbo, Terni and Roma provinces, Italy; syntypes: MNHN 3891 [5], Almaça, 1969: 1117; ANSP 6374–6411 [38], Böhlke, 1984: 84)

Leuciscus comes Costa, 1838: fasc. 19: 26, pl. 18bis (type locality: Kingdom of Napoli [now in Italy]; syntypes: LU)

Telestes Savigny Bonaparte, 1840: [fasc. 28, p. 247], pl. 115 fig. 1 (type locality: lake Lugano and various small lakes of Piemonte, Italy; syntypes: ANSP 6417–6423 [7], Böhlke, 1984: 90)

Systematic notes. See *Leuciscus souffia* for discussion.

5.17.13 *Leuciscus pleurobipunctatus* (Stephanidis, 1939)

Rutilus pleurobipunctatus Stephanidis, 1939a: 19, pl. 2 (type locality: streams Thiamos, Lourou, Acheron and Evinos, lake Trichonis / creek

Messoghi, area of Kalamictisa (1 hour from Aghios Matheus village), Corfou [Kerkira island], Greece; syntypes: lost ? [96])

Rutilus pleurobipunctatus alfiensis Stephanidis, 1971a: 183 (type locality: river Alfios basin [Alfios, Enipeus, Erymanthos, Ladon, Tragos], river Pinios and its tributary Langadi near Aghios Dimitrios, rivers Vergas and Peristeras [Kyparissia], Greece; syntypes: lost ? [22])

Systematic notes. Placed in *Phoxinellus* by Karaman (1972: 128) and Economidis (1991: 12) and in *Pseudophoxinus* by Bianco (1986: 293). Bogutskaya (1992: 283) excluded it from *Pseudophoxinus*. Placement in *Leuciscus* follows Bianco (1988b: 9) but needs to be confirmed by a proper phylogenetic revision and diagnosis of this genus.

5.17.14 *Leuciscus polylepis* (Steindachner, 1866)

Telestes polylepis Steindachner, 1866e: 300, pl. 1 (type locality: streams Mresniza [Mresnica] and Dobra and creek in Josefthal [Josipdol, about 10 km SSE of Ogudin], Croatia; syntypes [total 6, but presently not possible to find out which ones among following series]: NMW 18931–941 [11], 49709–715 [41], MSNM 4660 [1], Conci & Michelangeli, 1974: 225)

5.17.15 *Leuciscus pyrenaicus* Günther, 1868

Leuciscus pyrenaicus Günther, 1868: 223 (type locality: river Mondego and Cintra [Sintra], Portugal, restricted to Sintra by Costa Pereira, 1995: 495; syntypes: BMNH [8])

Nomenclatural notes. Günther (1868: 223) based his description of *L. pyrenaicus* on material from two localities, Sintra and river Mondego. Costa Pereira (1995: 495) noted that these represent two species and restricted the type locality to Sintra; the material from river Mondego belongs to *L. carolitertii*. The syntype series cannot be restricted and all of Günther's specimens are still syntypes. A lectotype designation would be in order to definitively link the name *L. pyrenaicus* to the present concept of the species.

An electrophoretic study of Portuguese *L. pyrenaicus* and *L. caroliterii* shows that populations from southern Portugal are only distantly related to these two species (Coelho et al., 1995). Other data (e.g., morphology) relevant to elucidate their status are not available.

5.17.16 *Leuciscus souffia* Risso, 1826

Leuciscus Souffia Risso, 1826: 438 (type locality: river Var, France: type material: NT)

Chondrostoma rysela Agassiz, 1835b: 38 (available by indication to Gesner [1560: 290, Risele, Ryserle, Ryssling]; type locality: "in silo torrento ad urbem nostram" = stream Sihl in our city [Zürich], Switzerland; neotype: MNHN 712, present designation)

Leuciscus agassii Valenciennes, in Cuvier & Valenciennes, 1844: 254, pl. 495 (type locality: Danube [basin] in München, Germany; lectotype: MNHN 712, designated by Almaça, 1969: 1123)

Telestes Rysela Heckel, 1852a: 387 (type locality: stream Sihl in Zürich, Switzerland; neotype: MNHN 712, present designation; a secondary junior homonym of *Chondrostoma rysela* Agassiz, 1835)

Systematic notes. Spillmann (1959, 1961b, 1962, 1966, 1967; d'Aubenton et al., 1971) recognised three subspecies in *L. souffia*: *L. s. souffia* from the Var basin, France, *L. s. agassii* from the Rhône, Rhine and Danube basins, and *L. s. muticellus* from Italy. Bănărescu (1992: 680) recognised five subspecies (without providing the supporting data): *L. s. souffia* from the Var and Rhône basins, *L. s. agassii* from the Rhine and Danube basins, *L. s. muticellus* from Italy, an unnamed subspecies from the upper Tisza basin in Romania and Ukraine, and *L. s. montenigrinus* from Montenegro. *Leuciscus montenigrinus* is considered as a valid species here. Spillmann's data show that his material of *L. s. agassii* is easily diagnosed from his *L. s. muticellus* by lateral line scale count. Geographically, the two stocks come very close in southern France. Spillmann's *L. s. souffia* occurs in a single basin (river Var) between the two other subspecies, but is in quite close agreement with his *L. s. agassii*. Instead of 3 subspecies, I see in this case 2 diagnosable species with extensive, discrete distributions and history (Italian and Rhône-Rhine-Danube stocks) and a narrowly delimited population probably representing past introgression between them (see Hewitt, 1989 for review of hybrid zones and Warren, 1992: 25–28 for a summarised discussion) or of independent origin (Var stock).

Nomenclatural notes. There is a slight nomenclatural problem resulting from the fact that the oldest name available for the *L. souffia* complex is based on material from the possible introgression zone. As the work of Spillmann has shown that it has greater similarity with the Rhône-Rhine-Danube species than with the Italian one, I consider the Var material as conspecific with the Rhône-Rhine-Danube species and the name *L. souffia* is to be used for this species. The earliest available name for the Italian species is *L. muticellus*. Names applied to hybrids cannot be used

(ICZN art. 23(h)) but this does not apply here as the name *L. souffia* is not based on a hybrid individual but on a population possibly of hybrid origin.

If future research were to demonstrate that the population from river Var is specifically (or subspecifically under the BSC) distinct from the Rhône-Rhine-Danube species, note that the earliest available name for the latter is *L. rysela* (Agassiz, 1835), not *L. agassii* Valenciennes, 1844.

The correct spelling of the name is *Leuciscus souffia* and not *L. soufia*; Risso (1826: 438) unambiguously used *L. souffia* as the scientific name and soufia as the local name. The correct spelling of the subspecies sometimes recognised from the Danube basin is *L. s. agassii* and not *L. s. agassizii* (e.g., Spillmann, 1961b, 1962, 1966, 1967), because the specific name is based on a latinised form of Agassiz's name (probably Agassius) and probably also because of euphonic usage at the time [the final 'z' of Agassiz is not pronounced in French – his native language].

The status and history of the use of *Chondrostoma rysela* is somewhat complicated. As originally proposed by Agassiz (1835b) the name is not accompanied by a description but is merely available by indication to the rysele of Gesner [edition not stated; see, e.g., 1560: 290]. Gesner's species has been identified as *L. souffia* by Heckel (1849: 288; 1852a: 377). Difficulties arise because Agassiz sent (unpublished) drawings of a fish labelled *C. rysela* to various correspondents (including at least Valenciennes, Heckel, Bonaparte and Selys-Longchamps) and the fish in the drawings likely was not the same as Gesner's species. This does not enter into consideration for the identification of Agassiz's (1835b) species as the name is available by indication, but these drawings have been used by several of his correspondents as a reference for the identification of various *Chondrostoma*. As the name *rysela* is technically available only for Gesner's rysele, these identifications have to be treated as misidentifications and the name is not available for a *Chondrostoma* species. This clearly applies to the use of *C. rysela* by Bonaparte (1840: [p. 251] pl. 115 fig. 3).

Valenciennes (1844) used both *Chondrostoma rysela* (p. 395) and *Leuciscus ryzela* (p. 199). His *C. rysela* is based on Agassiz's drawing and paper and is merely a subsequent use of that name. Valenciennes's *L. ryzela* is a description of a new species based on original specimens which Valenciennes considered to be the same as Bonaparte's (1840) *C. rysela*. The name *L. ryzela* is available and is treated here as a synonym of *Rutilus pigus*. Bonaparte's *C. rysela* has been identified as *C. soetta* by Heckel (1852a: 388) and as an hybrid *C. nasus* x *L. souffia* by Günther (1868: 235).

Heckel (1852a: 378, 388) noted the problem of the identification of Gesner's rysele and considered two valid species with the specific name *rysela*, a *Telestes* and a *Chondrostoma*. He considered his *Chondrostoma* to be the same as Agassiz's (based on the drawing) and his *Telestes* was a name for the Rysele of Gesner. This was logical in Heckel's context and probably correct under the then prevailing nomenclatural practices, but cannot be followed under our present nomenclatural rules. Formally, under the present ICZN, Heckel's *C. rysela* has to be considered a misidentification of *C. rysela* of Agassiz and has no nomenclatural status. [Although technically not the case, if one would alternatively argue that *C. rysela* of Heckel be considered as the description of a new species, it would have no validity because it would be a primary homonym of Agassiz's species].

Heckel's *Telestes rysela* is a name available because it is accompanied by a brief diagnosis and reference to Gesner's rysele (1560: 290) and Heckel (1849: 288 [given as p. 186 by Heckel, 1852a; probably based on an offprint]). Heckel (1852a: 388) seems to imply that he had used the name *T. rysela* in his 1849 paper. The combination is not used in the text, only in the index; but as the index refers merely to page 288 without further detail, the name cannot be available from that work. As Agassiz's *C. rysela* is conspecific with *T. rysela*, the latter name is a junior secondary homonym. There is no type material for Agassiz's species and Heckel's material is lost (B. Herzig, pers. comm., 1995) and a neotype designation is the only method of definitively solving the identity of these nominal species. I have not been able to examine fresh material from river Sihl and specimen MNHN 712 (lectotype of *Leuciscus agassii* Valenciennes, 1844) is here designated as neotype of *Chondrostoma rysela* Agassiz, 1835 and *Telestes rysela* Heckel, 1852. *Telestes* is now placed in the genus *Leuciscus*, but *L. rysela* (Agassiz) and *L. ryzela* Valenciennes are not homonyms as they differ by one letter (ICZN art. 57(f)).

5.17.17 *Leuciscus svallize* (Heckel & Kner, 1858)

Squalius svallize Heckel & Kner, 1858: 197, fig. 110 (type locality: lakes near Vergoraz and river Narenta [Neretva], Dalmatia [Croatia]; syntypes: NMW 49593 [1], 49595–597 [3], 49612 [1, illustrated by Bianco & Knežević, 1987: 51, fig. 2])

Systematic notes. Bianco & Knežević (1987: 51) recognise this species as valid and restricted to the Neretva and Trebinje basins, Bosnia. They comment that all the Greek specimens of the *L. cephalus* complex examined by them belong to *L. cephalus*. Economidis (e.g., 1991: 14; Economou et al., 1991) reported a second species from Greece as *L.* cf. *svallize* which agrees with the diagnostic characters listed by Bianco & Knežević but has a more slender appearance (pers. obs.). The broadly disjunct distribution ranges suggest that it might be distinct and on-going work should soon clarify its taxonomic status.

5.17.18 *Leuciscus turskyi* (Heckel, 1843)

Squalius Turskyi Heckel, 1843: 1041 (type locality: creek ["Felsenbach"] Cicola [Cikola] near Dernis [Drniš], Dalmatia [Croatia]; syntypes: NMW 49629 [18])

5.17.19 *Leuciscus ukliva* (Heckel, 1843)

Squalius Ukliva Heckel, 1843: 1042 (type locality: river Cettina [(Cetina), near Sign (Sinj); Heckel & Kner, 1858: 201], Dalmatia [Croatia]; syntypes: NMW 49635 [4], 496339 [3])

5.17.20 *Leuciscus zrmanjae* (Karaman, 1928)

Squalius svallizze zrmanjae Karaman, 1928: 159 (type locality: lower course of river Zrmanja, Dalmatia [Croatia]; syntypes: LU); repeated in 1929: 172

Systematic notes. The *Leuciscus* sp. of Bianco & Knežević (1987: 53, fig. 3d) is tentatively identified as *L. zrmanjae*, as implicitly suggested by these authors. Once material from the Zrmanja becomes available, a neotype designation is desirable to stabilise this use of the name.

Mylopharyngodon piceus (Richardson, 1846) introduced

5.18.1 *Pachychilon macedonicum* (Steindachner, 1892)

Leuciscus macedonicus Steindachner, 1892: 377, pl. 2 fig. 2 (type locality: lake Dojran, FYROM and Greece; syntypes: NMW 7025–7028 [4], 49811–813 [8])

Systematic notes. Howes (1981: 46) considers *Pachychilon* as a synonym of *Rutilus* and Karaman (1972) considers it as a subgenus of *Rutilus*. The osteological study by Šorić (1992) shows that *Pachychilon* is a distinct genus, including two species. Generic placement of *P. macedonicum* follows Karaman (1972: 145), Bianco (1986: 297) and Šorić (1992).

5.18.2 *Pachychilon pictum* (Heckel & Kner, 1858)

Squalius pictus Heckel & Kner, 1858: 196 (type locality: Rieka creek, Montenegro; syntypes: NMW 49310 [2]])

5.19.1 *Pelecus cultratus* (Linnaeus, 1758)

Cyprinus cultratus Linnaeus, 1758: 326 (based on Linnaeus [**1754: 82, pl. 2**]; type locality: "in M. Baltico"; type material: holotype: UUZM 224, Wheeler, 1991: 162)

Clupea ziga Wulff, 1765: 40 (type locality: "in lacu Curonico", Borussia [Prussia]; type material: NT?)

Nomenclatural notes. Bertin & Estève (1948: 85) list two syntypes (MNHN 3913) of "*Leuciscus cultratus* Cuv. Val.". Valenciennes (1844: 330) under the heading "*Leuciscus cultratus* nob" did not describe a new species, but merely established a new combination of *Cyprinus cultratus* Linnaeus, 1758, a name which is explicitly mentioned (p. 337). Several other citations of this name and its combinations are quoted in this account, and the material listed by Bertin & Estève obviously has no type status.

Cyprinus clupeoides Bloch (1795:49, pl. 408 fig. 2), sometimes listed as a synonym of *Pelecus cultratus* (e. g. Heckel & Kner, 1858: 127), is an Indian fish of the genus *Salmostoma* (see Bănărescu, 1968: 5). In any case, this name is a junior primary homonym of *Cyprinus clupeoides* Pallas, 1776 (see above *Chalcalburnus chalcoides*) and should be replaced by *Salmostoma balookee* (Sykes, 1839) (Kottelat, 1996).

Parabramis pekinensis (Basilewsky, 1855) introduced

Pimephales promelas Rafinesque, 1820 introduced

5.20.1 *Phoxinellus adspersus* (Heckel, 1843)

Leucos adspersus Heckel, 1843: 1038 (type locality: Imosky [Imotski], Croatia; syntypes: NMW [not yet located; B. Herzig, pers. comm., 1995])

Systematic notes. All species placed here in *Paraphoxinus* were considered as subspecies of *P. adspersus* by Karaman (1972). They are all distinct species under the PSC.

Nomenclatural notes. The type locality was originally stated as Imostki. Heckel & Kner (1858: 168) later state that they first collected it in Jessero Rosso, a lake near Imotski.

5.20.2 *Phoxinellus alepidotus* Heckel, 1843

Phoxinellus alepidotus Heckel, 1843: 1040 (type locality: waters around Livno, Bosnia; syntypes: NMW 51061 [3], 51106 [2], MHNN 1018 [1], Kottelat, 1984: 149)

Systematic notes. Howes (1985: 69) commented that the Croatian *Phoxinellus* actually belongs to one or more distinct genera, retaining *P. adspersus* in *Phoxinellus*. But he is quite ambiguous, stating that *Phoxinellus* includes "those species distributed throughout the Levant (*adspersus, zeregi*) ...". No mention is made of the type species *P. alepidotus*. Until the genus is critically revised, it seems reasonable to retain the Croatian species in *Phoxinellus*.

Nomenclatural notes. Trewavas (1971: 359) showed that *P. alepidotus* is the type species of the genus *Phoxinellus* Heckel, 1843 and that *Paraphoxinus* Bleeker, 1863b: 263 (repeated in 1863c: 209 and 1863d: 31) is an objective junior synonym. Therefore *Phoxinellus* has to be used for the present and the following species instead of *Paraphoxinus*. Eschmeyer (1990: 313) apparently overlooked Trewavas's argument.

5.20.3 *Phoxinellus croaticus* Steindachner, 1866

Phoxinellus croaticus Steindachner, 1866a: 594, pl. 1 (type locality: streams Licca and Novchicza [Novcica] near Gospich [Gospič], stream Ottucha [Otešica] near Grachaez [Gračac], stream Richicza [Ričina] near Stikada, Croatia; syntypes: NMW 51063–064 [14], 51115–116 [3], 51167 [45], MSNG 9076 [3])

5.20.4 *Phoxinellus epiroticus* (Steindachner, 1896)

Paraphoxinus epiroticus Steindachner, 1896: 185, pl. 1 fig. 3 (type locality: lake of Janina and river Luros, Albania [now Greece]; syntypes: NMW 12982–990 [9], 51119–132 [more than 100], 51133–143 [more than 69], 51146–155 [more than 80], MSNG 9054 [2], Tortonese, 1961: 187)

Nomenclatural notes. Steindachner (1896: 185) indicated that part of his material was from river Luros. Economidis (1991: 12) considered that the presence of the species in Luros is doubtful.

5.20.5 *Phoxinellus fontinalis* Karaman, 1972

Phoxinellus adspersus fontinalis Karaman, 1972: 134, fig. 5 (type locality: source in Hrnjakova Pecina cave, Krbavsko polje in Lika, Croatia; syntypes: LU [6])

5.20.6 *Phoxinellus ghetaldii* (Steindachner, 1882)

Paraphoxinus ghetaldii Steindachner, 1882b: 16, pl. 5 fig. 2 (type locality: cave in the plain of Popovo, Herzegovina [Bosnia]; syntypes: NMW 51158–159 [4], 51161–162 [4], 51164–165 [3])

5.20.7 *Phoxinellus metohiensis* (Steindachner, 1901)

Paraphoxinus metohiensis Steindachner, 1901: 197 (type locality: karstic waters and springs near Gacko, rivers Gračanica and Musica, stream Zalomska in the Nevesinje plain in Herzegovina, and river Ljuta near Grinda east of Ragusa Vecchia [Cavtat], Bosnia; syntypes: NMW 12972–975 [4], 51171–176 [14], BMNH 1911.9.22:12–13 [2], Howes, 1985: 57)

5.20.8 *Phoxinellus prespensis* (Karaman, 1924)

Paraphoxinus epiroticus f[orma] *prespensis* Karaman, 1924a: 32, fig. 6b [not 6a, see Karaman, 1924b: 63] (type locality: lake Prespa and backwaters, FYROM and Greece; syntypes: LU)

5.20.9 *Phoxinellus pstrossii* (Steindachner, 1882)

Paraphoxinus Pstrossii Steindachner, 1882a: 73, pl. 5 fig. 3 (type locality: stream Trebinschitza [Trebišnjica] near Trebinje, Bosnia; syntypes: NMW 51177 [2])

Nomenclatural notes. Specimens BMNH 1911.9.28:4–5 [2] listed as syntypes by Howes (1985: 57) cannot be syntypes. Steindachner explicitly indicated that his description is based on two specimens (p. 74: "... beiden Exemplaren ...") and these are in NMW.

5.21.1 *Phoxinus phoxinus* (Linnaeus, 1758)

Cyprinus Phoxinus Linnaeus, 1758: 322 (based on Artedi [1738: syn. 12, Cyprinus tridactylus ...]; type locality: "in Europa"; type material: NT)

Cyprinus aphya Linnaeus, 1758: 323 (based on Linnaeus [1746: 125, n. 331, Cyprinus ... radiis 9; **1747: 232**, Cyprinus minimus], Artedi [1738: gen. 4 [30], syn. 13, spec. 30 [4], Cyprinus biuncinalis ...]; type locality: "in Europae rivulis"; type material: NT)

Cyprinus rivularis Pallas, 1773: 717 (type locality: small streams in the Altaï range [p. 616: Zmeinogorsk, basin of river Alei], Siberia; syntypes: ZISP ?)

Cyprinus Morella Leske, 1774: 47 (type locality: creek Bode near Rübeland, 103 km NW of

Leipzig, Germany [by neotype designation; original locality: Leipzig, Germany]; neotype ZMB 32661, present designation)

Cyprinus isetensis Georgi, 1775: 621 (available by indication to Lepechin [1771a: 491, pl. 26 figs. 2–3]; type locality: Catharinopolis, Siberia; syntypes: LU)

Cyprinus Galian Gmelin, 1788: 1421 (type locality: Catharinopolis, Siberia; based on Lepechin [1771a: 491, pl. 26 figs. 2–3; **1772: pl. 9 figs. 4–5**]; syntypes: LU)

Cyprinus chrysoprasius Pallas, 1814: 318 (type locality: hill streams on Mount Chersones, Crimea, Ukraine; syntypes: LU)

Phoxinus varius Perty, 1832: 719 (unnecessary replacement name for *Cyprinus phoxinus* Linnaeus, 1758)

Phoxinus laevis Fitzinger, 1832: 337 (unnecessary replacement name for *Cyprinus phoxinus* Linnaeus, 1758; author indicated as Agassiz, but Fitzinger is actual author)

? *Leuciscus obtusus* De la Pylaie, 1835: 533 (nomen nudum; locality: Vendée, France)

Phoxinus marsilii Heckel, 1836: 232 (type locality: all clear streams around Wien, Austria; syntypes: NMW [not yet located; B. Herzig, pers. comm., 1995])

Cyprinus Lumaireul Nordmann, 1840: 482 (proposed in synonymy, name not available; locality: river Po, Italy; author indicated as Bonelli, but this is apparently based on unpublished sources)

Phoxinus Lumaireul Schinz, 1840: 331 (type locality: river Po, Italy; type material: NT ?)

Phoxynus montanus Ogérien, 1863: 362 (type locality: river Ain near Champagnole / waterfall Queue de Cheval, near Saint-Claude, France; type material: NT ?)

Phoxinus laevis var. *balchaschana* Kessler, 1879: 283 (type locality: river Ajagus [Ayaguz] near Sergiopol [Ayaguz], lake Balkhash basin, Kazakhstan; syntypes [total "almost 100"]: ZISP 4149, 4150 [6], Berg, 1912: 252)

Phoxinus laevis ujmonensis Kashchenko, **1899: 144** (river Katun' near Uimon village, Altai, river Ob basin, Siberia) from Berg, 1949: 591

Phoxinus laevis mikrosquamatus Kashchenko, **1899: 145** (lake Karalachinskoie in basin of river Argut [basin of river Katun], Altai, Siberia) from Berg, 1912: 251

Phoxinus saposchnikowi Kashchenko, **1899: 146** (lake on plateau of Ukök, source of river Kalguty, a tributary of river Argut, Altai, Siberia) from Berg, 1912: 251

Phoxinus czekanowskii sedelnikowi Berg, 1908a: 226 (type locality: lake Saissan [Zaisan], upper Irtysch basin, Karasuat-Busen, Kazakhstan; syntypes: ZISP 14361 [9])

Phoxinus phoxinus colchicus Berg, 1910: 0169 (available by indication to Kamensky, 1901: 63, 165; type locality: river Bachwis-tzchali in district Osurgety, Transcaucasia; syntypes: ZMT 141a, Berg, 1912: 263)

Phoxinus Csikii Hankó, 1922: 1, pl. 1 fig. 1 (type locality: near Korita [Donje Korito], 50 km north-west of Ipek, 40 km westsouthwest of Novipazar, Montenegro; syntypes: MNH [2])

Phoxinus phoxinus strandjae Drensky, 1926: 137 (type locality: Strandscha [Istrandzhha] range, Bulgaria; syntypes: NMNHS)

Phoxinus phoxinus carpathicus Popescu-Gorj & Dumitriu, 1950: 94, fig. 6 (type locality: lake Rosu, Romania; syntypes: LU)

Systematic notes. From a morphometric analysis Řepa & Pivnička (1980) concluded that there is a single species in the genus *Phoxinus*. As this conclusion was based on the BSC, on coefficients of differences and in part on literature data, it seems desirable to reevaluate the status of the different nominal species on the basis of fresh material, direct comparison, additional characters and a more appropriate approach.

Nomenclatural notes. *Cyprinus phoxinus* and *C. aphya* are simultaneous subjective synonyms. I did not trace the first reviser action determining respective priority. *Cyprinus phoxinus* seems to have been universally accepted as having priority.

Cyprinus morella Leske, 1774 could be the earliest available name for the fish usually called *Alburnoides bipunctatus* (Bloch, 1782). Bloch (1782: 52) himself noted that *C. morella* is possibly the same as his *C. bipunctatus*, but that the references in Leske's synonymy refers to *Phoxinus phoxinus* [and also *Rhodeus amarus*]. Leske's material has been reported by Karsten (**1789**) and had been purchased by the Dublin Society and brought to Ireland (O'Reilly, **1813**). The Dublin Society's collection became part of the National Museum of Ireland but no fish specimen is extant; some Leske's fish specimens may be part of Linnaeus collection in the Linnean Society of London (Wheeler, 1985: 5), but it will probably never be possible to demonstrate it. No specimen identifiable as *Cyprinus morella* is present in the LSL. Specimen ZMB 32661, 65 mm SL, from creek Bode near Rübeland, 103 km NW of Leipzig, Germany, is designated as the neotype of *C. morella* Leske, 1774; it is unambiguously identifiable as *P. phoxinus* and the two names are thus objective synonyms.

Berg (1912: 263) lists *Phoxinus phoxinus colchicus* Berg, 1910 as a nomen nudum. But the name is available in Berg (1910) by indication to Kamensky (1901).

5.22.1 *Pseudophoxinus beoticus* (Stephanidis, 1939)

Rutilus beoticus Stephanidis, 1939b: 57, pl. 2 (type locality: lake Yliki, Greece; syntypes: lost [16])

Systematic notes. Placed in *Pseudophoxinus* by Economidis (1991: 11) and Economidis & Bănărescu (1991: 266, 269), in *Pachychilon* by Karaman (1972: 145), and as a subspecies of *Phoxinellus pleurobipunctatus* [here a *Leuciscus*] by Stephanidis (1974b: 241).

5.22.2 *Pseudophoxinus minutus* (Karaman, 1924)

Paraphoxinus minutus Karaman, 1924a: 33, fig. 6a [not 6b, see Karaman, 1924b: 61] (type locality: lake Ohrid and backwaters, FYROM; syntypes: LU)

? *Phoxinellus stimphalicus montenigrinus* Karaman, 1972: 131 (type locality: creek Boka Kotorska near Radanovci, at cross road Kotor-Tivat, Montenegro; syntypes: LU [50])

Systematic notes. Maitland (1976) considers *Paraphoxinellus minutus* as a valid species of his *Phoxinellus* (which is not identical to *Phoxinellus* here). Bănărescu (1992b: 753) considers it a valid species of *Pseudophoxinus*.

5.22.3 *Pseudophoxinus stymphalicus* (Valenciennes, 1844)

Leuciscus stymphalicus Valenciennes, in Cuvier & Valenciennes, 1844: 295 pl. 498 (type locality: lake Zaraco, earlier known as lake Stymphale, Greece; syntypes: MNHN 5821, Fang, 1942b: 168)

Leucaspius marathonicus Vinciguerra, 1921: 328, pl. 4 fig. 4 (type locality: small creek near spring Sterna, near Kato-Souli village, Maratona plain, Greece; lectotype: MSNG 17154-A, designated by Tortonese, 1961: 187)

Leucaspius stymphalicus var. *thesproticus* Stephanidis, 1939a: 24, pl. 8 fig. 1 (type locality: marsh of Paramythias, villages Scoupitsa and Grica, district Thesprotia, Greece; syntypes: lost ? [32])

Systematic notes. Placed in *Pararhodeus* by Fang (1942b: 168). Placed in *Phoxinellus* by Karaman (1972: 128–131) who considered *marathonicus, minutus, thesproticus* and *montenigrinus* as subspecies; he gave no argument to justify this status and his descriptions are too vague to provide information useful in deciding on their status. *Leucaspius marathonicus* and *L. s. thesproticus* are tentatively considered as conspecific with *P. stymphalicus*; this deserves further research. The geographically isolated and diagnosable *P. minutus* is treated as a valid species. Placed in *Pseudophoxinus* by Bianco & Miller (1989: 385) and Bănărescu (1992b: 757).

Pseudorasbora parva (Temminck & Schlegel, 1842) introduced

5.23.1 *Rhodeus amarus* (Bloch, 1782)

Cyprinus Amarus Bloch, 1782: 52, pl. 8 fig. 3 (type locality: lake Müggelsee near Köpenik, Berlin, Germany; syntypes: ZMB 3393 [3])

Rhodeus Lucinae Walecki, 1863: 364 (apparently an unnecessary replacement name for *Cyprinus amarus* Bloch, 1782)

Rhodeus genitalis Walecki, 1863: 364 (apparently an unnecessary replacement name for *Cyprinus amarus* Bloch, 1782)

Rhodeus amarus var. *meridionalis* Karaman, 1924b: 41 (type locality: river Vardar near Skopje and lake Dojran, FYROM and Greece; syntypes: MNHN 35 – 358–360 [3], Bertin & Estève, 1948: 75)

Rhodeus sericeus sericeus forma *strumicae* Karaman, 1955: 183, fig. 2 (infrasubspecific, name not available)

Rhodeus sericeus amarus natio *danubicus* Holčík, 1959: 50 (infrasubspecific, name not available; locality: river Danube basin, Slovakia)

Rhodeus sericeus amarus natio *svetovidovi* Holčík, 1959: 50 (infrasubspecific, name not available; locality: rivers Dnieper and Bug, Ukraine)

Systematic notes. *Rhodeus amarus* has long been considered a subspecies of the East Asian *R. sericeus* (Pallas, 1776 [p. 704; type locality: Dauria (river Amur basin)]) (e.g., Holčík & Duyvené de Wit, 1964; Arai & Akai, 1988: 211). The two species are broadly disjunct, *R. amarus* occurring (roughly) in central and eastern Europe and northern Asia Minor, and *R. sericeus* in the Amur basin and Sakhalin Island. Holčík & Jedlička (1994: 147) discussed the variability of three characters and concluded that the two stocks are conspecific and that there is a West-East clinal variation. Indeed, the stocks reportedly are diagnosable only by modal values of lateral-line pored scales (4–6 in *R. amarus*, vs. 6–7 in *R. sericeus*, ranges 0–9 and 4–10 respectively) and gill-rakers (10–12, vs. 12–14; ranges 9–13, vs. 9–16) and apparently have similar ecology and ontogeny, except that eggs are incubated in different hosts (the East Asian hosts do not occur in Europe and vice versa).

The reported West-East clinal variation may appear only if *R. amarus* and *R. sericeus* are analysed together and if average values are used; if taken separately, the number of *R. sericeus* populations is too limited to show a cline. For the character with greatest interest (pored lateral line scales), the clinal variation is not obvious (p. 158, fig. 4) and the data in table 3 (p. 152) shows that: 1) while the average number of pored scales should increase from West to East, the lowest counts have been observed in the Elbe and Danube basins; 2) the Western Europe values are completely included within those of the Elbe, Danube, Black Sea and Middle East; and 3) the Eastern Europe and Asia Minor values are completely included within those of Western Europe. The number of examined populations is probably too low to demonstrate the existence of clinal variation.

[In a more general contex, while clinal variation can possibly be observed in terrestrial or marine organisms, the dispersal constraints in the freshwater habitats (linear, vs. bi-dimensional dispersal; see p. 16) certainly make clinal variation a concept not applicable to freshwater fishes without adjustment. Analyses extending across several basins should place emphasis on the hydrographic network and its historical evolution. Geographic variation should be analysed within a basin framework instead of within a coordinate grid. Of course, clines may exist within a given basin.]

The European and East Asian stocks are unarguably distinct lineages separated for an estimated 2 to 4 million years (Holčík & Jedlička, 1994: 160) by about 4000 km and they are diagnosable; they are treated here as species. Admittedly the differences between the two stocks are slight, but they exist [with large overlap]. Holčík & Jedlička's (p. 165) conclusion that *R. amarus* and *R. sericeus* "cannot be separated as the [coefficients of difference] values … are 0.75, 0.09 and 0.58 respectively, which is far below the accepted value of 1.28" was valid under the BSC, but is definitively not acceptable under other species concepts; as discussed in the introduction (pp. 12, 147), it is subjective to use magnitude of difference to deduce conspecificity or distinctness. To be objective, in this particular case my judgement might be somewhat biased by the huge geographic distance between the two species.

The above discussion assumes that *R. amarus* and *R. sericeus* constitute monophyletic lineages. The possibility that they are not monophyletic lineages has not yet been considered (e.g., that some of the European populations are more closely related to the East Asian populations than to the other European ones).

5.24.1 *Rutilus alburnoides* (Steindachner, 1866)

Leuciscus alburnoides Steindachner, 1866d: 263, pl. 1 fig. 3 (type locality: river Guadiana and its tributaries near Merida and Mertola, river Guadalquivir near Sevilla and Cordova [Cordoba], river Genil near Ecija, river Guadaira near Alcala de Guadaira, Spain; syntypes: NMW 49749 [15], 49778 [12])

Systematic notes. Generic placement doubtful. Placed in *Tropidophoxinellus* by Stephanidis (1974b: 248) because he assumed that "it is obvious that … a keel exist". Actually, the abdomen is not keeled and the generic placement is not correct. Present placement follows Collares-Pereira (1984) who also notes the presence of two forms in Portugal, a diploid bisexual one and an all-female triploid one (1985: 69).

5.24.2 *Rutilus arcasii* (Steindachner, 1866)

Leucos Arcasii Steindachner, 1866b: 199 (type locality: river Cailes near Tudela, river Ebro near Zaragoza and streams of Galicia, Spain; syntypes: NMW 49755–775 [54], 50646 [5], 60485 [1], 60743 [1]); see Steindachner (1866c: pl. 3 figs. 2–3) for illustration of syntypes

Systematic notes. Bianco (1988b: 9) suggested that this species might be a *Leuciscus* related to the *L. souffia* complex.

5.24.3 *Rutilus aula* (Bonaparte, 1841)

Squalius Aula Bonaparte, 1841: [fasc. 30], pl. 116 fig. 4 (type locality: Venetian Province, Italy; holotype: ? part of ANSP 6434–6445 [12], Böhlke, 1984: 69, MNHN 3934, Bertin & Estève, 1948: 58 [see Nomenclatural notes, below])

Squalius Elatus Bonaparte, 1841: [fasc. 30], pl. 116 fig. 3 (type locality: Lombardia, Italy; holotype: ? part of ANSP 6647–6649 [2], Böhlke, 1984: 75 [see Nomenclatural notes, below])

Leuciscus henle Bonaparte, 1841: [fasc. 30, introduction p. 15] (nomen nudum; locality: lake Lugano, Italy and Switzerland)

Leucos cisalpinus Heckel, 1843: 1038 (nomen nudum)

Leuciscus altus Valenciennes, in Cuvier & Valenciennes, 1844: 237 (type locality: lake Maggiore, Italy; holotype: MNHN)

Leuciscus pagellus Filippi, 1844: 400 (type locality: Verbano [lake Maggiore], Italy; syntypes: LU)

Leuciscus scardinus Filippi, 1844: 400 (type locality: canals near Milano, Italy; syntypes: LU)

Leuciscus pauperum Filippi, 1844: 401 (type locality: Lombardia, Italy; syntypes: LU)

Leucos rubellicus Bonaparte, 1845: 6 (type locality: "Dalmatia"; syntypes: LU)

Leucos cisalpinus Bonaparte, 1845: 6 (listed in synonymy, name not available)

Leucos cisalpinus Heckel, 1851b: 315 (available by indication to *Leuciscus scardinus* Filippi, 1844)

Rutilus erythrophthalmus Zerunian, 1982: n° 346 (type locality: lake Bracciano, Italy; syntypes: LU)

Nomenclatural notes. Böhlke (1984: 69, 75) lists 12 syntypes ANSP 6434–6445 for *Squalius aula* and 2 syntypes ANSP 6647–6649 for *S. elatus*. As these names are available from Bonaparte's (1841) plate 116, the illustrated specimen is the holotype and there are no syntypes. Bertin & Estève (1948: 58) list a holotype MNHN 3934 from Torino for *S. aula*; its status is doubtful as Bonaparte in the text, under a different name, indicated that his material came from the "Venetian Province".

Rutilus erythrophthalmus Zerunian, 1982, was originally described in a conference abstract. This suffices to make the name available from that publication, even if the 'description' is rudimentary. *Rutilus erythrophthalmus* Zerunian is a secondary junior homonym of *Cyprinus erythrophthalmus* Linnaeus, 1758, if this species is placed in *Rutilus* as done by some authors (e.g., Howes, 1981). In any case, there are several earlier names applied to this species (see Bianco & Taraborelli, 1985: 143 as well as Zerunian, 1984: 233) and, as a junior synonym, *R. erythrophthalmus* is not valid; the comments by Zerunian (1991) and Gandolfi et al. (1991: 133) are irrelevant and can only have been induced by a lack of familiarity with the ICZN. Zerunian's arguments against the use of *R. aula* are that the name has been used only as a caption of a poor-quality plate, without description, and that *R. aula* was a nomen oblitum when he described *R. erythrophthalmus*. A name published only as a caption of a plate is available; ICZN art. 12(b)(7) is very explicit and leaves no opportunity for discussion on this; the absence of a description for names published before 1931 or the quality of the plate are irrelevant to the argument. *Rutilus aula* cannot be rejected as a nomen oblitum on the ground advocated by Zerunian; the only names which can be rejected are those which have been explicitly designated as nomina oblita between 6 November 1961 and 1 January 1973 (see ICZN art. 79(c)(iii), Glossary 'nomen oblitum'). I could not find such a rejection and Zerunian gives no reference to one; thus *R. aula* is not a nomen oblitum and cannot be rejected. The fact that the name has not been used for 50 years by itself does not make a name a nomen oblitum.

Anyway, even if *R. aula* were a nomen oblitum (which is not the case), there are seven other names published between 1841 and 1851 which apparently refer to the same species and thus potentially have priority over *R. erythrophthalmus*. To make *R. erythrophthalmus* the valid name of the species, one would need to demonstrate that all of these names are not available or are invalid for the species, which has not been done.

Leuciscus aula and *L. elatus* are simultaneous synonyms and the first reviser's action is decisive to establish which name has priority (ICZN art. 24). The first reviser is Canestrini (1866: 95, 99) and he retained *L. aula* has having priority (as clearly stated by Bianco & Taraborelli, 1985: 143).

5.24.4 *Rutilus basak* (Heckel, 1843)

Leucos Basak Heckel, 1843: 1006, pl. 1 (type locality: Dalmatia [Vergoraz and lake Drusino near Imosky [Imotski], Croatia; Heckel & Kner, 1858: 166, figs. 88–89]; syntypes: NMW 50723 [2], 50725 [2])

Systematic notes. Valid according to Bianco & Taraborelli (1985: 149).

Nomenclatural notes. The authors of the name are usually indicated as Heckel & Kner (1858: 166). The name is actually available from Heckel (1843) where it is used for the caption of a plate illustrating pharyngeal teeth.

5.24.5 *Rutilus frisii* (Nordmann, 1840)

Cyprinus Wiresuba Güldenstädt, 1791: 169 (nomen nudum; locality: Yuzhnyi Bug, Ukraine [Berg, 1949: 532])

Leuciscus Frisii Nordmann, 1840: 487 (type locality: market in Odessa and rivers Danube and tributaries, Dniester, Bug, Dnieper and Don; syntypes: ? NMW 50456 [2])

Gardonus wyrozub Walecki, 1863: 360 (available by indication to *Leuciscus Frisii* Nordmann, 1840 and four other, ambiguous references; here restricted to reference to *Leuciscus Frisii* Nordmann, 1840; type locality: market in Odessa and rivers Danube and tributaries, Dniester, Bug, Dnieper and Don; syntypes: ? NMW 50456 [2])

? *Leuciscus frisii* var. *kutum* Kamenskii, in Radde, 1899: 317 (nomen nudum; localities: Boshy-Promysl [Bozhii Promysel on lower river Kura] and Lenkoran, Azerbaidjan)

? *Leuciscus frisii caspius* Lönnberg, 1900: 15 (type locality: mouth of river Volga, Russia; holotype: NRM)

? *Leuciscus frisii* var. *kutum* Kamensky, 1901: 23, 154, pl. 12 (type locality: southern part of Caspian Sea, rivers Kura, Arax, Terek, lower Volga and streams of the Lenkoran area; syntypes: ZMT ?)

Rutilus frisii velecensis Chichkoff, 1932: 355, pl. 1 fig. 1 (type locality: streams Veleca and Rezova Rieca [Rezovska Reka, Rezvaia], Bulgaria; syntypes: LU)

Systematic notes. It seems that the population from the Caspian Sea basin, usually called *R. f. kutum*, actually has to be treated as a distinct species. Berg (1912: 47) considered *R. f. kutum* and *R. f. caspium* as belonging to the same taxon but retained the name *R. f. kutum* although *R. f. caspium* has priority. Economidis & Bănărescu (1991: 261) list *R. f. velecensis* as a valid subspecies. The status of these taxa needs to be reevaluated once usable data become available.

5.24.6 ? *Rutilus heckelii* (Nordmann, 1840)

Leuciscus heckelii Nordmann, 1840: 491, pl. 23 fig. 1 (type locality not stated [Black Sea basin]; syntypes: ZISP 3008–3009 [3], Berg, 1912: 65)

Rutilus rutilus heckeli natio *dono-kubanensis* Pavlov, 1961: 250 (infrasubspecific, name not available; locality: Sea of Azov)

Rutilus rutilus morpha *migratorius* Holčík & Skořepa, 1971: 49 (infrasubspecific, name not available)

Systematic notes. Data in Holčík & Skořepa (1971) suggest that the various subspecies, natios and morphs earlier recognised within *R. rutilus* are conspecific, but these authors recognised the migratory forms of the Black, Azov and Caspian Seas as a distinct morph *migratorius*. The Black Sea stock occurs sympatrically with the freshwater one in the lower Dniester, Bug, Dnieper and Don (presence in Danube is open to question) where it migrates into freshwaters (Holčík & Skořepa, 1971: 41). It has been recognised as *R. r. heckeli* by earlier authors who had reported morphological differences between the two stocks (e.g., Berg, 1949: 493; Bănărescu, 1964: 305) but Holčík & Skořepa could not find any striking difference; however, they list differences in the early ontogeny (based on a compilation of published data). Their table 1 does not provide much comparison data except for gill-raker counts for *R. heckeli*; their table 2 could indicate that *R. heckeli* and the adjacent *R. r. carpathorossicus* differ in lateral-line scale and gill-raker counts, but as it is based on their own as well as compiled data, the table's reliability depends of the consistency of the methods used by the various authors. Awaiting a detailed comparison of sympatric and adjacent populations of the different stocks and considering the differences reported by earlier authors and what seems to be different life histories, it seems reasonable to retain them as two valid species.

Bănărescu (1991: 296, 1992: 732) suggested that *R. heckeli* might be a subspecies of *R. pigus*, but did not provide data.

If future studies confirm that the Black Sea basin *R. heckeli* is specifically distinct from *R. rutilus*, the status of other migratory stocks (e.g., those of the Caspian drainage) should be investigated too, as they are then unlikely to be conspecific with *R. heckeli*.

5.24.7 ? *Rutilus karamani* Fowler, 1977

Rutilus aula natio *karamani* Vladykov & Petit, 1930: 391 (infrasubspecific, name not available; locality: lake Ohrid near Pogradec, Albania)

Rutilus rubella karamani Fowler, 1977: 85 (available by indication to *Rutilus aula* natio *karamani* Vladykov & Petit, 1930: 391; type locality: lake Ohrid at Pogradec, Albania; syntypes [total 4 ?]: MNHN 1977.281 [3], B. Elvira, pers. comm., 1995)

Rutilus prespensis vukovici Maric, 1989: 65, figs 2d, 4 (type locality: lake Skadar, Montenegro; holotype: BZT)

Systematic notes. See discussion under *Rutilus ohridanus*. Tentatively considered valid.

Nomenclatural notes. *Rutilus aula* natio *karamani* Vladykov & Petit, 1930 is infrasubspecific and unavailable, but its use as a subspecific name in Fowler (1977: 85) makes it available.

5.24.8 *Rutilus lemmingii* (Steindachner, 1866)

Leuciscus Lemmingii Steindachner, 1866d: 265, pl. 1 fig. 2 (type locality: river Guadiana and its tributaries near Merida, rivers Guadalquivir and Guadaira near Sevilla, Spain; syntypes: NMW 52356–357 [6], 52363 [2], 52366 [2], 52373 [4])

Systematic notes. Generic position follows Elvira (1987: 138).

5.24.9 *Rutilus lusitanicus* (Collares-Pereira, 1980)

Chondrostoma lusitanicum Collares-Pereira, 1980a: 275 (type locality: Rio Xarrama, Sado basin, Portugal; holotype: MB c.1.1)

Systematic notes. Generic position follows Elvira (1987: 138).

5.24.10 *Rutilus macrolepidotus* (Steindachner, 1866)

Leuciscus macrolepidotus Steindachner, 1866c: 15 (type locality: creeks near Alcobazar, and Cintra, Portugal; syntypes: NMW 49815 [4; 3 according to original description]); see Steindachner (1866d: pl. 1 fig. 4) for illustration of a syntype

Systematic notes. Bianco (1988b: 9) suggested that this species might be a *Leuciscus* related to the *L. souffia* complex.

5.24.11 *Rutilus meidingeri* (Heckel, 1851)

Leuciscus Meidingeri Heckel, 1851a: 147 (available by indication to *Cyprinus grislagine* in Meidinger, 1790: pl. 40 ["lacu Kamerano"]; type locality: lake Attersee, Austria; syntypes: NMW 49826 [1], 50451 [1], 50452 [1])

Nomenclatural notes. Although Heckel described this species in 1852b (p. 88, pl. 9), his 1851a account suffices to make the name available. He also published a second account (1851b: 290) which would fulfil conditions to make the name available.

The earliest of these citations (1851a) makes the name available because it is accompanied by a reference to Meidinger (1790: pl. 40). As it is obvious from the content of the paper that Heckel had examined specimens, these are syntypes.

5.24.12 *Rutilus ohridanus* (Karaman, 1924)

Leucos aula var. *ohridana* Karaman, 1924b: 56 (type locality: lake Ohrid, FYROM; syntypes: LU)

Systematic notes. I tentatively follow the opinion of Bianco (1986) and Economidis (1991: 9) that *R. ohridanus* is a valid species. According to Maric (1989) and Bănărescu (1992b: 753) it is a subspecies of *R. basak*.

Maric (1989) considers *R. ohridanus* as a subspecies of *R. basak*, and *R. prespensis* as valid with 2 subspecies, *R. p. prespensis* and *R. p. vukovici*. Language and semantic problems make it very difficult to understand his argument; nowhere is it explained how the two 'species' differ and why the two pairs of 'subspecies' are assumed to be each other's closest relative. Awaiting more explicit data and clearer information, I tentatively accept that the four taxa are diagnosable and thus treat them as four distinct species. To treat some of them as conspecific (e.g., *ohridanus* and *basak*, *prespensis* and *vukovici*) could be acceptable only if it is demonstrated that they constitute a distinct lineage; there is no such demonstration. The reported sympatric occurrence of two of them seems to refute the hypothesis that a single species is involved.

From Maric's data, it seems clear that "*R. b. ohridanus*" and "*R. p. vukovici*" are sympatric in lakes Skadar and Ohrid and that they are distinguished by lateral line scale counts (41–45, vs. 37–41 [based only on material of lake Skadar]). If the same pair of species really occurs in both lakes, then it seems that *R. p. vukovici* is the same as *Rutilus karamani*, and this is the name retained here.

It seems that Maric's *R. ohridanus* is the same as Karaman's (but Maric had no material from lake Ohrid and there is a striking difference in number of branched dorsal rays, apparently the result of an error in Karaman [the simple rays are probably included again in his count of branched rays]). It also seems that it differs from *R. basak* in dorsal and anal ray counts and body depth. *Rutilus prespensis* seems to have a smaller eye than all others and different modal ray counts.

5.24.13 *Rutilus pigus* (La Cepède, 1803)

Cyprinus pigus La Cepède, 1803: 607, 610 (type locality: lakes Como and Maggiore, Italy [based on Rondelet (1555: 153, pigus, Lario [lake Como] and Verbano [lake Maggiore]), Artedi (1738: syn 13), Salviani (1554–58: fol. 83, pl. 17, pigo, Lario [lake Como], Verbano [lake Maggiore]), Valmont de Bomare [edition not stated]); syntypes: LU)

Leuciscus Roseus Bonaparte, 1839: [fasc. 24, p. 241], pl. 114 fig. 1 (type locality: "an unknown lake in Piemonte", Italy; holotype: ANSP 6525, Böhlke, 1984: 89)

Leuciscus ryzela Valenciennes, in Cuvier & Valenciennes, 1844: 199 (type locality: Torino, Italy; syntypes: MNHN 3935 [2], Bertin & Estève, 1948: 58)

Leuciscus virgo Heckel, 1852b: 69, pls. 11–12 (type locality: river Danube near Wien, Austria; syntypes: NMW 22373 [1], 50626 [1])

Systematic notes. Bănărescu (1992: 682, 732) considers *R. pigus* as introduced from the Danube into Italy and that *R. heckeli* is conspecific with *R. pigus*. Bianco (1995c: 254) considers that the species might have been introduced in Italy during the Middle Age. The populations from northern Italy and from the Danube are now considered as conspecific, but more data are needed on this matter.

The Italian and Danube populations have been earlier considered as different species, subspecies or natio. There does not seem to have been much actual comparisons of the two populations. Mišík (1957b) treated them as conspecific on the ground that *R. virgo* "does not differ much in the meristic characters" from *R. pigus*, but without providing data on the type of differences. He has not examined material of the Italian population and, beside Heckel & Kner (1858), does not cite authors who have done so. A direct comparison of the two species seems highly desirable.

Nomenclatural notes. See *Leuciscus souffia* for discussion of the status of *Leuciscus ryzela* Valenciennes, 1844.

Bertin & Estève (1948: 57) list a specimen MNHN 3916 from Roma as paratype of *Leuciscus roseus* Bonaparte, 1839, but there is no information in Bonaparte's text to indicate that he might have had more than one specimen.

Should future research show that the Italian and Danube populations are distinct taxa, the name *R. pigus* has to be used for the Italian one and *R. virgo* for the Danube one.

5.24.14 ? *Rutilus prespensis* (Karaman, 1924)

Leucos aula var. *prespensis* Karaman, 1924b: 57 (type locality: lake Prespa, FYROM and Greece; syntypes: LU)

Systematic notes. See discussion under *Rutilus ohridanus*. Tentatively considered valid. Economidis & Bănărescu (1995: 266) and Maric (1989) consider *R. prespensis* as a valid species, Economidis (1995: 211) as a subspecies of *R. ohridanus*.

5.24.15 *Rutilus rubilio* (Bonaparte, 1837)

Leuciscus Rubilio Bonaparte, 1837: [fasc. 19, p. 225], pl. 111 fig. 2 (type locality: lakes Bracciano and Nemi, Italy; syntypes: ANSP 6509–6519 [11], Böhlke, 1984: 89, NMW 49860 [1])

Leuciscus Trasimenicus Bonaparte, 1837: [fasc. 20, p. 233], pl. 112 fig. 4 (type locality: lake Trasimeno, Italy; syntypes: NMW 50789 [1], ANSP 5039–5059 [20], Böhlke, 1984: 93)

Leuciscus Rubella Bonaparte, 1837: [fasc. 20, p. 229], pl. 112 fig. 1 (type locality: river Tevere and all swamps and wetlands, Italy; syntypes: MNHN 3924, Almaça, 1969: 1117, ANSP 6487–6508 [22], Böhlke, 1984: 89, NMW 50772 [1])

Leuciscus Fucini Bonaparte, 1838: [fasc. 22, p. 235], pl. 113 fig 1 (type locality: lake Fucino, Italy; syntypes: ANSP 6448–6454 [7], Böhlke, 1984: 77)

Leuciscus lascha, Costa, 1838: fasc. 19: 19, pl. 16 (type locality: not stated, but title implies Kingdom of Napoli [now in Italy]; syntype: MNHN 194 [1], Almaça, 1969: 1119)

Leuciscus sardella Valenciennes, in Cuvier & Valenciennes, 1844: 243 (type locality: river Sarno at confluence with Garigliano, Italy; based on *Leuciscus dobula* of Costa, 1838: fasc. 19: 23, pl. 19 [= *R. rubilio* according to Bianco & Taraborelli, 1985: 136])

Rutilus italicus Calderoni, 1980: 459 (type locality: lake Trasimeno, Italy; syntypes: LU [no type designated, so that all specimens of "laschetta" used for the paper are syntypes])

Nomenclatural notes. *Leuciscus lascha* is considered a synonym of *Scardinius erythrophthalmus* by Zerunian (1984: 221) without discussion. The above synonymy follows the revision of Bianco & Taraborelli (1985: 136).

5.24.16 *Rutilus rutilus* (Linnaeus, 1758)

Cyprinus Rutilus Linnaeus, 1758: 324 (based on Linnaeus [1746: 124, n. 329, Cyprinus ... radiis 12], Artedi [1738: gen. 3 [10], syn. 10, spec. 10 [3], Cyprinus iride pinnis ...], Gronovius [1754: 2, n. 8, idem; 1746: 74, n. 51, idem, n. 52, Cyprinus Rex van Ruy: Waverveen, Belgium]; type locality: "in Europae lacubus"; syntype: LSL 44 [1], Wheeler, 1985: 32)

Cyprinus Rubellio Leske, 1774: 53 (type locality: Leipzig, Germany; type material: possibly LSL 63, 64, Wheeler, 1985: 5, 31)

? *Cyprinus simus* Hermann, 1804: 325 (type locality: not stated; holotype: LU)

Cyprinus lacustris Pallas, 1814: 314 (type locality: Siberia as far as river Lena, lake Baikal [Berg, 1949: 499]; syntypes: LU)

Cyprinus jaculus Jurine, 1825: 221, pl. 14 (type locality: Léman [lake Genève], Switzerland and France; type material: NT ?)

Leuciscus decipiens Agassiz, 1835b: 38 (nomen nudum)

Leuciscus prasinus Agassiz, 1835b: 46, pl. 2 (type locality: lake Neuchâtel, Switzerland; syntypes: MHNN 994 [2], 994-B [2], 995 [1], Kottelat, 1984: 148, ? MNHN)

? *Cyprinus xanthopterus* Vallot, 1837: 147 (type locality: stream Ouche, below the park [in Dijon], France; syntypes: LU)

? *Cyprinus fulvus* Vallot, 1837: 183 (type locality: market [in Dijon ?, France]; holotype: LU)

Gardonus pigulus Bonaparte, 1841:[fasc. 30, introduction p. 16] (nomen nudum)

Leucos cenisophius Bonaparte, 1841: [fasc. 30, introduction p. 16] (nomen nudum)

Leuciscus selysii Selys-Longchamps, 1842: 210, pl.

6 fig. 1 (type locality: Longchamps-sur-Geer, Belgium; syntypes: ? ISNB [not found], MHNN 996 [1], Kottelat, 1984: 148)

Leuciscus rutiloides Selys-Longchamps, 1842: 212, pl. 7 fig. 1 (type locality: river Meuse in Liège, Belgium; holotype: ISNB 108)

Leuciscus Pausingeri Heckel, 1843: 1039 (type locality: lake Egelsee, Austria; syntypes: NMW 49884–886 [3])

Leuciscus lividus Heckel, 1843: 1039 (type locality: Plattensee [lake Balaton], Marizza, Hungary; syntypes: NMW 49978–979 [5])

Leucos pigulus Bonaparte, 1844: 436 (type locality: lakes of Switzerland; holotype: ANSP 6450, Böhlke, 1984: 87)

Leucos cenisophius Bonaparte, 1845: 7. (type locality: "Sequana" [part of former Gaul drained by rivers Saône and Doubs, France]; holotype: ANSP 6430)

Cyprinus pigus Gronow, 1854: 183 (type locality: rivers and lakes of Europe; holotype: BMNH 1853.11.12:154, Wheeler, 1958: 211; junior homonym of *Cyprinus pigus* La Cepède, 1803: 607, 610)

Leuciscus rutilus var. *daugawensis* Dybowski, 1862: 92, 101, pl. 6 (type locality: river Düna in Riga, Latvia; syntypes: LU)

Leuciscus Jurinii Dybowski, 1862: 94 (type locality: lake Genève, Switzerland & France; available by indication to *L. rutilus* Jurine, 1825, *L. prasinus* of Valenciennes, in Cuvier & Valenciennes, 1844: 153 and *Leuciscus* nov. spec. Heckel, 1852b: 79; syntypes: MNHN [material listed by these authors; Jurine's specimen are not extant in MHNG (C. Weber, pers. comm., 1995), Heckel's ones cannot be found in NMW (B. Herzig, pers. comm., 1995)])

Gardonus ruboculus Walecki, 1863: 364 (apparently an unnecessary replacement name for *Cyprinus rutilus* Linnaeus, 1758)

Leuciscus pallens Blanchard, 1866: 386, fig. 88 (type locality: Annecy [river Rhône basin], France; syntypes: MNHN ?)

Leuciscus rutilus var. *caspicus* Yakovlev, **1870: 103** (delta of river Volga, Russia) from Berg, 1949: 513

Leuciscus rutilus var. *communis* Yakovlev, **1873: 333** (delta of river Volga, Russia) from Berg, 1912: 50

Leuciscus rutilus var. *fluviatilis* Yakovlev, **1873: 334** (delta of river Volga, Russia) from Berg, 1949: 497

Leuciscus rutilus var. *auratus* Yakovlev, **1873: 334** (delta of river Volga, Russia; junior primary homonym of *Leuciscus auratus* Mauduyt, 1848) from Berg, 1912: 67

Leuciscus rutilus forma *bolmensis* Malm, 1877: 560 (type locality: lake Bolmen in Småland, Sweden; syntypes: LU)

Leuciscus rutilus var. *elata* Fatio, 1882: 498 (infrasubspecific, name not available)

Leuciscus rutilus var. *elongata* Fatio, 1882: 499 (infrasubspecific, name not available)

Leuciscus rutilus var. *crassa* Fatio, 1882: 499 (infrasubspecific, name not available)

Leuciscus rutilus var. *aurata* Fatio, 1882: 506 (infrasubspecific, name not available)

Leuciscus rutilus var. *terekensis* Rossikov, **1895: n° 54** (river Terek, Mosdok) from Berg, 1912: 52

Leuciscus rutilus var. *communis* Rossikov, **1895: n° 54** (river Terek, Mosdok) from Berg, 1912: 52

Leuciscus rutilus var. *wobla* Grimm, **1896: 67, 114** (nomen nudum; river Volga at Tzaritzyn, Russia) from Berg, 1912: 68

Leuciscus rutilus var. *vobla* Dikson, **1909: 31** (Saratow, Russia) from Berg, 1912: 68

Leuciscus rutilus var. *erytraea* Antipa, 1909: 181, fig. 71 (infrasubspecific, name not available)

Rutilus rutilus aralensis Berg, 1916a: 134 (type locality: Aral Sea [Berg, 1949: 505]; syntypes: ZISP?)

Rutilus rutilus mariza Drensky, 1926: 133, fig. 3 (type locality: river Mariza, Bulgaria; syntypes: NMNHS)

Rutilus rutilus schelkovnikovi Derjavin, **1926: 162, fig.** (river Karasu, a tributary of river Araks, a tributary of river Kura, Caspian Sea basin) from Berg, 1949: 529

Rutilus rutilus caspius natio *knipowitschi* Pravdin, **1927: 84** (infrasubspecific, name not available; south-western Caspian Sea, Astrabad Bay) from Berg, 1949: 528

Leuciscus pigus dojranensis Karaman, 1928: 153, fig. 2a (type locality: lake Dojran, FYROM and Greece; syntypes: LU); repeated in 1929: 172

Rutilus rutilus carpathorossicus Vladykov, 1930: 103 (type locality: river Laborec, a tributary of Bodrog, Slovakia; lectotype: MNHN 30–211, designated by Almaça, 1969: 1119)

Rutilus rutilus aralensis morpha *phragmiteti* Berg, 1932c: 314, fig. 235 (infrasubspecific, name not available; Aral Sea at Muinak [Berg, 1949: 510])

Rutilus rutilus uzboicus Berg, 1932c: 315, fig. 237 (type locality: lake Yashkan, river Uzboi basin [Berg, 1949: 512]; syntypes: ZISP ?)

Rutilus rutilus caspicus natio *kurensis* Berg, 1932c: 323 (infrasubspecific, name not available; locality: river Kura, Azerbaidjan [Berg, 1949:

527])

Rutilus rutilus caspicus natio *tscharchalensis* Berg, 1932c: 325 (infrasubspecific, name not available; locality: lake Charkhal, river Ural basin [Berg, 1949: 528])

Rutilus rutilus bucharensis Nikolsky, 1933: 264 (type locality: area of Termes, upper Amu-Darja basin, Turkmenistan; holotype: ZMMSU P-1390)

Rutilus rutilus sucharensis Stangenberg, 1938: 47, 104 (type locality: lake Suchar Wielki, Poland; syntypes: LU)

Rutilus rutilus goplensis Stangenberg, 1938: 51, 104 (type locality: lake Goplo, Poland; syntypes: LU)

Rutilus rutilus caspicus natio *geoktshaicus* Barach, **1941** (infrasubspecific, name not available)

Rutilus rutilus v[ar]. *vegariticus* Stephanidis, 1950: 203 (type locality: lake Vegaritida, Greece; syntypes: lost ?)

Rutilus rutilus frici Misik, 1957a: 17, fig. 1 (type locality: Poltruba, an oxbow lake of river Elbe [Elbaltwasser] near Čelákovice, Czech Republic; syntypes: ? CUP [80])

Rutilus rutilus lacustris natio *menschikowi* Kirillov, 1962: 40 (infrasubspecific, name not available; locality: river Vilyui basin, Yakutia, Siberia)

Systematic notes. The clarification of the status of several nominal taxa placed in the synonymy of *R. rutilus* by Holčík & Skořepa (1971) requires more study. This particularly applies to populations of isolated basins of southeastern Europe. These should not be compared to the gobal range of variation of a few characters of a '*R. rutilus*' encompassing all northern and central European *Rutilus* populations. On the contrary, the effort should focus in thorough comparisons of populations inhabiting adjacent basins. In northeastern Greece, Economidis & Sinis (1982: 312) show that two group of populations (corresponding to the nominal taxa *mariza* and *dojranensis*) differ in gill-raker counts.

Rutilus vegariticus is considered a valid species by Economidis & Bănărescu (1991: 274) and as a subspecies of *R. rutilus* by Economidis (1995: 211). Not knowing on which characters this decision is based, I am left with no choice but to include it in the synonymy of *R. rutilus*. Hopefully this can be re-evaluated soon.

The migratory stocks of the Black Sea basin are tentatively considered as a distinct species; see above under *Rutilus heckeli*. Nominal species based on migratory stocks from the Caspian Sea basin are listed under the present species, but their status needs to be examined too.

Nomenclatural notes. Selys-Longchamps (1842: 210) considers Heckel as author of *Leuciscus selysii*. Heckel nowhere published this name and is responsible for none of the conditions which make it available in Selys-Longchamps (1842) and cannot be the author. Selys-Longchamps is alone responsible for the conditions making the name available and is thus author of the name (ICZN art. 50) (Kottelat, 1984: 148). This was probably a manuscript name of Heckel.

5.24.17 *Rutilus ylikiensis* Economidis, 1991

Rutilus aula rubella var. *ylikiensis* Stephanidis, 1939b: 55, pl. 3 (infrasubspecific, name not available; locality: lake Yliki, Greece)

Rutilus ylikiensis Economidis, 1991: 10 (available by reference to Stephanidis, 1939b; type locality: lakes Yliki and Paralimni / Aetolia and Akarnania (lakes Trichonis, Lyssimachia, Ozeros and Amvrakia, river Acheloos) / lake Pamvotis (Jannina), Greece; syntypes: lost ?)

Systematic notes. Listed as a valid species by Economidis & Bănărescu (1991: 269).

Nomenclatural notes. As published by Stephanidis (1939b: 55), the name *R. aula rubella* var. *ylikiensis* is not available. The next use of the name I could find is by Economidis (1991); it is used as a species name and refers to Stephanidis (1939b) and this makes the name available; as Economidis is author of the conditions which make the name available, he is author of the name.

5.25.1 *Scardinius acarnanicus* Economidis, 1991

Scardinius scardafa plotizza [forma] *acarnanicus* Stephanidis, 1939a: 26, pl. 4 (infrasubspecific, name not available; locality: lakes Trichonis and Lyssimachia, river Acheleoos, Greece)

Scardinius acarnanicus Economidis, 1991: 16 (available by reference to Stephanidis, 1939b; type locality: river Acheleoos basin [river Acheleoos and lakes Trichonis, Lyssimachia, Ozeros and Amvrakia], Greece; syntypes: lost ?)

Systematic notes. See Iliadou et al. (1996) for a recent discussion of the status of the species.

Howes (1981: 46) considers that *Scardinius* is not distinguishable from *Rutilus*. As presently understood, *Rutilus* is probably not a monophyletic lineage; awaiting an analysis of the interrelationships of its members, I conservatively retain the species of *Scardinius* as a distinct genus.

Nomenclatural notes. As published by Stephanidis (1939b: 26), the name *S. scardafa plotizza*

f. *acarnanicus* is not available. The next use of the name I could find is by Economidis (1991); it is used as a species name and refers to Stephanidis (1939b) and this makes the name available; as Economidis is author of the conditions which make the name available, he is author of the name.

5.25.2 *Scardinius erythrophthalmus* (Linnaeus, 1758)

Cyprinus Erythrophthalmus Linnaeus, 1758: 324 (based on Linnaeus [1746: 123, n. 324, Cyprinus ... radiis 14 pinnis rubris] and Artedi [1738: gen. 3 [9], syn. 4, spec. 9 [3], Cyprinus iride pinnis omnibus ...]; type locality: "in Europae septentrionali"; syntypes: LU)

Cyprinus erythrops Pallas, 1814: 317 (type locality: all streams of Russia and Siberia; syntypes: LU)

Cyprinus Compressus Hollberg, 1822: 66 (type locality: canals in Götheborg, Sweden; syntypes: GNM ?)

Cyprinus Scardula Nardo, 1827a: 482, 488 (type locality stated as Adriatic Sea basin but actually lake Zürich, Switzerland / lakes of Auvergne, France; available by indication to *Cyprinus latus* of Aldrovandri, 1613: 641, 642 [localities explicitly stated are: lake Zürich (after Gesner) and lakes of Auvergne (after Rondelet)]; type material: NT) or 1827b: 34, 40 (same data)

Cyprinus caeruleus Yarrell, [1833]: 8, pl. 2 fig. 2 (type locality: Knowsley Park, Lancashire, U.K.; syntypes: LU)

? *Cyprinus fuscus* Vallot, 1837: 146 (type locality: market [in Dijon ?, France]; syntypes: LU [2])

Scardinius hesperidicus Heckel, 1843: 1037 (nomen nudum); Bonaparte, 1844: 431 (nomen nudum)

Scardinius hesperidicus Bonaparte, 1845: 10 (available by indication to *Scardinius erythrophthalmus* of Bonaparte, 1840: [fasc. 28, pl. 115 fig. 2], 1840: [fasc. 30, pl. 116 fig. 2]; type locality: lakes of Piemonte, Italy; syntypes: LU)

Scardinius platizza Bonaparte, 1846: 32 (nomen nudum)

Scardinius macrophthalmus Heckel, 1853: 30 (nomen nudum; locality: Kizbüehl [sic], Tirol, Austria)

Leuciscus Apollonitis Richardson, 1856: 374 (type locality: lake Apollonitis [near Brussa], Asia Minor; holotype: BMNH ?)

Scardinius macrophthalmus Heckel & Kner, 1858: 160, fig. 85 (type locality: lake Hechtsee near Kupfstein, Tirol, Austria; syntypes: NMW 51678–684 [9])

Scardinius dergle Heckel & Kner, 1858: 156, fig. 81 (type locality: streams Kerka and Zermagna, Dalmatia [Croatia] / Livno, Bosnia; syntypes: NMW 51676 [6], 51753 [2], 51754 [3])

Scardinius plotizza Heckel & Kner, 1858: 159, fig. 84 (type locality: Jessero Grande near Vergoraz and near Imosky, Dalmatia [Croatia] / Livno, Bosnia; syntypes: NMW 51816 [8], 51817 [2])

Scardinius crocophthalmus Walecki, 1863: 364 (apparently an unnecessary replacement name for *Cyprinus erythrophthalmus* Linnaeus, 1758)

Scardinius erythrophthalmus var. *dojranensis* Karan, 1924b: 60 (type locality: lake Dojran, FYROM and Greece; syntypes: LU)

Scardinius scardafa natio *ohridana* Vladykov & Petit, 1930: 399 (infrasubspecific, name not available; locality: lake Ohrid near Pogradec, Albania)

Scardinius erythrophthalmus morpha *rutiloides* Vladykov, 1931: 306 (infrasubspecific, name not available; locality not explicitly stated: "with the typical forms"; includes a long list of localities throughout Europe)

Scardinius erythrophthalmus v[ar]. *achrus* Stephanidis, 1950: 206 (type locality: river Cholorema near Almiros, Thessalia, Greece; syntypes: lost ?)

Systematic notes. Howes (1981: 46) considered *Scardinius* as part of *Rutilus*.

The morphological analysis by Grupče & Dimovski (1984) indicates the presence of two species in FYROM (called *S. e. scardafa* and *S. e. dojranensis* by them). Comparison of the first one with Italian material is needed to confirm its identification; the second species should be compared with Danube or northern European material to confirm that it is distinct from them.

Economidis & Bănărescu (1991: 269) treat *S. plotizza* as a valid species, without further information.

Nomenclatural notes. The publication year of Yarrell's description of *Cyprinus caeruleus* is usually given as 1837. However, the name is cited (with Yarrell as author) by Jenyns (1835a: 26) and the paper is cited with correct page numbers by Jenyns (1835b: 413) and Yarrell (1836, vol. 1: 365). The paper was read June 19th, 1832 to the Linnean Society (Yarrell, [1833]: 5) and it seems obvious that volume 17 of their Transactions spans several years and that the title page, issued once the volume was complete has been printed in 1837. The last paper of vol. 16 was read on April 3rd, 1832 and the title page of vol. 16 is dated 1833. Yarrell's paper being at the beginning of volume 17 was probably printed much earlier than 1837, may be as early as 1832. A publication date in

1833, shortly after the title page of vol. 16, seems reasonable.

5.25.3 *Scardinius graecus* Stephanidis, 1937

Scardinius graecus Stephanidis, 1937: 266, pl. 2 (type locality: lake Yliki (Likerni), near Thebes, Beotia, Greece; syntypes: lost ?)

Systematic notes. See Iliadou et al. (1996) for a recent discussion of the status of the species.

5.25.4 ? *Scardinius racovitzai* Müller, 1958

Scardinius racovitzai Müller, 1958: 165, fig. 1 (type locality: pond Petzea, a tributary of Cris Repede, Romania; holotype: MGAB 49917, Mihai-Bardan, 1984: 453)

Systematic notes. This species is known only from a thermal spring in Romania. Bănărescu (1964: 355, 1966: 381) treated this taxon as a subspecies of *S. erythrophthalmus*, but as far as I can understand, without giving reasons. Later (1981: 477), he commented that "it is possible that in the lower course there might be intergrades between this subspecies and the nominal one" [my translation from Romanian]. He further commented on the differences between the two taxa that "one cannot rely on the phenotype, because it has no genotypic base", but does not provide supporting evidence. Considering the differences between the two taxa reported by Müller (1958) and Bănărescu (1964) (maximum size, number of vertebrae, general appearance) and the absence of concrete data showing the existence of intergrades or phenotypic plasticity, at present there is no choice but to consider this species as valid. Clearly, more accurate information is needed to clear the case; it is true that the differences may be due to differences in temperature, but it is not correct to imply it from the case of some other species; this explanation is only acceptable if it is demonstrated case by case.

5.25.5 *Scardinius scardafa* (Bonaparte, 1837)

Rutilus heegeri Agassiz, 1835b: 38 (nomen nudum)

Leuciscus Scardafa Bonaparte, 1837: [fasc. 19, p. 227], pl. 111 fig. 3 (type locality: lakes Nemi, Ronciglione, Bracciano, Fogliano and others, and many ditches, Italy; syntypes: ANSP 6211–6270 [59], 17002 [1], Böhlke, 1984: 90)

Leuciscus scarpata Bonaparte, 1837: [fasc. 19, p. 227] (nomen nudum; locality: lake Trasimeno, Italy)

Leuciscus marrochius Costa, 1838: fasc. 19: 12, pl. 13 (type locality: not stated [lake Fuccino, Italy, according to Tortonese, 1970: 261, supporting evidence not given]; syntypes: LU)

? *Leuciscus Heegeri* Bonaparte, 1839: [fasc. 24, p. 245], pl. 114 fig. 3 (type locality: some streams in Istria, Italy; holotype: LU)

? *Heegerius typus* Bonaparte, 1844: 435 (unnecessary replacement name for *Leuciscus heegeri* Bonaparte, 1839)

Leuciscus scarpetta Valenciennes, in Cuvier & Valenciennes, 1844: 126 (type locality: lake Trasimeno, Italy; syntypes: MNHN 3890 [2], Bertin & Estève, 1948: 80)

Systematic notes. Considered as valid by Bianco (1990b, 1994b: 455, 1995a: 165) and Economidis & Bănărescu (1991: 269).

5.26.1 *Tinca tinca* (Linnaeus, 1758)

Cyprinus Tinca Linnaeus, 1758: 321 (based on Artedi [1738: gen. 4 [27], syn. 5, spec. 27 [4], Cyprinus mucosus ...] and Linnaeus [1746: 122, n. 321, Cyprinus ... ossiculorum [1]; type locality: "in Europae stagnis, lacubus"; type material: NT)

Cyprinus Tinca Auratus Bloch, 1782: 90, pl. 15 (type locality: pond in Schönhausen castle, Germany, introduced from Schlesien [now Poland]; holotype: ZMB 3312)

Tinca aurea Gmelin, 1788: 1414 (not binominal, name not available; refers to Bloch, 1782: 90, pl. 15)

Cyprinus zeelt La Cepède, 1803: 550, 552 (type locality: not stated; holotype: MNHN ?)

Cyprinus tincauratus La Cepède, 1803: 541, 542 (unnecessary replacement name for *Cyprinus tinca auratus* Bloch, 1782)

Cyprinus Tincaurea Shaw, 1804: vol. 5 (1): 217, pl. 130 (unnecessary replacement name for *Cyprinus tinca auratus* Bloch, 1782)

Tinca vulgaris Fleming, 1828 (type locality: "lakes and rivers, England"; available by description and by indication to earlier sources; type material: NT ?)

Tinca chrysitis Fitzinger, 1832: 337 (unnecessary replacement name for *Cyprinus tinca* Linnaeus, 1758; author indicated as Agassiz, but Fitzinger is actual author)

Tinca Italica Bonaparte, 1836: [fasc. 18, p. 205], pl. 109 fig. 1 (type locality: Italy; syntypes: ANSP 6119–6122 [4], Böhlke, 1984: 79)

Tinca vulgaris var. *maculata* Costa, 1838: fasc. 19: 10, pl. 12 (infrasubspecific, name not available; localities: lakes Vulture and Matese, Italy)

Tinca communis Swainson, 1839: 285 (available by indication to Bloch, 1782, pl. 14 [*Cyprinus tinca*])

Tinca limosa Koch, in Koch, Herrich-Schäffer & Forster, 1840: 40 (unnecessary replacement name for *Cyprinus tinca* Linnaeus, 1758)

Tinca Linnéi Malm, 1877: 564 (unnecessary replacement name for *Cyprinus tinca* Linnaeus, 1758)

Tinca vulgaris var. *Cestellae* Segre, 1904: 2 (type locality: lake Cestella, Padola, Cadore, Alpi Venete, Italy; syntypes [total 38]: MZUT 1448 [3], Tortonese, 1940: 140)

5.27.1 '*Tropidophoxinellus*' *hellenicus* (Stephanidis, 1939)

Rutilus alburnoides hellenicus Stephanidis, 1939a: 23, pl. 3 (type locality: lakes Trichonis and Lyssimachia, Greece; syntypes: lost ? [40])

Systematic notes. The generic position of this species is not clear. Bianco (1988b: 9) suggests that it might belong to the genus *Alburnus*. A direct comparison of the two species placed in *Tropidophoxinellus* shows that they are not closely related. They differ in body and head shape, mouth structure, etc. The only character they share is the presence of a ventral keel between pelvic fins and anus, a character present in many other genera. The species shows some resemblance with *Alburnus*, but it differs in having a very weak symphysal knob on the dentary (vs. well developed), the upper jaw protactible (vs. only slightly) with premaxilla with a very long ascending process (vs. short), and apparently a different structure of the keel. It apparently also differs from *Alburnus* species in having fewer branched anal rays (8–10, vs. 10–20).

It is provisionally retained in *Tropidophoxinellus*, avaiting for a more detailed study of its relationships. Transferring it provisionally to *Alburnus* (where is is likely not to remain) presents no advantage at this stage.

Nomenclatural notes. This name is available from Stephanidis (1939a) and the types and type locality are those specimens and locality mentioned in this paper. Stephanidis referred to another '1939' paper as containing the original description, but this paper did not appear until 1971 (see comment under *T. spartiaticus*). Stephanidis (1971a) actually is this '1939' paper in its original form, with footnotes updating it. The 'original' description (1971a: 180) has obviously no validity having appeared much later than the 'accidental' description of 1939a.

5.27.2 *Tropidophoxinellus spartiaticus* (Schmidt-Ries, 1943)

Rutilus spartiaticus Schmidt-Ries, 1943: 332 (type locality: Peloponese, Greece; type material: NT ?)

Rutilus spartiaticus Stephanidis, 1971a: 176, fig. 3 (type locality: river Eurotas near Sparta, Kelefinas, Mangoulitsa, Rezinas and Vassilopotamos, Greece; syntypes: MNHN 1975-849, B. Elvira, pers. comm., 1995 [total: 46, rest apparently lost]; a junior primary homonym of *R. spartiacus* Schmidt-Ries, 1943)

Rutilus spartiacus var. *megalophthalmus* Stephanidis, 1971a: 180, fig. 4 (infrasubspecific, name not available)

Systematic notes. Bianco (1988b: 9) suggested that this species might belong to the genus *Scardinius*, but without providing data.

Nomenclatural notes. Schmidt-Ries's (1943) brief diagnosis makes the name *R. spartiaticus* available. His account refers to a publication by Stephanidis dated 1939 in Acta Instituti et Musei Zoologici Universitatis Atheniensis, vol. 2, fasc. 5/6. Stephanidis (1971a: 163) explains that the paper was ready for printing when the journal was discontinued and that this is the reason why he mentions the paper in his own 1939 publications. Schmidt-Ries, who had seen Stephanidis's manuscript, probably believed that the paper was published inbetween. The paper was finally published in 1971 (Stephanidis, 1971a).

5.28.1 *Vimba elongata* (Valenciennes, 1844)

Abramis elongatus Agassiz, 1835b: 39 (nomen nudum)

Abramis elongatus Valenciennes, in Cuvier & Valenciennes, 1844: 75 (type locality: river Danube; type material: not stated; based on a drawing sent by Agassiz, the material on which the drawing is based is possibly in MHNN)

Systematic notes. *Vimba* is considered as a synonym of *Abramis* by Howes (1981: 46).

Uiblein & Winkler (1994) analysed the morphometry of Austrian *Vimba*. Their conceptual base is quite confusing and blurred by semantic problems: e.g., the dichotomy between a so-called taxonomic hypothesis and a functional hypothesis, the labelling of species as populations, the poor morphological definitions of body landmarks used, the neglect of many other potentially useful characters, and a unusual understanding of fish morphology (p. 57–58: "... common variation in morphometric and meristic traits such as ... the number of gill-rakers are functionally interconnected with specific habitat parameters, such as current velocity and the availability of certain food types"; as a rule, meristic characters have a genetic basis). Uiblein & Winkler reached no taxonomic conclusion, but observed a "high variability in morphometric characters among ecologically separable groups of *Vimba* which are best explained by ongoing processes of adaptation to spatial food preference" (p. 57). To the systematist, this kind of argument is unlikely to yield an answer to the question 'is *V. elongata* specifically distinct from *V. vimba* ?' According to the authors, the two "forms" clearly differ in distribution, habitat, feeding, reproduction, spawning migrations, etc., and, as they pointed out (p. 63), lake forms in most fish groups have a deeper body, etc., while it is the reverse in the present case. From the available information, I see no reason to doubt that each form fits into what has been defined as a species in the Introduction.

Nomenclatural notes. This species is often listed as "*Abramis elongata* Agassiz, 1835". Actually, Agassiz merely listed the name and did not provide any description, diagnosis or indication (in the sense of ICZN art. 12(b)(1)) and it is thus a nomen nudum.

5.28.2 *Vimba melanops* (Heckel, 1837)

Abramis melanops Heckel, 1837: 154, pl. 9 fig. 3 (type locality: river Marizza [near Philippoli] in Rumelia [southern Bulgaria]; holotype: NMW 55270)

Abramis elongatus var. *asianus* Steindachner, 1897: 689, pl. 4 fig. 1 (type locality: Kiutahia-Su near Eskischehir, Turkey; syntypes: NMW 55251 [5])

Systematic notes. Bănărescu (1964: 403; Bănărescu et al., 1970) considers *Vimba elongata* and *V. melanops* as two valid species.

5.28.3 *Vimba vimba* (Linnaeus, 1758)

Cyprinus Vimba Linnaeus, 1758: 325 (based on Linnaeus [1746: 123, n. 326, Cyprinus ... radiis 24] and Artedi [1738: gen. 6 [18], syn. 14, spec. 18 [6], Cyprinus rostro nasiformi ...]; type locality: "in Sveciae lacubus"; type material: NT)

Cyprinus Zerta Leske, 1774: 44 (type locality: Leipzig, Germany; type material: possibly LSL 71, Wheeler, 1985: 5, 33)

Cyprinus persa Gmelin, 1774: 233, 241 (nomen nudum; locality: Caspian Sea)

Cyprinus vimpa Strøm, 1784: 120 (type locality: Eger [in Boskerud District, south west of Oslo], Norway; type material: NT)

Cyprinus Serta Shaw, 1804: vol. 5 (1): 232 (unnecessary replacement name for *Cyprinus vimba* Linnaeus, 1758)

Cyprinus Persa Pallas, 1814: 310 (type locality: "Persa; in lacubus ad Cyrum"[Iran, in lakes along river Kura]; syntypes: LU)

Cyprinus carinatus Pallas, 1814: 323 (type locality: river Don and Azov Sea; syntypes: LU)

Abramis tenellus Nordmann, 1840: 510 (type locality: stream Tschornaïa Retschka near Inkerman, near Sevastopol, Crimea, Ukraine; syntypes: LU)

Abramis frivaldszkyi Heckel, 1843: 1032 (type locality: Brussa, in Notolien [Anatolia], Turkey; syntypes: NMW [not yet located; B. Herzig, pers. comm., 1995])

Leuciscus parvulus Valenciennes, in Cuvier & Valenciennes, 1844: 64, pl. 487 (type locality: Crimea, Ukraine; holotype: MNHN 3954, Bertin & Estève, 1948: 78)

Abramis Nordmannii Dybowski, 1862: 179 (type locality: Crimea, Ukraine; available by short diagnosis and indication to *A. melanops* of Nordmann, 1842: pl. 22 fig. 2; syntypes: LU)

Abramis parsa [sic] var. *pontica* Yashchenko, **1895: 90** (nomen nudum; locality: river Salgir where it enters the Sivash, [Biyuk-Karasu basin], southern Crimea, Ukraine) from Berg, 1949: 796 and N. da Costa Pereira, pers. comm.

Vimba vimba tenella natio *karasuensis* Tseeb & Delyamure, **1938: 145** (infrasubspecific, name not available; river Biyuk-Karasu, Black Sea basin) from Berg, 1949: 796

Vimba vimba bergi Velikokhatko, **1940: 273** (river Bug upstream as far as Aleksandrovskaya Hydroelectric Station, Ukraine) from Berg, 1949: 795

Vimba vimba vimba infranatio *borysthenica* Velikokhatko, **1940: 272** (infrasubspecific, name not available; lower river Dnieper to river Konka, Ukraine) from Berg, 1949: 791

Vimba vimba tenella natio *istanbulensis* Battalgil, 1941: 181 (infrasubspecific, name not available; locality: stream Kâathane, draining to the Bosphorus near Istanbul, Turkey [European side])

Vimba vimba tenella natio *sapancae* Battalgil, 1941: 181 (infrasubspecific, name not available; locality: lake Sapanca, Turkey)

Vimba vimba tenella natio *nicaeensis* Battalgil, 1941: 181 (infrasubspecific, name not available; locality: lake Iznik, Turkey)

Vimba vimba tenella natio *aphnitis* Battalgil, 1941: 181 (infrasubspecific, name not available; locality: lake Manyas, Turkey)

Vimba vimba tenella natio *abulyontis* Battalgil, 1941: 181 (infrasubspecific, name not available; locality: lake Abulyont, Turkey)

Acanthobrama mirabilis Ladiges, 1960: 132, fig. 4 (type locality: river Menderes near Saraköy, Denizli Prov., Turkey; holotype: ZMH 1084, Wilkens, 1977: 157)

Systematic notes. *Vimba vimba carinata* is considered as a distinct subspecies by Balon et al. (1987: 241) who do not provide explicit evidence, while Bănărescu et al. (1970: 69) could not distinguish subspecies within *V. vimba*. Bănărescu et al. (1963: 398, 1970: 69) considered that two (possibly three) forms differing by body shape and spawning season coexist over most of the range of the species which actually may be reproductively isolated; Balon et al. (1987: 245) disagree.

Nomenclatural notes. When creating the name *Cyprinus persa*, Gmelin (1774: 233, 241) wrote that the species is already described in "Comment. Acad. Petersb." without providing exact reference. I could find no later reference to such a paper by Gmelin. As it is not accompanied by a description or an indication (sensu ICZN art. 12(b)), the name is a nomen nudum. The same name has been used again by Pallas (1814: 310) who based his description on Gmelin's manuscript, implying that the description has not been published. Pallas is author of the name as he is author of the conditions making it available.

Bănărescu et al. (1970: 47) indicate the author of *Abramis persa pontica* as Kessler (1877: 192), but I could not find it in this publication. Berg (1949: 796) states that this is an unpublished museum name of Kessler, first published in Yashchenko (**1895: 90**).

Cobitidae

The family name Cobitidae has sometime been spelt Cobitididae. The spelling Cobitidae has been confirmed by a ruling of the International Commission on Zoological Nomenclature (1988; see Kottelat, 1986 for history).

6.1.1 *Cobitis bilineata* Canestrini, 1866

Cobitis taenia var. *bilineata* Canestrini, 1866: 148 (type locality: Modenese and Treviso, Italy; syntypes: LU)

Cobitis taenia var. *puta* Cantoni, 1882: 362, pl. 1 fig. 1 (type locality: Torino and Vercellese, Italy; syntypes: LU)

Cobitis taenia var. *septa* Cantoni, 1882: 363, pl. 1 fig. 2 (type locality: Italy; type material: NT ?)

Cobitis taenia zanandreai Cavicchioli, 1965: 1152, fig. 1 (type locality: river Volturno at Ponte Annibale, Capua, Caserta, Italy; holotype: Istituto di Anatomia Comparata, Università di Ferrara)

Systematic notes. As implied by Vasiljev & Vasiljeva (1994: 67), a comparison of their karyological data of Russian *Cobitis* with those of the Italian one by Cataudella et al. (1977: 163) indicates that the Italian material is not conspecific with any of the species known from the former USSR. I hypothesise that the species is restricted to the Italian peninsula and material from central Europe is conspecific with the Scandinavian *C. taenia*; both hypotheses need confirmation. See *C. taenia* for further comments.

Nalbant (1993: 108) lists *C. zanandreai* as a valid species, without supporting discussion or data.

Nomenclatural notes. I tentatively hypothesise that the species is restricted to the Italian peninsula and use the older available name for it. Among the many taxa considered to be synonyms of *C. taenia*, only *C. spilura* Holandre, 1837 was published before *C. bilineata*.

6.1.2 *'Cobitis' calderoni* Bacescu, 1962

Cobitis Calderóni Bacescu, 1962a: 440, pl. 1 figs. 2–3, pl. 2 figs. 6–7 (type locality: stream Arlanzón, tributary of river Duero at Cardena-Jimeno, Charcas de San Medel and La Gravera, Burgos, Spain; holotype: MGAB 7 [now 49415, P. Bacalu, pers. comm.])

Systematic notes. As indicated by Vasiljeva et al. (1992: 82 [translation]), this species does not belong to *Cobitis* and it should probably be placed in a genus of its own once the relationships within *Cobitis* sensu lato are understood.

Nomenclatural notes. The "type locality" given by Bacescu (1962a: 440) is obviously the combination of three localities. Exact locality data of the holotype are apparently lost; according to P. Bacalu (pers. comm.), data associated with the specimen in MGAB are 'Arlanzon river'. All localities listed by Bacescu are within a radius of ca. 2 km (B. Elvira, pers. comm. 1995). The actual publication date is 1962 and not 1961 as is usually indicated.

6.1.3 *Cobitis elongata* Heckel & Kner, 1858

Cobitis elongata Heckel & Kner, 1858: 305, fig. 164 (type locality: river Sala near Idria, Krain, Slovenia; syntypes: NMW 48609–610 [5])

Systematic notes. See Bănărescu & Nalbant (1957).

6.1.4 *Cobitis elongatoides* Bacescu & Maier, 1969

Cobitis taenia var. *elongatoïdes* Bacescu, 1962b: 294 (infrasubspecific, name not available; locality: rivers Neajlov, Jiu and Sîi, southwestern Romania)

Cobitis taenia elongatoides Bacescu & Maier, 1969: 39 [of translation], figs. 3a, 7-1 (type locality: river Argesel, Danube basin, Romania; syntypes: LU)

Cobitis taenia danubialis Nalbant, 1993: 109 (type locality: river Mures at Sarmas, Harghita, Transilvania, Romania; holotype: MGAB 49923)

Systematic notes. Nalbant (1993) treated *C. elongatoides* (as *C. t. danubialis*) as a subspecies of *C. taenia* but he did not explain this status and did not indicate the characters distinguishing the two taxa. *Cobitis elongatoides* is tentatively accepted as valid species, pending a critical revision of the genus.

Nomenclatural notes. In the original description of *C. danubialis*, Nalbant (1993: 109) listed Bacescu as author of the name. The text, however, makes it clear that Nalbant is author of both the name and for satisfying the criteria of availability and he is thus to be treated as author of the name (ICZN, art. 50(a)).

In Bacescu & Maier (1969), the name *C. taenia elongatoides* is used. The mention in the text of characters distinguishing it makes the name available, although it is nowhere clearly stated on which material it is based, but there is an explicit mention of a locality, which becomes type locality.

Nalbant proposed *C. danubialis* as a valid name for the taxon named *C. taenia* var. *elongatoides* by Bacescu (1962b: 294) as this name is not available. He overlooked that the name *C. t. elongatoides* is available from Bacescu & Maier (1969: 39) for apparently the same species and clearly has priority over *C. danubialis*.

6.1.5 *Cobitis megaspila* Nalbant, 1993

Cobitis megaspila Nalbant, 1993: 108, figs. 24–28 (type locality: delta of river Danube at Caraorman, Romania; holotype: ISBB 4497)

6.1.6 *Cobitis meridionalis* Karaman, 1924

Cobitis taenia meridionalis Karaman, 1924b: 75 (type locality: lake Prespa and its small tributaries, FYROM and Greece; syntypes: LU)

Systematic notes. Considered as valid by Economidis (1991: 29, 41, fig. 3) and Economidis & Nalbant (in press).

6.1.7 *Cobitis paludica* (de Buen, 1930)

Acanthopsis taenia forma *paludica* de Buen, 1930: 33, fig. 48 (type locality: Fuente del Roble, Talayuela, Cáceres, Spain; holotype: LU; available by indication [ICZN art. 12(b)(7)])

Cobitis taenia paludicola Berg, 1932a: 155 (unjustified emendation of *C. taenia paludica* de Buen, 1930)

Cobitis taenia haasi Klausewitz, 1955: 42, fig. 2 (type locality: Albufera near Valencia, Spain; holotype: SMF 3232)

Systematic notes. *Cobitis paludica* was considered a synonym of *C. maroccana* Pellegrin, 1929 (p. 525, fig. 1; type locality: Oued Tiflet at Tiflet and Sidi Yahia, Morocco) by Doadrio et al. (1988: 156) and Vasiljeva et al. (1992). Doadrio (1994: 26) considers them as specifically distinct, a point of view apparently supported by data in Perdices et al. (1995). A detailed morphological comparison of the African and Iberian stocks would be desirable.

6.1.8 *Cobitis stephanidisi* Economidis, 1992

Cobitis stephanidisi Economidis, 1991: 27, 41 (fig. 7) (nomen nudum; locality: Kefalovrissos spring in Velestino village (Feres), Thessaly, Greece)

Cobitis stephanidisi Economidis, 1992: 60 (type locality: lake Karlas and Kefalovrissos spring in Velestino village (Feres), Thessaly, Greece; syntypes [material listed by Economidis & Nalbant, in press]: DZAUT 1992-40 [1], 1988-30 [9], 1989-13 [56], 1989-35 [26], 1992-37 [23], ISBB 4572 [33], USNM 330137 [1], SMF [4], MNHN 1994-516 [2], NMW 92822 [3])

Nomenclatural notes. The complete description *Cobitis stephanidisi* is in Economidis & Nalbant (in press); however, the use of the name accompanied by a diagnosis and a figure in Economidis (1992) makes the name available from this publication and with Economidis as author.

6.1.9 *Cobitis strumicae* Karaman, 1955

Cobitis taenia strumicae Karaman, 1955: 190, fig. 4 (type locality: Monospitovo swamp and river Strumica, FYROM; syntypes: LU)

Cobitis peschevi Sivkov & Dobrovolov, 1984: 1673, fig. 1 (type locality: river Eleshnitsa, a tributary of river Kamchiya, Bulgaria; holotype: MNHV 1627)

Systematic notes. Considered valid by Economidis (1991: 27) and Economidis & Nalbant (in press). Synonymy follows Economidis & Nalbant (in press).

6.1.10 *Cobitis taenia* Linnaeus, 1758

Cobitis Taenia Linnaeus, 1758: 303 (based on Artedi [1738: gen. 2 [4], syn. 3, spec. 4 [2], Cobitis aculeo bifurco ...], Linnaeus [1746: 126, n. 333, idem] and Gronovius [1754: 2, n. 5, idem]; type locality: lake Mälaren, Sweden [by present restriction; see Nomenclatural notes]; syntype: ? UUMZ 205, Wheeler, 1991: 163)

Cobitis spilura Holandre, 1837b: 253 (type locality: Liège, Belgium / river Moselle, stream Nied, below Malroy, river Meuse below Saint Mihiel, France; holotype: LU [description explicitly based on a single specimen; "syntypes": Mus. Metz, Blanchard, 1866: 288]; author stated as Carlier, but Holandre is responsible for conditions making name available and thus is author)

? *Cobitinula anatoliae* Hanko, 1924: pl. 3 fig. 6 (type locality: lake Ak-Göl, Turkey; syntypes: MNH [2]); synonymy according to Coad & Sarieyyüpoglu, 1988: 426

Cobitis taenia ohridana Karaman, 1928: 162, figs. 4a, 5 (type locality: lake Ohrid, FYROM; syntypes: LU); repeated in 1929: 173

Cobitis taenia narentana Karaman, 1928: 163 (type locality: river Neretva, Dalmatia (Croatia and Bosnia); syntypes: LU); repeated in 1929: 173

Cobitis taenia dalmatina Karaman, 1928: 163 (type locality: river Cetina, Dalmatia; syntypes: LU); repeated in 1929: 173

? *Cobitis taenia tanaitica* Bacescu & Maier, 1969: 39 [of translation], fig. 1 (type locality: river Don below Rostov, Ukraine; syntypes: LU [6])

Cobitis taenioides Bacescu & Maier, 1969: 39 [of translation] (type locality: western Europe and Danube basin; syntypes: LU)

Systematic notes. Vasiljev & Vasiljeva (1994: 67) report that '*C. taenia*' of the former USSR actually includes at least 3 and probably up to 5 species. The identification of one of the Russian species as *C. taenia* sensu stricto is tentatively accepted, but comparison with and karyological data of material from the type locality of *C. taenia* is needed to confirm this hypothesis. Data on material of the Rhine basin is needed to confirm the conspecificity of *C. spilura* and *C. taenia*. The Italian material is not conspecific with any of the Russian species and is treated as a distinct species, *C. bilineata*. It seems likely that several populations from south-eastern Europe will turn out to be distinct species once examined in detail. *Cobitis meridionalis* and *C. strumicae* are considered as valid species by Economidis (1991) and Bănărescu (1992b: 753, 755).

Ráb & Slavík (1996) report a diploid-triploid-tetraploid complex involving *C. taenia* and an unidentified species in the Elbe basin in the Czech Republic. Again the identification of *C. taenia* will requires a comparison with material from the type locality. The unidentified species (fig. 4b) shows some superficial affinities with *C. elongatoides* as illustrated by Nalbant (1993: 104, as *C. t. danubialis*), but this should be confirmed by examination of well preserved material of both. The existence of triploids in European waters is also reported by Boroń (1992) from the Vistula basin in Poland and by Sofradžija & Berberovič (**1978**, cited by Ráb & Slavík, 1996: 203) from the Morova basin in Bosnia. See Ráb & Slavík (1996) for a review of chromosome numbers in the genus *Cobitis*. Boroń (1992: 205) identified *C. granoei* as one of the parent of the triploid she described, a conclusion not supported by Ráb & Slavík (1996: 209). [Note that *C. granoei* Rendahl, 1935 is a synonym of *C. melanoleuca* Nichols, 1925 according to Nalbant (1993: 108).]

Nomenclatural notes. The type locality of *C. taenia* presently encompasses most of Europe. Linnaeus's (1758) description is based on three earlier literature accounts and the specimens on which these accounts are based are syntypes and their localities together constitute the type locality. These accounts are in Artedi (1738), Linnaeus (1746) and Gronovius (1754). Artedi's account is based on specimens from lake Mälaren (west of Stockholm), Sweden and literature accounts by Rondelet (1555: 204), Aldrovandri (1613: 617), Gesner (edition not stated, pp. 404, 482; 1563: 163), Charleton (1668: 157), Jonston (1649: pl. 26 fig. 21, pl. 46 fig. 1), Willughby (1686: 265, 266), Ray (1710: 124), Schonevelde (1624: 74, pl. 4 fig. 12), and Hildegarde de Pinguia (1533: 92). Linnaeus's (1746) account is possibly based on material from lake Mälaren too, on the above-mentionned account by Artedi, on the same accounts by Rondelet, Gesner, Jonston, Charleton, Schonevelde, Willughby, and Ray, and on Marsili (1726: part 3, pl. 1 fig. 2). Gronovius's account is based on specimens from Bruxelles (Belgium) and the same accounts by Artedi and Marsili. I have not checked all these secondary references, but some of them probably refer to earlier ones too. In summary, the type locality of *Cobitis taenia* includes a collection of localities probably including Sweden, France, Germany, England, Italy and the middle Danube, that is several of the species recognised here. As first reviser, I retain lake Mälaren (the only locality explicitly mentionned by Linnaeus and Artedi) as type locality. A possibly syntype survives in Linnaeus's collection (Wheeler, 1991: 163).

In Bacescu & Maier (1969), the name *C. taenioides* (also misspelt *C. taeṅoides*) is used. The mention of characters distinguishing it in the text makes this name available, although it is nowhere clearly stated on which material it is based. The type locality is ambiguous, *C. taenioides* is once recorded from western Europe, once from the Danube basin, once from the "rest of Europe" [p. 39].

6.1.11 *Cobitis trichonica* Stephanidis, 1974

Cobitis trichonica Stephanidis, 1974a: 227, figs. 1–3 (type locality: lake Trichonis, Greece [by present restriction]; syntypes: lost ?)

Nomenclatural notes. Stephanidis (1974a: 227) designated two "holotypes", a male and a female. As there should be a single specimen designated as holotype, this designation is not valid and all the 34 specimens he examined are syntypes. As there is no holotype, there is no clear type locality and as first reviser, I restrict the type locality to lake Trichonis because this is the locality where Stephanidis's "holotypes" have been collected. Stephanidis's material is apparently lost (Economidis, pers. comm., Feb. 1996), so that a lectotype designation is not possible.

6.1.12 *Cobitis vardarensis* Karaman, 1928

Cobitis taenia vardarensis Karaman, 1928: 163 (type locality: basin of river Vardar, FYROM; syntypes: LU); repeated in 1929: 172

Systematic notes. Treated as valid species by Economidis (1991: 27) and Nalbant (1993: 107).

6.1.13 *Cobitis* sp. 1

Cobitis punctilineata Economidis, 1991: 28, 41 (fig. 4), 1992: 75 (nomen nudum; locality: stream Aggitis, tributary of river Strymon, Philippi plain, Greece)

Nomenclatural notes. This species is described and formally named by Economidis & Nalbant (in press).

6.1.14 *Cobitis* sp. 2

Cobitis hellenica Economidis, 1991: 28, 41 (figs. 1–2), 1992: 75 (nomen nudum; locality not stated)

Nomenclatural notes. This species is described and formally named by Econimodis & Nalbant (in press).

6.1.15 *Cobitis* sp. 3

Cobitis hellenica arahthosensis Economidis, 1991: 28, 1992: 75 (nomen nudum; locality: rivers Louros and Arachthos, Epirus, Greece)

Nomenclatural notes. This species is described and formally named by Economidis & Nalbant (in press).

6.2.1 *Misgurnus anguillicaudatus* (Cantor, 1842) introduced

Nomenclatural notes. This species has been reported as introduced in Germany, as *M. mizolepis* Günther, 1888 (Riffel et al., 1994). Reasons for identifying this population as *M. mizolepis* are not stated. The latest systematic revision of the Chinese species of the genus *Misgurnus* treats *M. mizolepis* as a synonym of *M. anguillicaudatus* (Chen, 1981) and this is tentatively followed here. Considering the morphological and karyological variability observed in the species, it would not be surprising if a more detailed study shows that several species are confused under the name *M. anguillicaudatus*. Whatever its identity, the species is likely to evolve as a threat to other aquatic organisms.

6.2.2 *Misgurnus fossilis* (Linnaeus, 1758)

Cobitis fossilis Linnaeus, 1758: 303 (based on J. F. Gronovius [1748: 79, pl. 3, Cobitis aculeo bifurco ...], Artedi [1738: gen. [spec.] 2, syn. 3, Cobitis caerulescens ...] and Linnaeus [**1754**: 76, idem]; type locality: "in Europa"; syntypes: BMNH 1853.11.12:121 [1], NRM 69 [1], Wheeler, 1958: 213, Fernholm & Wheeler, 1983: 218)

? *Petromizon* [sic] *variegatus* Wulff, 1765: 16 (type locality: Borussia [Prussia]; type material: NT)

Nomenclatural notes. The original description of *Petromizon variegatus* Wulff (1765: 16) is ambiguous. The species is placed in the genus '*Petromizon*' diagnosed by the presence of "7 spiracles", but the synonymy and description are indicative that at least part of the article is based on a loach and most likely *M. fossilis*; it is restricted here to this meaning.

6.3.1 *Sabanejewia balcanica* (Karaman, 1922)

? *Cobitis aurata* Filippi, 1863: 391 (type locality: Sartschem [apparently Sarcham-e Sofla, 39°07'N 47°54'E, B. W. Coad, pers. comm; near the falling of river Zanjan into Qezel Owzan; Berg, 1949], Iran; lectotype: MZUT 674, designated by Tortonese, 1961: 188)

? *Cobitis hohenackeri* Kessler, 1877a: 177 (type locality: river Kura, Caspian Sea basin, Azerbaidjan [Berg, 1949: 894]; syntypes: LU; author indicated as Brandt, but Kessler is actual author)

? *Cobitis aralensis* Kessler, 1877a: 184 (type locality: mouth of rivers Syr-Darya and Amu-Darya, Aral Sea [Berg, 1949: 895]; syntypes: LU)

Cobitis balcanica Karaman, 1922: 307 (type locality: river Vardar [and its tributaries near Skopje (Üskub) and Veles], FYROM, restricted by Bănărescu et al., 1972: 1; syntypes: LU, ?MNHN 28-222 [1], Bertin & Estève, 1948: 93)

Cobitis montana Vladykov, 1925b: 320 (type locality: streams Apšica, Terešovka, Teresulka, Luzanka and Terebla, tributaries of river Theiss [Tisza]; and river Theiss between villages Akna-Slatina and Buštino, Ukraine; syntypes: LU [219])

Cobitis aurata balcanica natio *radnensis* Jaszfalusi, 1951: 116, pl. 1 fig. 1 (infrasubspecific, name not available; locality: river Zebrak, a tributary of the Szamos [Somesul ?] / river Maros [Mures] near Gödemesterháza and creek Göde, Romania)

Cobitis aurata vallachica Nalbant, 1957: 209, figs. 1–3 (type locality: river Ialomitza near Crivina, north-east Vallachia, Romania; holotype: SMF 4087)

Cobitis aurata radnensis Bănărescu, Müller & Nalbant, 1960: 124 (short diagnosis; locality: upper rivers Mures and Tirnava, Romania; syntypes: LU)

Cobitis aurata bosniaca Karaman, 1963: 629, fig. 1 (type locality: creeks Saturlija and Siroka Rijeka near Banja Luka, Vrba basin, Bosnia; syntypes: LU [144])

? *Sabanejewia aurata kubanica* Vasiljeva & Vasiljev, 1988: 210 [p. 33 of translation], fig. 2 (type locality: river Nevinka, Kuban basin, Russia; holotype; ZMMSU P-16384)

Sabanejewia aurata baltica Witkowski, 1994: 44, fig. 10 (type locality: river Widawa near village Kielczopwek, 4 km from Wroclaw, river Oder basin, Poland, 51°18'N 17°12'E); holotype: NMHW 638)

? *Sabanejewia aurata doiranica* Economidis, 1995: 211 (nomen nudum)

? *Sabanejewia aurata thrakica* Economidis, 1995: 211 (nomen nudum)

Systematic notes. Bănărescu et al. (1972: 3) consider *S. balcanica*, *S. bulgarica*, *S. radnensis* and *S. vallachica* as valid subspecies of *S. aurata* in Romania. The sympatric occurrence (Bănărescu et al., 1972: p. 38) of *S. balcanica* (or "intergrades" *balcanica-vallachica*) and *S. bulgarica* indicates that they represent two species, as already concluded by Vasiljeva & Vasiljev (1988). *Sabanejewia vallachica* and *S. radnensis* are tentatively considered conspecific with *S. balcanica*. The data in Bănărescu et al. (1972: 41) could suggest that *S. balcanica* and *S. vallachica* are distinct, but as the range of *S. vallachica* is quite restricted with a larger area occupied by *balcanica-vallachica* "intergrades", I treat them as a clinal variation of a single species.

Sabanejewia aurata has been described from Iran and subsequently several nominal species have been referred to it, as synonyms or as subspecies, resulting in a complex polytypic species extending from the Aral Sea to Iran South and West of the Caspian Sea, a narrow corridor across Russia and Ukraine, and the Danube basin (Bănărescu, 1992b: 688, fig. 11/10). This distribution range is quite tortuous and apparently unique. In Iran, *S. aurata* is known from the basins of the Safid Rud (where the type locality is situated; Caspian Sea drainage) and Tedzhen (a small endorheic basin in north-eastern Iran) (Coad, 1980: 96). It is not known from Turkey according to Bănărescu & Nalbant (1964: 182); subsequent records from eastern Turkey (Kuru, 1971; Erkakan & Kuru, 1982) are likely but need confirmation. As discussed above, in the Danube basin, especially Romania where detailed data are available (Bănărescu et al., 1972), what was treated as a single polytypic species under the BSC actually is at least two species under the PSC. Similar data are badly missing for the rest of the range of *S. 'aurata'* and at present it is not possible to know if one of the Danube species is possibly conspecific with the Iranian *S. aurata*. To consider one of them rather than another to be conspecific with *S. aurata* would be arbitrary given our present knowledge; and there would be no advantage in such an arbitrary treatment. I therefore consider tentatively that the real *S. aurata* is restricted to Iran and possibly adjacent areas, but does not occur in European waters. Vasiljeva & Vasiljev (1988) considered the populations of the Caspian Sea and the river Don basin as representing a single subspecies, while they could not conclude on the status of the populations of the Danube basin. They distinguish two groups of populations on the basis of details of colour pattern in the Danube basin. Vasiljeva & Ráb (1992) report that the karyotype of the *S. balcanica* from middle Danube basin differs from *S. aurata* (and *S. kubanica*).

The type locality of *S. balcanica* is in the

Vardar basin. Confirmation of the identification of the Danube *S. balcanica* populations by direct comparison with Vardar material is needed.

Sabanejewia 'aurata' is present in the Vistula and Njemen basins (Rolik, 1960) and the Oder basin (Frankiewicz, 1985). Frankiewicz commented that the Oder (Baltic Sea drainage) population could be distinguished as a subspecies as there were "considerable differences" between it and Dniester (Black Sea) specimens; he referred to his table 3 which only shows differences in body depth, pectoral-pelvic distance and eye diameter (the data of the Dniester population are from Rolik, 1967: 143, and it is not possible to know if the methods are the same).

The Baltic populations have been treated as a distinct subspecies by Witkowski (1994: 44). The character states used in the diagnosis apparently are indicative of interpopulation variation but most statements of the diagnosis are not supported by the data: more lateral spots (not supported by figure 2 which shows 8–19 in Baltic populations [numbers 1–7], vs. 8–18 in other populations of *S. balcanica* [numbers 9–27]), more dorsal spots (not supported by figure 4: 9–18, vs. 8–20), presence of large caudal spots (possibly uninformative; the range of variation illustrated in figure 8 is commonly observed in numerous species of the suborder Cobitoidei and may also be influenced by stress and fixative), shape and size of lower lip (not supported by figure 6 and text p. 33), shallow body (not supported by graphs in figures 5: maximum depth 12–18% SL, vs. 13–20; "minimum depth" [?] 6.5–9.5% SL, vs. 5.5–10.0), longer caudal fin (not supported by graphs in figure 5: 18.5–23.0, vs. 17–22 [I ignore specimens apparently aberrant]). The caudal peduncle seems longer (supported by graphs in figure 5: 18–25, vs. 15–23) and the shape of the suborbital spine seems to be slightly different). Here again, a problem is that the tabulated data includes original measurements and values compiled from 5 additional sources and we cannot judge of their compatibility.

Nomenclatural notes. *Cobitis aurata balcanica* natio *radnensis* Jaszfalusi, 1951 is not available because it is an infrasubspecific name. The use of this name as a subspecies with a short diagnosis in Bănărescu et al. (1960: 24) also makes it available, with Bănărescu, Müller & Nalbant as authors. The specimens then examined by these authors (not listed) are the syntypes. Its use as a subspecies in Bănărescu (1960) would also make it available by indication to Jaszfalusi (1951), with Jaszfalusi's material as syntypes. As the two publications appeared in 1960, their respective priority is determinant. Bănărescu (1960) is dated November 1960, Bănărescu et al. appeared in a volume for 1957–59 published in 1960; the exact publication date is unknown, but P. Bănărescu informed me that it appeared before his November 1960 paper and it thus has priority.

6.3.2 *Sabanejewia bulgarica* (Drensky, 1928)

Cobitis bulgarica Drensky, 1928: 171 fig. 5–2 (type locality: small tributaries of the Danube in Widdin [Vidin] and Danube mainstream at Krai Panaira, 3 km downriver of Widdin [Vidin], Bulgaria; syntypes: ? NRM 10432 [2])

Cobitis albicoloris Chichkoff, 1932: 368, pl. 1 fig. 3 (type locality: creek Provadiiska Rieca, Bulgaria; holotype: LU)

Cobitis taenia tesselatus Pietschmann, 1937: 29 (type locality: Widin [Vidin] on the lower Danube, Bulgaria; syntypes: NMW 48624 [2], EAWAG 996 [1])

Systematic notes. See *Sabanejewia balcanica* for comments. Vasiljeva & Vasiljev (1988) considered *S. bulgarica* as a valid species.

6.3.3 *Sabanejewia larvata* (Filippi, 1859)

Cobitis larvata Filippi, 1859: 50 (type locality: creeks near Settimo Torinese [North East of Torino], Italy; syntypes: MZUT 510 [4], Tortonese, 1940: 141, Mus. Zool. Univ. Pavia [1], Cantoni 1882: 366, ZMUC 439–441 [3], Nielsen, 1974: 49)

Cobitis taenia var. *conspersa* Cantoni, 1882: 364, pl. 1 fig. 3 (type locality: based on a specimen of unstated locality and reference to 2 specimens from Pavia, Italy, identified by B. Crivelli as *C. larvata*, cited by Pavesi, 1877: 499 [as p. 87]; syntypes [total 3]: Mus. Zool. Univ. Pavia [2], not listed by Cantoni, 1882)

Nomenclatural notes. Note that publication date of *C. larvata* is 1859. The often-cited paper (Filippi, 1860: lxxi) appeared after an earlier use of the name by Filippi (1859: 50).

6.3.4 *Sabanejewia romanica* (Bacesco, 1943)

Cobitis caspia romanica Bacesco, 1943: 137, figs. 4–6, 7G (type locality: river Bratia, a tributary of the Arges, at Vladesti, Muscel, Romania; lectotype: MGAB 49916, present designation)

Nomenclatural notes. Mihai-Bardan (1984: 458) lists a specimen as holotype. Bacesco (1943: 137) stated that he examined 185 specimens but nowhere designated a type or a holotype; so all specimens are syntypes. He stated a type locality (p. 137), but as there is no holotype, all the localities he listed (p. 140) are part of the type locality. The specimen considered as holotype by Mihai-Bardan, from the "terra typica" of Bacesco, is here designated as lectotype.

Balitoridae

Loaches of the subfamily Nemacheilinae (about 400 valid species, mainly in tropical and subtropical Asia) where long classified in the family Cobitidae. Anatomical and phylogenetic studies have shown that they actually belong to the same lineage as the hill-stream loaches of Southeast Asia (Sawada, 1982). This family had been classically called Homalopteridae, but the valid name is Balitoridae (Kottelat, 1988b); this has been confirmed by a ruling of the International Commission on Zoological Nomenclature (1993).

7.1.1 *Barbatula barbatula* (Linnaeus, 1758)

Cobitis barbatula Linnaeus, 1758: 303 (based on Artedi [1738: gen. [spec.] 2, syn. 2, Cobitis tota glabra...] and Linnaeus [1746: 125, n. 332, idem]; type locality: "in Europae, Asiae aquis dulcibus"; type material: NT)

Cobitis variabilis Günther, 1868: 355 (as a label in collection, name not available; locality: Moravia, Czech Republic)

Cobitis Barbatula Parisiensis De la Pylaie, 1835: 534 (nomen nudum; locality: Paris, France)

Cobitis Barbatula Pictava De la Pylaie, 1835: 534 (nomen nudum; locality: France)

Cobitis furstenbergii Bonaparte, 1846: 26 (nomen nudum; locality: eastern Germany [probably now Poland])

Cobitis Fürstenbergii Heckel & Kner, 1858: 301 (cited in synonymy, name not available; author indicated as Fitzinger [Prodr. Faun. Austr.] which is apparently Fitzinger [1832], but the name does not appear in this work)

Cobitis barbatula var. *pironae* Nardo, 1866: 143 (type locality: Basso Friuli, Italy; type material: NT ?)

Cobitis toni Dybowski, 1869: 957 (type locality: "common in both river systems" [rivers Onon and Ingoda, Amur basin, Siberia]; syntypes: ZISP ?, MNHN B-738 [8], MNHN B-739 [4])

Nemachilus Sturanyi Steindachner, 1892: 378, pl. 2 fig. 3 (type locality: lake Ohrid at Pestani, between Ohrid City and Naum monastery, FYROM; holotype: NMW 48440)

Nemachilus barbatulus vardarensis Karaman, 1928: 164 (type locality: basin of river Vardar, FYROM; syntypes: LU); repeated in 1929: 173

Nemacheilus barbatulus aberr. *erythrinna* Berg, 1933: 550 (infrasubspecific, name not available)

Noemacheilus barbatulus quignardi Bacescu-Mester, 1967: 359, figs. 1, 5c-d (type locality: river Le Lez near Montpellier, France; holotype: MGAB 77)

Nemacheilus barbatulus forma *anglicana* Bacescu-Mester, 1967: 369 (infrasubspecific, name not available; locality: river Cambridge, England)

Nemacheilus barbatulus forma *blackiana* Bacescu-Mester, 1967: 369 (infrasubspecific name not available; locality: river Black Beck, England)

Nemacheilus barbatulus forma *hispanica* Bacescu-Mester, 1967: 369, fig. 6a–b (infrasubspecific, name not available; locality: river Nervion at Durango and river Tajo, Spain)

Nemacheilus barbatulus hispanica Lelek, 1987: 256 (available by indication to Bacescu-Mester, 1967; type locality: river Nervion at Durango and river Tajo, Spain; syntypes: MGAB [11, material used by Bacescu-Mester, 1967])

Systematic notes. The status of several populations, especially in southern Europe (e.g., *N. b. pironae*, *N. b. sturanyi*, *N. b. vardarensis*, *N. b. quignardi*), needs a critical examination.

Nomenclatural notes. The common stone loach classically has been placed in the genus *Nemacheilus* Bleeker, 1863 whose type species is *N. fasciatus* (Valenciennes, in Cuvier & Valenciennes, 1846) from Java and Sumatra (Kottelat, 1987, 1990a: 43). *Nemacheilus* includes only species from Southeast Asia. The European species has more recently been called *Orthrias* Jordan & Fowler, 1903 (Bănărescu et al., 1978), but this name is a synonym of *Barbatula* Linck, 1789 (Kottelat, 1990a: 18).

7.1.2 *Barbatula bureschi* (Drensky, 1928)

Nemacheilus bureschi Drensky, 1928: 160, 179, fig. 1 (type locality: river Struma, near Semen railway station, Radomir District, Bulgaria; syntypes: NMNHS [2])

Systematic notes. Treated as one of four subspecies of *B. brandtii* (Kessler, 1877a: 174, pl. 6 fig. 23) by Bănărescu et al. (1978: 261). Awaiting a revision of this 'polytypic' species, I tentatively recognise *B. bureschi* as a valid species. Other 'subspecies' are: *B. b. brandtii* from the Arax basin in eastern Turkey and Azerbaidjan, *B. b. simavika* Balik & Bănărescu (in Bănărescu et al., 1978: 261) from stream Simav near Izmir, western Turkey, and *B. b. samantica* Bănărescu & Nalbant (in Bănărescu et al., 1978: 263) from Seyhan basin, southern central Turkey.

7.1.3 *Barbatula* sp.

Orthrias pindus Economidis, 1991: 26, p. 42 (fig. 4), 1992: 75 (nomen nudum; locality: river Aoos basin, Epirus, Greece)

Ictaluridae

***Ameiurus melas* (Rafinesque, 1820) introduced**

8.1.1 *Ameiurus nebulosus* (Lesueur, 1819) introduced

Ictalurus nebulosus pannonicus Harka & Pintér, 1990: 69 (type locality: river Tisza at Poroszló, Hungary; holotype: Mus. Nat. Sci. Budapest 87.1.1)

Systematic notes. The Hungarian introduced stock of the North American catfish *Ameiurus nebulosus* has been described as a distinct 'subspecies' on the claim that it is different from other introduced stocks in Europe or native ones in North America and the assumption that it might have had an hybrid origin. Beside the biological non sense of naming new taxa on the basis of introduced stocks of unknown origin, one may note that all the data on non-Hungarian stocks were based on the literature (without indication that terminology and method may be consistent), that no data are provided to support the hybrid hypothesis, and that recent North American literature on ictalurids has been largely ignored. Supposing that giving new names to introduced or captive stocks might make sense (to most systematists it certainly does not !), this should at least be based on direct examination of material of the already named, related taxa and should follow a study of the relevant literature on the wild populations of the species. For an introduction to recent literature on Ictaluridae, see, e.g., Jenkins & Burkhead (1993: 528–569) and Lundberg (1992).

***Ictalurus punctatus* (Rafinesque, 1818) introduced**

Siluridae

9.1.1 *Silurus aristotelis* Garman, 1890

Glanis Aristotelis Agassiz, 1856: 333 (nomen nudum; locality: river Achelous, Acarnania, Greece)

Silurus aristotelis Garman, 1890: 8 (type locality: river Achelous, Acarnania, Greece; syntypes: MCZ)

Nomenclatural notes. *Glanis aristotelis* Agassiz, 1856 is not available because Agassiz provided no description. Agassiz mainly said that the Greek silurid belong to a different genus than the northern European one and that he would describe it later, but he did not mention how they differ. The references (p. 332) to Aristotle cannot be considered as an indication because Aristotle did not describe the fish. Aristotle described its spawning behaviour, commented that Cordylus "has a tail like the Glanis", commented on the gill-arches ("other [fishes] have four [gills] but in two lines, except the last, as the kichle, the perke, the glanis, the cyprinos"), that the gall-bladder is on the liver (shared with "galeodes, rhine, leiobatos, narke"), but there is no information allowing recognition of the species.

The identity of Aristotle's glanis, cordylus, kichle, perke, cyprinos, etc. is in limbo. Despite the similarity of the names with names used in modern nomenclature, none of them can be unambiguously identified. Later authors in other countries identified their local fauna as the same species as mentionned by Aristotle, but without comparison with the Greek fauna. While there is an historical and linguistic interest in identifying these animals, I doubt it serves any purpose to base today's nomenclature on Aristotle's description.

9.1.2 *Silurus glanis* Linnaeus, 1758
Silurus Glanis Linnaeus, 1758: 304 (based on Linnaeus [**1751**: 61, Mal], Osbeck [**1756: 34, pl. 3**, Silurus], Artedi [1738: gen. [spec.] 82, syn. 110, Silurus cirris 4 in mento] and Gronovius [1754: 6, n. 25, Silurus cirris duobus ...]; type locality: "in Oriente, minus frequens in Europae lacubus"; syntype: BMNH 1853.11.12:168 [1], Wheeler, 1958: 214).
Silurus silurus Wulff, 1765: 33 (type locality: "in lacu Curonico ac Bandeburgico, ... in fluviis Pregelae, Memelae & ejusdem ostiis capiuntur", Germany; type material: NT ?)
Silurus glanis var. *aralensis* Kessler, 1872: 48 (type locality: Syr-Darya, Zeravshan, Amu-Darya, Aral Sea basin [Berg, 1949: 904]; syntypes: ZISP ?)

Esocidae

10.1.1 *Esox lucius* Linnaeus, 1758
Esox Lucius Linnaeus, 1758: 314 (based on Artedi [1738: gen. 10 [53], syn. 26, spec. 52 [14], Esox rostro plagioplateo], Linnaeus [1746: 114, n. 304, idem], and Gronovius [1754: 9, n. 28, idem]; type locality: "in Europa"; syntype: BMNH 1853.11.12:114 [1], Wheeler, 1958: 209)
Luccius Vorax Rafinesque Schmaltz, 1810b: 68 (unnecessary replacement name for *Esox lucius* Linnaeus, 1758)
Esox Lucius var. *variegatus* Fitzinger, 1832: 339 (infrasubspecific, name not available; localities; river Danube and lakes Erlaph and Schwarzensee, Austria)
Esox Reichertii var. *baicalensis* Dybowski, 1874: 392 (type locality: all lakes and ponds of lake Baikal basin [in lake Baikal only at the mouth of the tributaries], Siberia; syntypes: IZPAN ?)
Trematina foveolata Trautschold, **1884** (fossil) from Berg, 1948: 457
Esox lucius var. *atrox* Anikin, **1902: 109** (river Ob, Siberia) from Berg, 1948: 458
Esox lucius bergi Kaganovskii, **1933: 4** (river Anadyr, Siberia) from Berg, 1948: 458
Esox lucius lucius natio *wiliunensis* Kirillov, 1962: 37 (infrasubspecific, name not available; locality: river Vilyui basin, Yakutia, Siberia)

Umbridae

11.1.1 *Umbra krameri* Walbaum, 1792
Umbra Krameri Walbaum, 1792: 657 (type locality: Danube; syntypes: LU)
Aphyra lacustris Grossinger, 1794: 195 (not binominal, name not available [repeated in Hanko, 1923: 89; locality: Komitat Zemplén [Zemplin], now Slovakia [Hanko, 1923: 90])
Cyprinodon umbra Cuvier, 1829: 281 (type locality: "lakes of Austria, especially subterranean waters"; also available by indication to Kramer [1756: 396, Umbra]; syntypes: MNHN)
Umbra Krameri Fitzinger, 1832: 333 (unnecessary replacement name for *Cyprinodon umbra* Cuvier, 1829; junior homonym of *Umbra krameri* Walbaum, 1792)
Umbra lucifuga Gronow, 1854: 143 (available by

indication to Kramer [1756: 396, Umbra], Marsili [1726: pl. 13, Gobius caninus] and Gronovius [1763: 114]; type locality: "in cryptis Danubii" [river Danube]; holotype: BMNH 1853.11.12:98, Wheeler, 1958: 209)

Umbra canina Károli, 1882: 188 (type locality: lake Fertö, Pest, lake Balaton, Komadi, Bodrogköz, Hungary, and Wien, Austria [from translation in Berg, 1948: 456]; syntypes: LU)

Umbra krameri pavlovi Kux & Libosvárský, 1957: 219 (type locality: lake Kugurlui, Danube delta; syntypes: the 31 specimens measured by Pavlov, **1953**)

Systematic notes. *Umbra krameri pavlovi* is not considered valid by Baruš & Libosvárský (1983).

***Umbra pygmaea* (DeKay, 1842) introduced**

Osmeridae

12.1.1 *Osmerus eperlanus* (Linnaeus, 1758)

Salmo Eperlanus Linnaeus, 1758: 310 (based on Artedi [1738: gen. 10 [45], syn. 21, spec. 45 [10], Osmerus radiis pinnae ani 17 ...] and Linnaeus [1746: 118, n. 311, Osmerus radiis pinnae ...]; type locality: "in Europa, fluviis primo vere descendens"; syntype: LSL 45 [1], ? NRM 78 [1], Wheeler, 1985: 29)

Eperlanus Schonfoldii Rutty, 1772: 358 (work not consistently binominal, name not available (ICZN art. 11(c)); locality: Dublin, Ireland)

Salmo eperlano-marinus Bloch, 1782: 182, pl. 28 (type locality: North Sea and Baltic Sea; syntypes: ZMB 3736 [2])

Salmo Spirinchus Pallas, 1814: 387 (type locality: rivers and lakes of Germany, Russia, Ingria [now Russia], Livonia [now Estonia and Latvia], lakes Beloozero and Peipus [Chud], Russia; syntypes: LU)

Eperlanus vulgaris Gaimard, 1842: pl. 18 fig. 2 (type locality: Iceland; holotype: MNHN ?)

Osmerus eperlanus eperlanus natio *ladogensis* Berg, 1932a: 133 (nomen nudum; locality: lake Ladoga, Russia)

Osmerus eperlanus eperlanus natio *ladogensis* Berg, 1932c: 281 (infrasubspecific, name not available; locality: lake Ladoga, Russia [Berg, 1948: 443])

Eperlanus Schonfieldii Kljukanov & McAllister, in Hureau & Monod, 1973: 158 (published in synonymy, name not available)

Osmerus eperlanus schonfoldi McAllister, in Whitehead et al., 1984: 402 (type locality: Poland westward to British Isles; syntypes: LU)

Nomenclatural notes. The name *Osmerus eperlanus schonfoldi* is first available from McAllister (in Whitehead et al., 1984) since earlier uses of the name do not make it available. McAllister note that the two "subspecies" of *O. eperlanus* are apparently sympatric in parts of Poland, Denmark and the Baltic. If this is confirmed and if the two stocks are morphologically distinct, it seems doubtful that they should be treated as a single species.

Coregonidae

Recognition of the family Coregonidae as distinct from the Salmonidae follows Sanford (1990: 149). See Nelson (1994: 189) for alternative classifications.

Coregonid systematics

History. The history and development of coregonid systematics have been described and commented on at length in many earlier publications (e.g., Wagler, 1941, 1950; Steinmann, 1950a) and I shall not review that history here. Many data from these earlier works are valuable as they provide us with information about stocks as they were before man started to alter radically the habitats and their fish populations. Their taxonomic conclusions, however, are strongly biased by both personal and contemporary idiosyncrasy, if not by polemics (e.g., the comments by Nüsslin, 1903 on Fatio's considering as subspecies his 'good' *C.*

macrophthalmus [this also points to a frequent semantic and psychological problem of the reductive or degrading perception of the word subspecies]).

To summarise (and simplify), the following trends or schools can be recognised in coregonid systematics during the last hundred years. Noteworthy is that no significant new alternative has been proposed in the last 50 years, with the notable exception of Svärdson (1979) for the Scandinavian species.

In central Europe, Fatio (1890) had recognised two main groups which he divided into eight species and a number of subspecies; he concentrated on the species of Switzerland and marginally dealt with those of adjacent areas. Although his classification was probably not very natural, this was the first attempt at reporting the whole diversity of the group in many different lakes ... and this was the last descriptive account with general information on the morphology of the species not restricted to a few (or a single) characters. Fatio's nomenclature is cumbersome and does not follow modern (present) rules. In addition, some confusion results from his using different names for the same species or the same name for different species in two subsequent versions of his system (1885, 1890) (he changed some of the earlier names which he found were not appropriate descriptors).

Berg (1932a, 1948) recognised a single species in central Europe (*C. lavaretus*), with several subspecies and an endless enumeration of natios and other infrasubspecific categories. His nomenclature is cumbersome and the natio concept was never really accepted outside eastern Europe (which does not mean that the importance of infraspecific variation is denied, just that it is not worth the trouble of formally naming every single population). Similarly Reshetnikov (1980: 219, 221; Dorofeyeva et al., 1985) implicitly considers that all European whitefishes belong to four species, *C. albula*, *C. peled*, *C. pollan*, and *C. lavaretus*, the latter with 6 subspecies and many "ecological forms" which can live sympatrically in the same water body. Under any species concept, two non-interbreeding, sympatric stocks cannot be conspecific.

Wagler (1941, 1950) concluded that there were only four species in Central Europe and he tried to have all European stocks fitting his divisions (1950: 9–10); he assumed that four species had spread across all Europe, occupying different combinations in different European lakes. It seems that he came to this conclusion quite early in his researches and I suspect that his concept of four catch-all species is strongly biased by his having started his coregonid work with lake Konstanz which hosts (hosted) four species. The main character recognised by Wagler was growth rate; stocks with similar growth rates from different lakes were squeezed in a single species, notwithstanding important morphological differences. Steinmann (1950a: 126) already commented that Wagler's four species are those known in lake Konstanz and applies poorly or not at all to other lakes. Wagler (1950: 9–10) commented: "I have called these units 'species'. One could as well choose another terminology; one could speak of species-groups, form-groups, etc. This is strictly a matter of taste and depends of the systematic value one gives to the separating properties, if one considers the small differences in the development of the characters (gill-rakers, snout shape, eye size, etc.) as more important than the general habitus and the biological behaviour (location in lake, feeding, growth, spawning habits, etc.)" [my translation]. I do not think that the names given to units is a matter of taste, but that in order to have a universal classification, concepts like species should follow a precise definition. The hierarchy of values of characters is reminiscent of the Aristotelian Logical Division mentioned in the introduction (p. 12). It is not clear also how detailed Wagler's studies of several of the stocks were: for instance, the palée of lake Neuchâtel (here *C. palaea*) appears under both his *C. wartmanni* and *C. maraena* (1941: 386, 394). Dottrens (1959: 4) also criticised Wagler's concept; overemphasising growth patterns resulted in unnatural groupings of allopatric stocks.

Steinmann (1950a–b) also recognised a single species. In his view, its ancestors had invaded all central European lakes and had given rise within each lake or group of lakes (which he called natios; not equivalent to Berg's natios) to up to five "oecotypus". In each natio he recognised the same one to five "oecotypus" to which he consistently gave the same five names. Despite the obvious teleological bias, this was implicitly supposed to be a systematic discussion based on the BSC (Steinmann, 1951: 80); clearly, it was not. Again, the nomenclature is very cumbersome and pays no attention to the many non-interbreeding sympatric stocks which cannot be treated as conspecific.

One of the great weaknesses of most of these earlier works is that they tried to explain and describe coregonid evolution with a single and rigid pattern (Mayr's 1952 comments are still valid): Wagler with four species spreading all over Europe and diverging in the different lakes or Steinmann with a single species colonising each lake and evolving in situ in the same five morphs are the two extremes. The 'truth' is likely to be much more complex and the genesis of each lake community might be distinct and unique. I see no theoretical reason to exclude the possibility that sympatric speciation occurred in some lakes while allopatric speciation happened in others. Some lakes might have been colonised by the same original 2, 3, ..., n species, while some other could have been colonised (at the same or different times) by both some more ancestral stocks and some that had evolved recently in other, adjacent lakes. There is also no reason to hypothesise dispersal only from the east to the west (the collective unconscious of western Europe).

Also, it seems that Wagler and Steinmann's theories are not exempt from circular reasoning. For example, Wagler (1950: 47) discusses populations from Finland and comments on Järvi's (1943: 15) distinction of three forms based on gill-raker counts. He argues that it is known that within a single species this figure shows great variation from lake to lake, and that if one were to follow Järvi, the [various, Alpine] species should be dismantled. Then he concludes (p. 54–55): "It becomes more than likely that everywhere, in [northern Europe] as well as in the Alps, the same types ... are present. Thus, ... the forms from the northern and from the southern distribution areas have to be put together." Järvi (1943) (as interpreted by Wagler, 1950: 54; I could not find such a statement in Järvi) followed Berg (1932) in seeing in the present distribution of the north European and Baltic maräne a reason against lumping them with the sub-Alpine forms and in considering the existing similarities of shapes as irrelevant. Wagler objected that gill-rakers are not the only character which can be used, but he actually used nothing but gill-rakers and growth in his whole discussion. Nowhere does he state clearly that he recognises confidently a sub-Alpine species in the Scandinavian material. Also revealing of the confusion between systematics (how many species ?) and nomenclatural issues (which name ?) are Wagler's (1941: 382) arguments for considering a northern European *C. maraena* and the sub-Alpine *C. fera* as conspecific: the argument is not a biological one, but merely the desire for not using the name *C. fera* because he was not sure what exactly that species was.

Dottrens (1959) recognised six species, but most of his discussion is based on a single character, the number of gill-rakers. Stocks which had intermediate values were considered the result of hybridisation or introgression. Although this is certainly true for some stocks, there is no reason why intermediate values should ipso facto be indicative of hybridisation; it could also be evidence of the existence of additional species. Stocks considered as conspecific on the basis of similar gill-raker counts by Dottrens can actually belong to species differing by other morphological characters (see Gasowska, 1960: 479, 1964). Finally, Dottrens's nomenclature does not follow the Code.

Wagler's nomenclature is so reductive that much information is lost while Fatio's, Berg's, Steinmann's and Dottrens's classifications are cumbersome and/or do not follow nomenclatural rules. As a result most workers preferred not to decide for one or the other and just give the name of their fish in the different systems, usually adding the name of the lake and the local name. For example the kropfer of lake Thun is called:
by Fatio (1890): *Coregonus schinzii helveticus* var *thunensis*,
by Wagler (1941): *Coregonus acronius*,
by Berg (1932): *Coregonus lavaretus fera* natio *alpinus* (notwithstanding misidentification),
by Steinmann (1950b): *Coregonus lavaretus* natio *arurensis* oecotypus *profundus*.
It is thus no wonder that most workers find more convenient to call it just by its local name or as *Coregonus* sp. Kropfer, lake Thun. If this is the end-result of 100 years of polemics on coregonid systematics, I doubt that it indicates significant progress.

Pragmatic approach. As previous coregonid classification do not follow the International Code of Zoological Nomenclature, express strong conceptual or teleological bias and result in ambiguous and cumbersome terminologies, they cannot be accepted and I introduce here a neutral classification which follows nomenclatural rules, does not require a priori assumptions on evolution or phylogeny and is based on intrinsic (objective) characters of the species.

As mentioned in the Introduction, one of the goals of systematics is to describe the phylogeny of a group, and this phylogeny is then reflected by the nomenclature. The proposed scenarios are very conflicting, ad hoc explanations (theories created for that particular purpose), without a strong base and the nomenclatural conclusions are often unnatural. But the present situation is so complex (and the image is definitely blurred by many introductions, transplantations, hybridisations, and extinctions) and the published data of such limited use in clarifying the phylogeny of the group, that even with proper support it would still need some time to present a natural phylogeny and a natural classification. As there is an obvious need for a workable nomenclature (and a set of testable hypotheses), I am thus left with no choice but to propose a pragmatic approach which temporarily conforms with the little we know of the phylogeny, the quite large amount of data we have about biology, the very poor morphological descriptions, as well as the apparent and reported uniqueness of many of the stocks.

Many workers have tried to group allopatric populations into species, often on the basis of a single character, e.g., gill-rakers (Dottrens, Svärdson), growth rate (Wagler) and stocks not fitting with their divisions were somehow forced into these species, assuming undemonstrated plasticity and environmental influence. The results are species supposedly homogenous on one character but displaying a wide variability for any other character. For a systematist this is usually a strong indication, if not evidence, of an artificial, thus unacceptable, classification. This was in part governed by the desire to avoid using "too many" names. This argument is not acceptable; if there are, let us say, 300 species, they should be recognised as such, and there is no advantage in artificially (and arbitrarily) recognising only a limited number of them. Why four, six or seven species ? Why not five, eight, seventeen or eighty-two ? As discussed p. 15, it is not the number of species which is the cause of chaotic systematics, but the absence of clear concepts.

The pragmatic way to handle the problem is not to consider the global coregonid population and wonder how to (subjectively) split it in a convenient number of species, but to (objectively) describe the diversity in using precise and workable definitions. The problem of the number of species is relatively easily solved within a single lake or group of water bodies where non-interbreeding stocks occur in sympatry (thus are distinct species). The difficulties arise in deciding whether allopatric populations are conspecific or not. I recognise as distinct those which were earlier shown to differ on the basis of morphological, life history or other characters, unless it has been demonstrated that they cannot be distinguished. There are actually very few inter-basin comparisons providing such data.

For Central Europe, within each lake or group of lakes, I recognise each diagnosable and sympatric stock as a distinct species. Compared to earlier classifications, the result is an increase of the number of species, but this increase is compensated by abandoning the cumbersome subspecies, natios, etc. of earlier authors. One could argue that the use of subspecies associated, e.g., with Wagler's four-species system could result in a simpler system showing some affinities between the stocks of different lakes. The problems with subspecies have been discussed in the Introduction (p. 17); in addition, to group different stocks as subspecies of a single species implies that they are each other's closest relatives and derived from a common ancestor not shared by the other species. Without objective data supporting such an assumption, there is no advantage in hypothesising that a taxon A is more related to B than to any other. Such assumptions must be avoided as long as no objective data support them. Also, some stocks definitely do not fit in a four-species system.

It is possible (or likely) that some of the species actually occur in more than one lake or group of lakes, but I could not find an unambiguous demonstration of such a case. Therefore, at this stage, I prefer to retain geographically isolated stocks as different species because I see no advantage in postulating phylogenetic relationships between stocks [i.e. conspecificity of geographically isolated stocks] without evidence of the relationships.

This system may appear as a too fine tuning of the nomenclature, but within a given geographic area, it results in fewer entities than Berg's or Steinmann's systems, it escapes Wagler and Steinmann's teleological bias, it respects nomenclatural rules (contrary to Fatio's, Berg's, Steinmann's and Dottrens's), and it recognises sympatric, non-interbreeding and diagnosable stocks for what they are, species (as defined in Introduction, p. 15, PSC). The system escapes an implicit teleological assumption of most of these authors (except Fatio) that speciation is paralleled by morphological and adaptive divergence; we know that the two are not necessarily linked. With just binominal names, this system is more convenient to handle than the Fatio, Berg or Steinmann systems; it allows a more accurate and explicit designation of the different stocks than Wagler's system; it does not pretend to have resolved relationships; and, although not really relevant in a systematic discussion, it allows an unambiguous administrative handling which is vital for sound conservation management (e.g., *Coregonus lavaretus fera* natio *alpinus* has a great tendency in being abbreviated to *C. lavaretus* and become just the same 'thing' as any other '*C. lavaretus*' subdivision; see example for lake Genève, p. 104).

I could apply these principles to almost all natural coregonid stocks known from central Europe and the British Isles; the situation in the different lakes will be briefly summarised under the respective headings. For Scandinavia and the Baltic Sea basin, I follow Svärdson's (1979) system as it satisfies my requirements in recognising non-interbreeding sympatric stocks as different species. Not having contradictory data, I follow his pooling of different allopatric stocks in single species, with the reservation that, as with most authors, the morphological base is very limited and somewhat restricted to gill-rakers counts. His evolutionary scenarios are ad hoc theories and they do not seem to have a phylogenetic base. Svärdson's nomenclature has been adjusted to correct some errors and for the disappearance of subspecies under the PSC. I suspect that many of his species actually include unrelated stocks and that, once usable descriptions become available, we may have to recognise more species (see Gasowska, 1960: 479, 481 for some examples, based on an earlier version of Svärdson's system).

The system used here does not aim at demonstrating any given theory of the evolution or speciation of coregonids (there is probably not a single, unifying theory, but an array of explanations which have to be found case by case for each lake or area) by uniting populations that authors *think* are a single species on the basis of a speculative evolutionary scenario; on the contrary it aims at recognising facts, and the only objective facts we have are species which *are* demonstrably different (diagnosed by their intrinsic characters).

The classification used here does not actually differ much from standard fisheries practice, where most species are often called '*Coregonus* sp.' followed by the local name and the name of the lake. In any case, the present nomenclatural chaos is so confusing that it is desirable to replace the old terminology (and the implied philosophy) with a new set of names with precise and neutral meanings.

The argument that the introduction of a new system will represent a complete change and destabilisation of nomenclature is not defendable. Presently, coregonid nomenclature is all but stable. The present nomenclature is chaotic and it varies more or less randomly from one country to another. Most people using one or the other nomenclature cannot put forward arguments (relevant in a systematic context) to explain why they favour one system to another. The only objective argument is that in the absence of arguments they just follow local 'traditions'. Behnke (1972: 657) while recognising the distinctness of sympatric stocks commented that "for any other than salmonid fishes, full species recognition would be advised in such situation"; I do not perceive why there should be a all-but-salmonid species concept on the one hand, and a salmonid one on the other hand.

The complicated nomenclatures sometimes used actually reflect more the interest of the individual workers. Earlier researchers were often convinced that coregonids were some special animals just beginning to speciate [what is the beginning of speciation ? what is the end ?], and, implicitly or explicitly, they were trying to show species appearing or disappearing in the populations they studied. Therefore some sophisticated, ad hoc theories and complicated nomenclatures appeared. These a priori conceptions made most of them unwilling or unable to realise that coregonids are just fish as other fish, whose evolution is ruled by the same principles as other groups; simply, their habitat (midwater in cold lakes) and absence of colour marks make it more difficult for the human eye and brain immediately to identify them than, e.g., colourful, benthic, territorial fishes in coral reefs or tropical lakes. But the important criteria in recognising species is not our ability to recognise them, but the fish's ability to do so. We do not know how they do, but the species have efficient mechanisms to avoid hybridisation, and unless the habitat is disturbed, they certainly do not hybridise. Actually silvery or plain-coloured (usually mid-water) fishes of lakes world-wide present the same type of systematic problems [or human difficulty to perceive species] (see, e.g., Chen, 1986; Yang & Chu, 1987; Nagelkerke et al., 1994; Myers, 1960; Parenti, 1984; Lauzanne, 1982).

That different species are not mere ecological morphs of a single species is evinced by the extinction of single stocks by overfishing. If they were ecological morphs, there should be recruitment to compensate for the removed fishes. Similarly, after extinction of the two native stocks of lake Genève, the introduction of one species from lake Neuchâtel should have resulted in the reappearance of the two original 'ecological morphs'; this did not happen (Dottrens, 1950).

Molecular data. Published genetic data are diverse and usually relate to sympatric stocks. Most of them are presented as genetic distances based on electrophoretic data, and, as discussed in the Introduction (p. 19), are of very limited use in the present context. An outstanding exception is Bernatchez & Dodson's (1994) analysis of mtDNA of 63 different stocks from Europe, northern America and Siberia. For the eight sub-Alpine and ten Scandinavian and Polish stocks analysed, the following conclusions are of interest to systematics (see also Fig. 1). The sub-Alpine and the Scandinavian (together with some North American) stocks constitute two independent monophyletic lineages (this is especially clear from their fig. 3 which shows phenetic distances [see pp. 18, 19 for reservation on the significance of phenetic distances]). This disagrees with Svärdson's and Wagler's views that some of the sub-Alpine and Scandinavian stocks are conspecific.

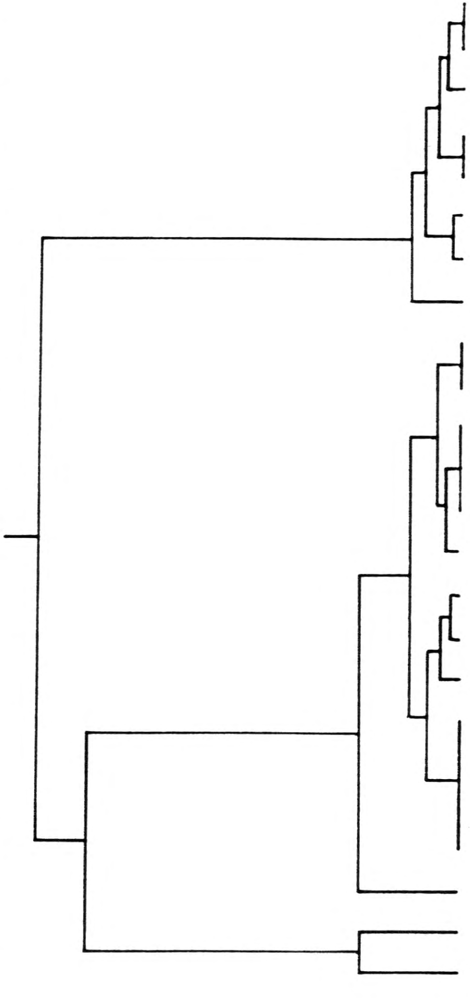
Sympatric stocks from lakes Brienz and Konstanz do not cluster together, contradicting Steinmann's theory of parallel sympatric speciation. In Wagler's (1941: 390) system, the 'fall spawning' coregonid of lake Brienz (brienzlig) is conspecific with the gangfisch of lake Konstanz (*C. macrophthalmus*) and Bernatchez & Dodson's data (fig. 3, but not fig. 2) could be used to corroborate at least part of Wagler's conclusion. On the reverse, the 'winter spawning' of lake Brienz (= albock of lake Thun) and the blaufelchen of lake Konstanz which are considered as conspecific by Wagler (1941: 386, *C. wartmanni*) are not closely related in Bernatchez & Dodson's clustering (but Wagler [1937: 442] considered the albock to be a 'sandfelchen', that is a *C. maraena* in his 1941 system). The 'spring spawning' of lake Brienz is reported as morphologically indistinguishable from the 'fall spawning' (Steinmann, 1951: 373; Kirchhofer, 1990: 57–64); among the central European stocks examined by Bernatchez & Dodson, it does not cluster closely with any of the other stocks.

The analysed stock from lake Genève (Léman) is the introduced palée from lake Neuchâtel which Wagler (1941: 386) listed as being in part his *C. wartmanni* and again (p. 394) as his *C. maraena*; in 1950 (p. 12), he only recorded definitely *C. macrophthalmus* (bondelle) and *C. maraena* from lake Neuchâtel. In Bernatchez & Dodson's figure 3, the palée clusters with *C. wartmanni* from lake Konstanz.

Dottrens (1959) had recognised five species of *Coregonus* in Central Europe (conspecific with Scandinavian stocks). He considered the lavaret of lake Aiguebelette and the gangfish of lake Konstanz as conspecific; Bernatchez & Dodson's data do not show them as each other's closest relatives; this also applies to the powan of Loch Lomond and the blaufelchen of lake Konstanz, also considered conspecific by Dottrens. In Dottrens's system, the palée is not conspecific with any of the four species of lake Konstanz. Finally, Bernatchez & Dodson show that nucleotide variability, on average, is higher for European than for North American stocks.

Bernatchez & Dodson suggested that all the stocks they examined should be considered as a single variable and circumpolar species. At least for the European stocks, this is definitely not acceptable because the many sympatric non-interbreeding stocks known from many lakes are different species and not just different morphs or any subdivision of a species. To use the argument that "levels of mtDNA variation ... is more representative of intraspecific variation" to conclude that a single species is involved is not acceptable because there is no theory to require that a given level equals a given taxonomic differentiation (see p. 18) (this might be a semantic problem linked with the use of words like hierarchy, level, rank and especially subspecies under the polytypic species of the BSC; also there is a risk that this kind of reasoning quickly becomes circular). Bernatchez & Dodson stated that "Such a genetic structure contrasts sharply with the general observation that most freshwater fishes currently exhibit the highest levels of interpopulation gene diversity reported in any animal group ... The broad scale continental and intercontinental geographic distribution of slightly differentiated phylogenetic assemblages observed in whitefish approaches the type of phylogenetic structure usually documented in species with life history conducive to dispersal and/or that occupy a range free of firm barriers to gene flow such as marine organisms, bird species and humans". In my point of view, this is an indication (if not actual evidence) that there is not a uniform tuning of 'genetic' distance and taxonomic differentiation; systematists have known for long that there is not a uniform tuning between phenetic distance and taxonomic level and a priori there is no reason that the same should not apply to any other kind of computed distance. In some groups of coregonids, obviously a quite fine tuning is needed.

Bernatchez & Dodson concluded "This cast doubts on the validity and utility of different taxonomic designations ... based solely on morphological patterns". This may be true, but one must admit that most morphological descriptions and analysis of European coregonids are poor and too often based on a single or few characters and not acceptable for systematists as well. To me, data in Bernatchez & Dodson is one more argument for recognising non-interbreeding sympatric stocks as distinct species, but also for recognising diagnosable stocks in different basins as distinct species. Such a classification may be artificial and temporary but it fits better with current knowledge and especially with management and conservation



#	lake (stock)	name in system of:			
		Wagler (1937, 1941, 1950)	Steinmann (1951)	Dottrens (1959)	present
53	Konstanz (gangfisch)	*macrophthalmus*	*lavaretus* natio *bodensis* oekot. *nanus*	*macrophthalmus*	*macrophtalmus*
56	Brienz (brienzlig)	*macrophthalmus*	*lavaretus* natio *arurensis* oekot. *nanus*	*macrophthalmus*	*albellus*
54	Brienz (albock)	*wartmanni* (1941) *maraena* (1937)	*lavaretus* natio *arurensis* oekot. *primigenius*		*fatioi*
58	Aiguebelette (lavaret)	*	*lavaretus* natio *rhodanensis* oekot. *pelagicus*	*macrophthalmus*	*lavaretus*
59	Annecy (*)	*	*	*	*
52	Konstanz (blaufelchen)	*wartmanni* (1941)	*lavaretus* natio *bodanensis* oekot. *pelagicus*	*wartmanni*	*wartmanni*
57	Geneva (palée)	*wartmanni* (1941: 386) *maraena* (1950: 394)	*lavaretus* natio *jurassica* oekot. *primigenius*	*lavaretus*	*palaea*
55	Brienz (spring spawning)	*macrophthalmus*	*lavaretus* natio *arurensis* oekot. *nanus*	*macrophthalmus*	unnamed
49	Kymijoki R., Finland ('lavaretus')				*
60	Lomond (powan)			*wartmanni*	*clupeoides*
47	Malaxa R., Finland ('lavaretus')				*
62	Lapin R., Siberia ('pidschian')				*
63	Sos'va R. Siberia ('pidschian')				*
61	Kola Peninsula, R. ('lavaretus')				*
42	Kiiminkijoki R., Finland ('lavaretus')				*
43	Mickelsörarna, Finland ('widegreni')				*
44	Öja, Dinland ('lavaretus')				*
45	Kyrönjoki R., Finland ('lavaretus')				*
46	Lestijoki R., Finland ('lavaretus')				*
48	Dyhajarvi, Finland ('muksun')				*
50	Niewleno, Poland ('lavaretus')				*
51	Sperillen, Norway ('lavaretus')				*
36	Squanga, Canada ('clupeaformis')				*
37	McEvoy, Canada ('clupeaformis')				*

Fig. 1. Phenetic clustering of *Coregonus* populations according to Bernatchez & Dodson (1994: 247, fig. 3) and correlation with nomenclatures used in Wagler (1937, 1941, 1950), Steinmann (1951), Dottrens (1959) and the present system. Stock numbers are those of Bernatchez & Dodson. Asterisks (*) indicate that published data do not allow to identify the stock.

needs; it has a greater heuristic value as, at least, it provides a series of hypotheses which are explicitly stated and can be refuted or confirmed by future research.

To lump all these species into a single catch-all species would not be an act of progress. The need for accurate and detailed taxonomy is best summarised by Kevan (1973: 1212): "One assumes that when [experimental biologists] state that they used 5 ml ethanol, they were not using 6 ml of methanol; and yet, if the experimental animal is wrongly identified, what are the grounds for such an assumption ?"

Morphological changes ? Morphological changes of coregonid stocks in recent times is often alluded to in discussions and meetings, but I could not find any unambiguously documented case that this happened (it is also not clear which lakes and species are involved, or whether these were supposed to be pure, native, hybrid or introduced stocks). But as the topic shows up again and again, it seems justified to discuss it.

To be able to demonstrate that a stock has changed morphology, one would need detailed descriptions of the original stocks and well preserved voucher samples, properly labelled and curated in a suitable collection. Neither is available for most stocks.

Few or no hybrids are known from natural, undisturbed waters. On the contrary hybrids are known to be indicators of disturbed habitats (Hubbs, 1955) and the presence of *Coregonus* hybrids would merely indicate environmental stress (change of habitat topography, overfishing, introductions, etc.). Additionally the existence of hybrids has no value for a phylogenetic discussion, as it merely is a symplesiomorphy (see Introduction, p. 10). If the stocks are originally distinct, morphological shifts due to environmental changes (especially changes in growth rates consequent to eutrophication or different fisheries pressure) do not change the fact that the stocks are distinct. An overfed fat dog is still a dog.

Similarly, morphological changes of *Coregonus* stocks following transplantation in other lakes is often mentioned. Data in Dottrens (1950) and Svärdson (1979: 16–17) actually seem to show that the morphology of transplanted *Coregonus* populations does not change. When changes have been documented, they are apparently due to hybridisation with other (local or transplanted) species. There is apparently no published documentation of such changes; the closest seems to be Svärdson (1970: 38–41) which does not show important changes (and a description of methods and conditions of the experiment is missing). A 'classical' case of differentiation of transplanted *Coregonus* was reported by Thienemann (1912) from lake Laacher. The local population resulted from introductions and Thienemann assumed that it resulted from the introduction either of madümaräne from lake Madü [lake Miedwie, Poland] or fera [sandfelchen] of lake Konstanz, which had evolved into a new species since 1866–1872. Wagler (1937: 444–445; 1941: 460–462) reviewed the case and concluded that the fish if compared to the species known from lake Konstanz was more reminiscent of the gangfisch than any other species and that the introduced stock apparently was not from lake Konstanz but from some other Swiss lakes; he favoured *C. candidus*, the bondelle of lakes Neuchâtel and Bienne as the likely introduced stock.

Transplanted to another habitat, any species is likely to have to face somewhat different conditions and this *may* influence its morphological appearance. Of course these transplanted animals exist, but they should not be the basis for a discussion on systematics and phylogeny; neither should these populations be used for describing species. Systematics should be based on natural populations. Carp, goldfish and dog systematics are based on natural populations, not on transplanted or manipulated stocks. Some lake Victoria and neotropical cichlids fed different diets can develop different jaw and teeth morphology (Witte, 1984; Meyer, 1987; Wimberger, 1992), even showing close similarity to other species, but this does not affect or negate their identity as species because they still have they own separate phylogeny. Here again, what is demonstrated for one species cannot automatically be extrapolated to be valid for another species or for all fishes. Polymorphism and alternative life-history styles certainly exist but their existence can only be accepted as a fact once it is demonstrated; in systematic studies, polymorphism in one species cannot be guessed or assumed from what is known from another, related species. Also I suspect that several assumed cases of polymorphism (see Wimberger, 1994 for a review) actually involve different species.

Unless there is a serious effort by experienced systematists to investigate coregonid systematics, I predict that introductions, transplantations, hybridisations, and extinctions might quickly contribute to simplify the systematics into an ubiquitous hybrid-swarm. Although they may seem obvious, I wish to end here by repeating and stressing the concluding comments of Kirchhofer's (1990: 86) study of coregonids of lake Brienz. They apply to all lakes: only obviously identifiable specimens should be used for captive breeding and stocking; in any lake, no stocking should be done with stocks from other lakes. This is the only way to preserve what is left of the coregonid diversity.

LAKES GENÈVE, BOURGET AND ANNECY

At least three species were originally present in lake Genève [river Rhône basin] and they are now assumed to be extinct (Dottrens, 1950; Spillmann, 1958). The only species now present in the lake is the introduced palée, *C. palaea*, first introduced from lake Neuchâtel in 1923 (Dottrens, 1950: 803). Other species have accidentally been introduced, including *C. peled* (?) (Gerdeaux, 1993: 21), perhaps an obvious example of management problems which can result from confusing all stocks under a single name like *C. lavaretus*.

River-spawning individuals are known to ascend the river Rhône upriver of lake Genève for a few kilometres (Büttiker, in Ruhlé & Kindle, 1992: 407), and they would be worth a detailed study and comparison with the palée and the known museum specimens of the extinct species.

13.1.1 *Coregonus bezola* Fatio, 1888 [bezoule (lake Bourget)]

Coregonus Bezola Fatio, 1888a: 1541 or 1888b: 185 (type locality: lake Bourget, France; type material: NT)

13.1.2 *Coregonus fera* Jurine, 1825 [féra (lake Genève)]

Corregonus [sic] *Fera* Jurine, 1825: 190, pl. 7 (type locality: lake Genève, Switzerland and France; type material: NT)

Coregonus Schinzii Fatio, 1885: 664, pl. 22 II.B (unnecessary replacement name for *Coregonus fera* Jurine, 1825)

Coregonus lavaretus natio *rhodanensis* Steinmann, 1950b: 383 (infrasubspecific, name not available; locality: lake Genève, Switzerland and France; originally included two stocks)

Systematic notes. Apparently extinct.

Nomenclatural notes. *Coregonus fera* Jurine, 1825 differs from *Salmo ferra* Walbaum, 1792 and *S. muraena ferra* Gmelin, 1818 (see *C. wartmanni*) by one letter. The names are not homonyms and *C. fera* is available (ICZN art. 57(f)).

When Fatio (1885) created *C. schinzii*, he divided it into three subspecies (*C. s. alpinus* Fatio, 1885, *C. s. palaea* Cuvier, 1829, *C. s. fera* Jurine, 1825), without using one of them as nominotypical subspecies (that is, without using for it the same name as for the species). As *C. fera* is the oldest name, it has priority as the name for the species (in Fatio's sense) and has to be regarded as nominotypical subspecies, making *C. schinzii* an objective junior synonym and an unnecessary replacement name.

13.1.3 *Coregonus hiemalis* Jurine, 1825 [gravenche (lake Genève)]

Corregonus [sic] *hiemalis* Jurine, 1825: 200, pl. 8 (type locality: lake Genève, Switzerland and France; type material: NT)

Systematic notes. Apparently extinct.

13.1.4 *Coregonus lavaretus* (Linnaeus, 1758) [lavaret (lakes Genève, Bourget and Aiguebelette)]

Salmo Lavaretus Linnaeus, 1758: 310 (based on Artedi [1738: gen. 10 [37], syn. 19, spec. 37[10], Coregonus maxilla superiore longiore pinna ...] and Gisler [1753: 195]; type locality: "in Europa"; restricted here by neotype designation to lake Bourget, France; neotype: MHNG 2583.51, present designation)

Coregonus Rondeletii Valenciennes, in Cuvier & Valenciennes, 1848: 470 (unnecessary replacement name for *Salmo lavaretus* Linnaeus, 1758; name available, proposed conditionally before 1961, for the species called Lavaret by Rondelet [1555: 162, 163] and Bélon [**1553: 186**])

Coregonus dispersus cognatus Fatio, 1885: 660 (type locality: lake Bourget, Savoie, France; type material: NT)

Coregonus lavaretus wartmanni natio *cuvieri* Berg, 1932a: 123 (infrasubspecific, name not available; indication to lake Bourget specimens of *C. lavaretus* sensu Valenciennes, in Cuvier & Valenciennes, 1848, and *C. wartmanni lavaretus* sensu Fatio, 1890)

Systematic notes. Spillmann (1958) reports two specimens of this species collected last century in lake Genève and preserved in MNHN. The species is now extinct in lake Genève.

Nomenclatural notes. The name *lavaretus* (or its variant spellings) dates back at least to Rondelet (1555: 162, Lauareto ... lacuum Allobrogum proprius est ut Burgetii & Aequebeletii [the lavaret ... of the lakes of Savoie at Bourget and Aiguebelette]) and Bélon (**1553: 186**, 1555: 278). It is derived from the local name of the present species. The name formally entered the zoological nomenclature as *Coregonus lavaretus* Linnaeus, 1758. Linnaeus's species is based on Gisler's (1753) and Artedi's (1738) accounts. Artedi's species was composite, based on a description of Swedish material (1738: descr. 10) and on a long list of synonyms (1738: syn. 19), including material from Sweden, Germany (lake Ammersee), U.K. (the schelly), lakes Konstanz, Genève and Bourget (accounts by Rondelet and Bélon). None of Linnaeus or Artedi's specimens is left.

The name *C. lavaretus* has at some time been applied to almost any Eurasian coregonid stock and often without much respect to nomenclature rules, resulting in a great confusion. Several authors restricted its use to one or the other stock, without paying attention to or without knowledge of earlier restrictions of the type locality. In order to stabilise the nomenclature, it is important to formally link the name with a precise stock by the designation of a neotype.

It could be argued that Cuvier (1816: 163), referring to the "true lavaret of lake Bourget or of Rondelet and Bélon", restricted the name *S. lavaretus* to the species from lake Bourget, but this is not explicit because there is no reference to the composite species of Linnaeus. Valenciennes (in Cuvier & Valenciennes, 1848: 456–461) reviewed the basis of Linnaeus's *C. lavaretus*, and restricted (p. 466–471) the name to a species which he considered to be the one recognised by Rondelet and Bélon under the name lavaret. To stabilise this usage, specimen MHNG 2583.51 (Fig. 2), collected on 12–13 September 1950 in lake Bourget is designated as neotype. This is part of the material described by Dottrens (1959). The neotype is 291 mm SL; head length 20.6% SL, snout length 5.6% SL, eye diameter 4.3% SL (adipose eyelid not taken into consideration), 84+5 scales along lateral line, 13 scale rows between lateral line and dorsal-fin origin, 9 between lateral line and pelvic-fin origin, $13\frac{1}{2}$ between lateral line and ventral mid-line in front of pelvic-fin origin, 13+24=37 gill-rakers on right anterior gill arch.

Smitt (1886: 249) had selected a marine stock from the Baltic as the 'typical form' of *C. lavaretus*, but this restriction was made after Valenciennes's (1848) and is not valid.

LAKES NEUCHÂTEL, BIENNE, AND MORAT

Two species are presently recorded from these lakes of the Rhine basin (Dottrens & Quartier, 1949; Rufli, 1978) but the data in Fatio (1890) seem to indicate that two more species were present in lake Morat [or Murten] which are now extinct. Fatio's material still in MHNG does not include specimens of these extinct stocks; material of this epoch exists in the collection of the Naturhistorishes Museum in Bern (K. Grossenbacher, pers. comm., 1996), but was not available at the time of writing due to ongoing building modifications; this material could allow to confirm or refute Fatio's identifications. Other Swiss museums do not have material from lake Morat in their collections.

The original hydrography and environment of the lakes has been much altered by the extensive so-called 'Jura water corrections' in 1868–78 and 1962–70 (Winistörfer, 1990: 69; Hantke, 1980: 579); these were large-scale hydrographic modifications in order to drain marshes and regulate water levels in lakes and rivers. The level of the lakes has been lowered by 2.4 meters and their area decreased by 30 km^2.

13.1.5 *Coregonus candidus* Goll, 1883 [bondelle (lakes Neuchâtel and Bienne)]

Coregonus candidus Goll, 1883: 341 (type locality: lake Neuchâtel, Switzerland; neotype: MHNG 656.36, present designation)

Coregonus restrictus Bondella Fatio, 1885: 662, pl. 22 I.D.9 (type locality: lake Neuchâtel, Switzerland, by lectotype designation [originally: lakes Neuchâtel and Bienne, Switzerland]; lectotype: MHNG 656.36, present designation)

? *Coregonus fera* var. *sancti benedicti* Thienemann, 1912: 176, pl. 2 figs. 1–3, pl. 3 fig. 11 (type locality: lake Laacher, west of Andernach, Eiffel, Germany [apparently introduced from lakes Neuchâtel or Bienne; Wagler, 1937: 445]; syntypes: LU ["about 30"])

Nomenclatural notes. Goll's (1883) description of *Coregonus candidus* is very rudimentary; none of Goll's specimen is known to have been preserved (M. Sartori, Musée Cantonal de Zoologie, Lausanne, pers. comm., Feb. 1996) and in order to stabilise nomenclature, specimen MHNG 656.36 is designated as neotype. This specimen is also the lectotype of *Coregonus restrictus bondella* Fatio, 1885 and the two names are thus objective synonyms.

13.1.6 *Coregonus confusus* Fatio, 1885 [pfärrig (lake Morat)]

Coregonus annectus confusus Fatio, 1885: 661, pl. 22 I.C.5 (type locality: lakes Morat, Neuchâtel and Bienne, Switzerland; syntypes: MHNG, lost in 1902)

Systematic notes. Fatio (1885: 661; 1890: 132) recognised the pfärrig as a valid species. Steinmann (1950b: 394) considered it as the same 'eco-

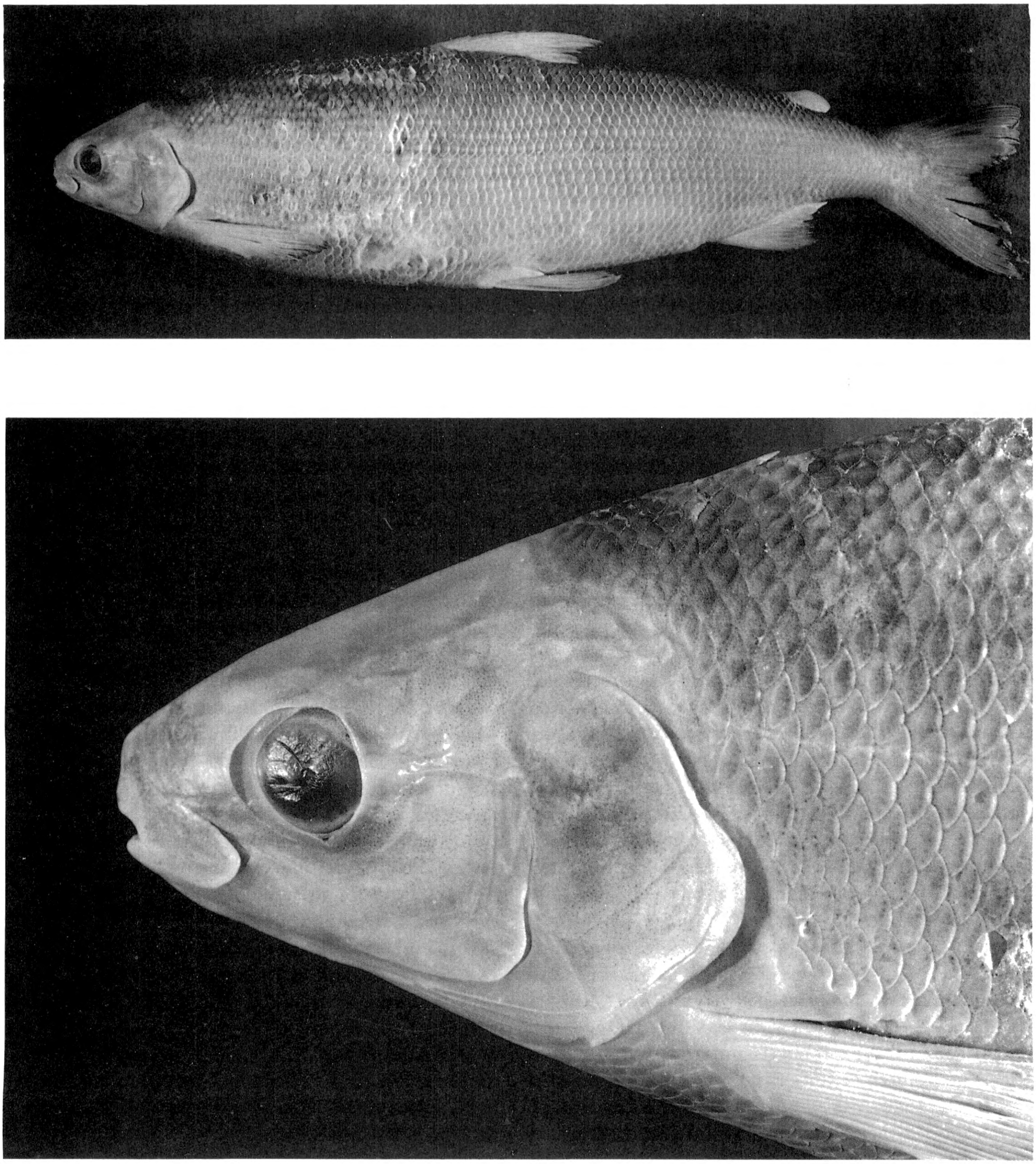


Fig. 2. *Coregonus lavaretus*, neotype, MHNG 2583.51, 291 mm SL, France: Rhône basin: lake Bouget.

type' as *C. palaea*, although stating that he had not seen any specimens from lake Morat where coregonids were then disappearing. As the gill-raker counts given by Fatio (1890: 134) are much higher (33–38 in specimens 300–350 mm SL) than those reported for *C. palaea* by him (22–28 in specimens 360–420 mm SL, p. 236) or by Steinmann (19–32), this synonymy seems unlikely. Fatio's data do not allow the identification of this nominal species with any other and it is considered as valid. This cannot be confirmed by a re-examination of Fatio's specimens as these have been discarded in 1902 (C. Weber, pers. comm.).

Fatio reported this species only from lake Morat, tentatively considering rare individuals from lakes Neuchâtel and Bienne as hybrids between it and the local species. The appearance at that time of such hybrids could have resulted from the then recent (1868–78) completion of the 'correction' of the waters of lakes Neuchâtel, Bienne and Morat and associated rivers (see above). If the species is really distinct, it seems to be extinct as no coregonid survives in lake Morat (A. Kirchhofer, pers. comm.).

13.1.7 *Coregonus palaea* Cuvier, 1829 [palée (lakes Neuchâtel, Bienne and Morat)]

Coregonus palaea Cuvier, 1829: 308 (type locality: lake Neuchâtel, Switzerland; syntypes: MNHN)

Coregonus lavaretus natio *jurassica* Steinmann, 1950b: 394 (infrasubspecific, name not available; locality: lakes Neuchâtel, Bienne and Morat, Switzerland; originally included two stocks)

Nomenclatural notes. Note correct original spelling and authorship of *C. palaea*.

13.1.8 *Coregonus restrictus* Fatio, 1885 [férit, kropfer (lake Morat)]

Coregonus restrictus Fatio, 1885: 662, pl. 22 I.D (type locality: lake Morat, Switzerland; type material: NT)

Coregonus dispersus Fatio, 1885: 660 (type locality: lake Morat, Switzerland; type material: NT)

Coregonus restrictus Feritus Fatio, 1885: 662, pl. 22 I.D.7 (type locality: lake Morat, Switzerland; syntypes: MHNG 656.64 [2], lost in 1901)

Nomenclatural notes. Fatio (1885: 662, 1890: 185) recognised the férit as a valid subspecies. Steinmann (1950b: 394) considered it as the same 'ecotype' as bondelle, without examining specimens from lake Morat in which he stated that coregonids had almost disappeared. A re-examination of Fatio's material would be needed to confirm the existence of the morphological differences which he reported, but this material is not among Fatio's specimens preserved in MHNG and no material of this species has yet been found in other museums. There is no real argument showing that the bondelle and the férit could be conspecific and the férit is tentatively considered as a distinct species. It seems to be extinct as no coregonid survives in lake Morat (A. Kirchhofer, pers. comm.).

Nomenclatural notes. When he created the name *C. dispersus*, Fatio (1885) divided it into four species (*C. wartmanni* Bloch, 1784, *C. crassirostris* Fatio, 1885, *C. annectus* Fatio, 1885, *C. restrictus* Fatio, 1885) and nine subspecies. As first reviser, I restrict the name to *C. restrictus*. As *C. restrictus* and *C. dispersus* are thus simultaneous synonyms, as first reviser I retain *S. restrictus* as having priority.

When Fatio (1885) created *C. restrictus*, he divided it into three subspecies (*C. r. feritus* Fatio, 1885, *C. r. nuesslini* Fatio, 1885, *C. r. bondella* Fatio, 1885), without treating one of them as the nominotypical subspecies (that is without using for one of them the name of the species). Berg (1932a: 124), as first reviser, retained *C. r. feritus* has being the nominotypical subspecies, making *C. restrictus* and *C. r. feritus* objective simultaneous synonyms, and retaining *C. restrictus* as having priority.

LAKES THUN AND BRIENZ

Fatio (1890) recognised three species in these lakes (Rufli, 1978: 9, has it that Fatio recorded four, but I can find only three; Rufli lists different Fatio names for brienzlig and kropfer but, as shown below, Fatio (1890) used a single name for them [but obviously he had seen only one of them]). Wagler (1941) reports four species from lake Thun, but is not very explicit about them. Steinmann (1950b: 365) recognised three 'ecotypes' (primigenius, nanus, profundus) and mentioned occasional specimens which he considered as two additional 'ecotypes' (litoralis, pelagicus); it seems he was not very sure of their status, for when giving the names he added "in case it is necessary to give a name".

Rufli (1978) seems to admit that there were originally four species of coregonids in lake Thun and that two of them (bodenalbock and schwebalbock) hybridised resulting in today's 'albock'. The assumption of the earlier existence of these two 'parent' species seems to be based on Wagler (1937) and Steinmann. Steinmann (1950b) was not very clear and consistent with his terminology, even within a single paragraph; for example, p. 352 (figure 29) he lists "kropfer = bodenalböcke" and "balchen = uferalböcke", and he regularly refers to brienzlig as schwebenalbock. While p. 365–367 he named five "ecotypes", in his summary of lake Thun coregonids (p. 367–369), he recognised only three. Rufli assumed that the two kinds of albock differed by average gill-raker counts (but not range), spawning season and site. I cannot find any of these data in Steinmann's account of lake Thun (1950b: 340–369) or in Wagler (1937).

In an earlier part of the same work, Steinmann (1950a: 135) recognised three species from lake Thun (balchen, albock, kropfer) but he does not mention the brienzlig. He mentions different spawning times and places for balchen and albock. The balchen of the 1950a paper became the albock in the 1950b (p. 367) paper, and the albock became brienzlig, which he also called zwergalbock and schwebalbock (1950b: 366). I assume that Rufli has been confused by Steinmann's terminological inconsistency. Clear concepts, use of scientific names instead of labile and colloquial terminology and observance of the nomenclature rules would certainly have made Steinmann's discussion clearer.

It seems therefore that there have never been more than three species of *Coregonus* in lake Thun and that Rufli had collected all of them.

Three species are recognised from lake Brienz (Kirchhofer, 1990). They are recognised by their spawning season: winter, spring and fall. The winter spawning stock, locally known as fällchen, is morphologically distinct and is apparently conspecific with the albock of lake Thun. The spring and fall spawning stocks are morphologically indistinguishable (Kirchhofer, 1990: 57–64) but are genetically distinct (Bernatchez & Dodson, 1994: 246, 247). The fall spawning stock (brienzlig) apparently also occurs in lake Thun (zwergalbock of Steinmann, 1950b: 366). The spring spawning stock is apparently unique to lake Brienz; there is no name available for it.

13.1.9 *Coregonus albellus* Fatio, 1890 [brienzlig (lakes Thun and Brienz)]

Coregonus exiguus albellus Fatio, 1890: 179 (type locality: lake Thun, Switzerland, by lectotype designation [originally: lakes Thun, Brienz and Vierwaldstätter, Switzerland]; lectotype: MHNG 816.22, present designation [MHNG 676.1, branchial arch of specimen 17 cm, probably the lectotype])

Systematic notes. Fatio (1890: 179) is somewhat confusing about this species, because he considered as conspecific the kropfer of lake Thun and the brienzlig of lake Brienz. He also includes in it the 'weissfisch' from lake Vierwaldstätter which is assumed here to be a different species (see below, *C. zugensis*). Obviously his description and discussion are based mostly on material of brienzlig from lake Thun which he characterised by having 37–43 gill-rakers on the first gill arch. This agrees with the brienzlig of Steinmann which has 32–42 gill-rakers while the kropfer has 13–25. This is the albock of Dottrens (1959: 15).

13.1.10 *Coregonus alpinus* Fatio, 1885 [kropfer (lake Thun)]

Coregonus schinzii alpinus Fatio, 1885: 664, pl. 22 II.B.4 (type locality: lake Thun, Switzerland; lectotype: MHNG 717.45, present designation)

Coregonus balleus Fatio, 1885: 663 (type locality: lake Thun, Switzerland; lectotype: MHNG 717.45, present designation)

Coregonus Schinzii helveticus Fatio, 1890: 222 (unnecessary replacement name for *C. s. alpinus* Fatio, 1890)

Coregonus Schinzii helveticus var. *Thunensis* Fatio, 1890: 228 (infrasubspecific, name not available; locality: lakes Thun and Brienz, Switzerland)

Coregonus lavaretus natio *arurensis* Steinmann, 1950b: 365 (infrasubspecific, name not available; locality: lakes Thun and Brienz, Switzerland; originally included five stocks)

Systematic notes. Fatio (1890: 227) recognised four "varieties" in his *C. s. helveticus*: one from lakes Thun and Brienz, one from lake Zug, one from lake Vierwaldstätter and one from lake Konstanz. His general description pools together data of the four 'varieties' and it is often difficult to sort out which are the characteristics of the individual ones. However, his variety *thunensis* is characterised by: mouth subterminal, eye 25% of head length (lectotype 22), 23–27 gill-rakers on first gill arch (lectotype 28), most individuals around 30–38 cm, spawning in December, deep water.

The total length would be indicative of albock, while the eye size and gill-raker counts are more indicative of kropfer, as defined by Rufli (1978). It seems likely that either Fatio's material includes more than one species or that he partly confused the life history data, local names and specimens of some species.

Rufli (1978: 23) commented on slight differences in his gill-raker counts of the kropfer, compared to those of Steinmann (20–32, vs. 13–25) and assumed that this might be due to hybridisation. An alternative explanation is that either Steinmann consistently miscounted or that he used a different method. Steinmann's averages are four units less than Rufli's for both kropfer and brienzlig (see Rufli, pp. 23, 26) and Kirchhofer (1990: 78) also reports that Steinmann's maxima are 4 units less than his for brienzlig of lake Brienz. As a possible explanation, Rufli (p. 26) also suggested that small protuberances become 'real' rakers now that fish grow much larger than before.

Nomenclatural notes. When Fatio (1885) created *C. balleus*, he included in it three species (*C. asperi* Fatio, 1885, *C. schinzii* Fatio, 1885, *C. acronius* Rapp, 1854) and six subspecies. *Coregonus schinzii* is an unnecessary replacement name for *C. fera* Jurine, 1825 (see above). As first reviser, I designate here specimen MHNG 717.45 as lectotype of *C. balleus* Fatio, 1885. This specimen is also the lectotype of *C. alpinus* Fatio, 1885. They are simultaneous objective synonyms and as first reviser I retain *C. alpinus* as having priority.

13.1.11 *Coregonus fatioi* Kottelat, 1997, new name

[albock (lakes Thun and Brienz)]

Coregonus wartmanni alpinus Fatio, 1890: 140 (type locality: lake Thun, Switzerland; lectotype: MHNG 809.59, present designation [MHNG 675.96, branchial arches of a 160 mm specimen, probably lectotype]; junior homonym of *C. schinzii alpinus* Fatio, 1885)

Coregonus lavaretus wartmanni natio *fatioi* Berg, 1932a: 124 (replacement name for *C. crassirostris nobilis d* Fatio, 1885 and *C. wartmanni alpinus* Fatio, 1890; infrasubspecific, name not available)

Nomenclatural notes. This species has been described by Fatio (1890: 140) as *Coregonus wartmanni alpinus*. The name is not available because the name *alpinus* is preoccupied in the genus *Coregonus* by *C. schinzii alpinus* Fatio, 1885. Berg (1932a: 124) proposed a replacement name, but it is not an available name as it is infrasubspecific. I propose here the name *C. fatioi* as a replacement name for *C. w. alpinus* Fatio, 1890. The only extant syntype of *C. fatioi* (MHNG 809.59) is designated as lectotype.

13.1.12 *Coregonus* sp. spring spawning

Systematic notes. See general discussion of lakes Thun and Brienz above.

LAKES VIERWALDSTÄTTER, ZUG, SEMPACH, ETC.

Available data do not allow to decide whether some or all of the species from this group of lakes are conspecific or not from those of lakes Thun and Brienz. Therefore they are conservatively considered as distinct. Alternatively, some of the species might be shared with lakes Zürich and Walenstadt. Three species are recognised and *C. wartmanni* from lake Konstanz has been introduced (Steinmann, 1950b; Svarvar & Müller, 1982: 302).

13.1.13 *Coregonus nobilis* Haack, 1882

[edelfisch (lake Vierwaldstätter)]

Coregonus nobilis Haack, 1882: 128 (type locality: lake Vierwaldstätter, Switzerland; neotype: MHNG 656.56, present designation)

Coregonus crassirostris Fatio, 1885: 661, pl. 22 I.B (unnecessary replacement name for *Coregonus nobilis* Haack, 1882)

Nomenclatural notes. The first use of the name *C. nobilis* by Haack, 1882 was a conditional ("I intended to name this fish *C. nobilis*, but Professor Siebold to whom I had sent a few of these fishes called them *C. wartmanni*, and I do not believe that I should go against such an authority"). Additionally the only information that we are given is that the local name of the fish is edelfisch; that it occurs in lake Vierwaldstätter and that it spawns in July and August. In the case of coregonids, the spawning season is a useful taxonomic character (as defined in the Glossary of ICZN) (if one considers that the spawning season is neither a description nor a definition in the sense of ICZN art. 12(a), Haack's *C. nobilis* is a nomen nudum and the next available name for this fish is *C. nobilis* Fatio, 1885; 4 of Fatio's specimens are still preserved [MHNG 807.26] and should then be treated as syntypes).

In order to stabilise nomenclature specimen MHNG 656.56 (out of MHNG 807.26) is designated as neotype of *C. nobilis* Haack, 1882. I could not find traces of Haack's specimen. He mentioned that some had been sent to Siebold; they may have been retained in ZSM and lost with the whole fish collection in 1945 (Kottelat, 1988a and unpublished data).

When Fatio (1885) created the name *C. crassirostris*, he divided it into two subspecies, (*C. cr. nobilis* Haack, 1882, *C. cr. compactus* Fatio, 1885), without using one of them as nominotypical subspecies (that is without giving to one of them the name of the species). As *C. nobilis* is older than *C. crassirostris*, it has priority as the name for the species (in Fatio's sense) and has to be regarded as nominotypical subspecies, making *C. crassirostris* an objective junior synonym and an unnecessary replacement name.

Work is needed to show if this taxon is really distinct from *C. albellus* of lake Thun; if they are conspecific, the name *C. nobilis* has priority.

13.1.14 *Coregonus suidteri* Fatio, 1885

[ballen, balchen]

Coregonus annectus Fatio, 1885: 661, pl. 22 I.C (type locality: lakes Hallwyl and Baldegg, Switzerland, as restricted by Berg, 1932a: 123; type material: NT)

Coregonus annectus balleoides Fatio, 1885: 661, pl. 22 I.C.6 (type locality: lakes Hallwyl and Baldegg, Switzerland; type material: NT)

Coregonus Suidteri Fatio, 1885: 662 (type locality: lake Sempach, Switzerland; syntypes: MHNG 715.89 [1, MHNG 676.07, branchial arches of a specimen 330 mm SL, probably syntype 715.89], 816.26 [1])

Coregonus Schinzii helveticus var. *Zugensis* Fatio, 1890: 228 (infrasubspecific, name not available; locality: lake Zug, Switzerland; junior primary homonym of *C. macrophthalmus zugensis* Nüsslin, 1882)

Coregonus Schinzii helveticus var. *Lucernensis* Fatio, 1890: 229 (infrasubspecific, name not available; locality: lake Vierwaldstätter, Switzerland)

Coregonus lavaretus fera natio *vogti* Berg, 1932a: 129 (infrasubspecific, name not available; locality: lake Zug, Switzerland; proposed as a replacement name for *C. schinzii alpinus e* Fatio, 1885 and *C. s. helveticus* var. *zugensis* Fatio, 1890)

Coregonus lavaretus natio *riusensis* Steinmann, 1950b: 397, 416 (infrasubspecific, name not available; locality: lakes Vierwaldstätter, Sarnen, Lungern, Zug, Lowerz and Aegeri, Switzerland; originally includes five stocks from six lakes)

Nomenclatural notes. Fatio (1885) described *C. annectus*, dividing it into two subspecies (*C. a. confusus* Fatio, 1885, *C. a. balleoides* Fatio, 1885), but without using one as nominotypical subspecies (that is, without giving to one of them the name of the species). He did not designate a holotype and the species is obviously composite. Berg (1932a: 123), as first reviser, restricted the name *annectus* to the ballen of lakes Hallwil and Baldegg, that is Fatio's *C. a. balleoides*. Thus *C. balleoides* and *C. annectus* are objective simultaneous synonyms; Berg (1932a: 123), as first reviser, retained *C. annectus* as having priority.

As the balchen of lakes Vierwaldstätter, Zug, Sempach, Baldegg, and Hallwyl are considered conspecific, then *C. annectus* and *C. suidteri* are simultaneous synonyms; as first reviser I retain *C. suidteri* as having priority.

13.1.15 *Coregonus zugensis* Nüsslin, 1882 [albeli, weissfisch (lakes Vierwaldstätter and Zug)]

Coregonus macrophthalmus var. zugensis Nüsslin, 1882b: 211 (type locality: lake Zug, Switzerland; syntypes: LU)

Coregonus crassirostris compactus Fatio, 1885: 661, pl. 22 I.B.4 (type locality: lake Zug, Switzerland; syntypes: MHNG 715.93 [2])

Systematic notes. Concerning the original population of lake Zug, Steinmann (1950b: 426) commented that "Due to increased pollution, the spawning places [deeper parts of the lake] have been transformed into an oxygen-poor 'hydrogen sulphide zone' and can no longer be used. It is difficult to decide if this resulted, as the fishermen believe, in the extinction of the albeli, or if after appropriate transformation of its life style and adjusting to other spawning and habitat conditions it returned to the balchen type" [my translation]. Someway, this statement illustrates Steinmann's conception of coregonid evolution.

LAKES ZÜRICH, WALENSTADT, ETC.

In his discussion of the coregonids of lake Zürich, Steinmann (1950b: 442–448) is quite confusing, recognising two and four "ecotypes". In his discussion of the adjacent lake Walenstadt, he recognised four 'types' (one of them divided into two or three subunits; pp. 455–460) which he considered similar to the four types of lake Zürich. Formal and valid names exist only for two species, apparently present in both lakes. There are no valid names for the remaining stocks; one is Steinmann's grunder (lake Walenstadt) or blaalig (lake Zürich), the other is schwebblaalig (both lakes); I do not propose new names for them here, as their status is far from clear.

The status of these stocks, following Steinmann's identifications, has to be clarified. Steinmann's system for lake Walenstadt is reminiscent of Fatio's system (1890: 253) for lake Zürich [which Steinmann criticised vividly (1950b: 444)]. If more species actually occur in lake Zürich, some of Fatio's names listed here in the synonymy of *C. zuerichensis* might apply to them. This can only be clarified by the re-examination of Fatio's material (when extant), once the number of species and their characters are known. The hydrographic system has been greatly altered by the so-called 'correction of the Linth' waterworks between 1807 and 1822; see Steinmann (1950b: 451–454) for a description of their possible impact on fish communities and ecology of lakes Zürich and Walenstadt.

Two of the stocks recognised by Steinmann in lake Walenstadt were the sommeralbeli (spawning from July to December) and winteralbeli (spawning from December to February). Ruhlé (1986: 145) seems to imply that the winteralbeli appeared during this century; judging from Steinmann's (1951: 453, 458) account, an alternative explanation could be that it had been overlooked because of its small size, deep-water habitat, low intensity of fishing activity [especially in winter], gear selectivity and lack of scientific interest. A single stock (albeli) now exists in lake Walenstadt, with a peak breeding period in October–November; some mature individuals may be found throughout the year (Ruhlé, 1988: 177). Ruhlé (1986: 151) concluded that the reproductive barriers between the two species have disappeared and that the present stock results from the introgression of the two earlier stocks. This may be true; but considering that the previous data on the stocks of lake Walenstadt are scanty and quite vague (Fatio [1890] lists a single stock in this lake; I could not find earlier accounts) and that Steinmann's (1951) data on their reproduction are apparently second-hand or anecdotal, I would not exclude the possibility that there was only one original stock.

13.1.16 *Coregonus heglingus* Schinz, in Cuvier, 1822

[hägling (lake Zürich), albeli, sommeralbeli, ? winteralbeli (lake Walenstadt)]

Coregonus Heglingus Schinz, in Cuvier, 1822: 275 (type locality: lake Zürich, Switzerland; type material: NT)

13.1.17 *Coregonus zuerichensis* Nüsslin, 1882

[blaalig, bratfish (lakes Zürich and Walenstadt), albeli (lake Pfäffikon)]

Coregonus macrophthalmus var. *Zürichensis* Nüsslin, 1882b: 209 (type locality: lake Zürich, Switzerland; syntypes: LU)

Coregonus Sulzeri Nüsslin, 1882c: 253 (type locality: lake Pfäffikon, Switzerland; syntypes: SMNS 3125 [3], R. Fricke, in litt., NMW 78751 [1])

Coregonus Wartmanni dolosus Fatio, 1885: 660, pl. 22 I.A.2 (type locality: lakes Zürich and Walenstadt, Switzerland; syntypes: MHNG 656.53 [1], 715.92 [6])

Coregonus asperi Fatio, 1885: 663, pl. 22 II.A (unnecessary replacement name for *Coregonus zuerichensis* Nüsslin, 1882)

Coregonus asperi maraenoides Fatio, 1885: 663, pl. 22 II.A.1 (type locality: lake Zürich, Switzerland; syntypes: MHNG 816.42 [2])

Coregonus asperi dispar Fatio, 1885: 664, pl. 22 II.A.3 (type locality: lake Greifen, Switzerland; syntypes: MHNG 807.48 [3])

Coregonus tigurinus Fatio, 1890: 200 (listed in synonymy, name not available)

Coregonus Schinzii duplex Fatio, 1890: 252 (type locality: lake Zürich, Switzerland; type material: NT)

Coregonus lavaretus sulzeri natio *sieboldi* Berg, 1932a: 130 (infrasubspecific, name not available; unnecessary replacement name for *C. asperi maraenoides* Fatio, 1885)

Coregonus lavaretus natio *intermedia* Steinmann, 1950b: 438 (infrasubspecific, name not available; locality: lakes Sempach, Hallwil, Baldegg, Greifen and Pfäffikon, Switzerland; originally included one stock from five lakes)

Coregonus lavaretus natio *lindimacensis* Steinmann, 1950b: 448 (infrasubspecific, name not available; locality: lakes Zürich, Walenstadt and Klöntal, Switzerland; originally included five stocks from three lakes)

Systematic notes. The original populations from lakes Pfäffikon and Greiffensee are extinct (Steinmann, 1950b: 450).

Nomenclatural notes. The descriptions of *C. m. zuerichensis* and *C. sulzeri* appeared in consecutive issues of the same journal and the priority of *C. m. zuerichensis* is obvious; *C. Zürichensis* has to be emended into *C. zuerichensis* (ICZN art. 32(d)(i)(2)).

When Fatio (1885) created *C. asperi*, he divided it into three subspecies (*C. a. sulzeri* Nüsslin, 1882, *C. a. maraenoides* Fatio, 1885, *C. a. dispar* Fatio, 1885), without using one of them as nominotypical subspecies (that is, without giving to one of them the name of the species). As *C. sulzeri* is the oldest name, it has priority as the name for the species (in Fatio's sense) and has to be regarded as nominotypical subspecies, making *C. asperi* an objective junior synonym and an unnecessary replacement name.

LAKE KONSTANZ

Four species have classically been recognised in lake Konstanz (Wagler, 1941, 1950; Steinmann, 1950b). Nümann (1978: 519) recognises two species each with two subspecies in lake Konstanz; under any species concept, two subspecies of the same species cannot occur in sympatry. A fifth stock has recently been reported which is morphologically diagnosable from these four species and which has a distinctive biology. It undertakes spawning migrations in the Rhine in September–November, reaching at least 45 km upriver of lake Konstanz (Ruhlé & Kindle, 1992). It is tentatively recognised as a distinct (unnamed) species.

13.1.18 *Coregonus arenicolus* Kottelat, 1997, new species

[sandfelchen]

Coregonus Schinzii helveticus var *Bodensis* Fatio, 1890: 229 (infrasubspecific, name not available;

locality: lake Konstanz, Switzerland [-Germany-Austria])

Diagnosis. *Coregonus arenicolus* is distinguished from the other species of *Coregonus* in lake Konstanz in having 18–27 gill-rakers (mean 22.3), an inferior mouth, and in inhabiting and spawning in shallow coastal areas (data from Steinmann, 1950b: 483–485, 490–491).

Holotype. EAWAG 239, 298 mm SL; Switzerland: lake Konstanz [Bodensee]; P. Steinmann, Dec. 1950.

Paratypes. EAWAG 239-B, 4, 286–345 mm SL; same data.

Description of holotype. Morphometric data (in percents of standard length): total length 119.1; head length 20.7; head depth 14.1; body depth at dorsal-fin origin 25.4; depth of caudal peduncle 8.0; length of caudal peduncle (from base of last anal-fin ray to posterior extremity of hypural complex) 12.9; eye diameter 5.6; interorbital width 6.3; predorsal length 48.7; prepelvic length 49.7; preanal length 75.5; length of pelvic fin 16.6; length of pectoral fin 15.2.

Dorsal fin with 3 simple and 10 branched rays, last one split to the base; anal fin with 2 simple and 10 branched rays, last one split to the base; 13 pectoral rays; 12 pelvic rays; caudal fin possibly misformed, with 6+8 branched rays. 85 + 5 scales in longitudinal row; $\frac{1}{2}26\frac{1}{2}$ scales in transverse row from dorsal-fin origin to about 5 scales in front of pelvic-fin insertion; $\frac{1}{2}20$ scales between dorsal-fin origin and pelvic-fin origin. 10+1+15 gill-rakers on anterior, right gill-arch. Method for counts and measurements follows Hubbs & Lagler (1947).

Systematic notes. This is the species called sandfelchen by Steinmann (1950b: 483, 490), Wagler (1941, 1950) and Nümann (1978). The species is commonly referred to in the literature and appears to have no valid name; the purpose of the present action is to create a valid scientific name for it, linked with a correct holotype designation, in order to ease unambiguous discussion of the species. This does not constitute a taxonomic revision as advocated p. 20 which is still badly needed.

Nomenclatural notes. Although Fatio (1890) created two taxa with the name *bodensis*, no first reviser action is needed to establish priority as *C. s. h.* var. *bodensis* is not available. This is the species called sandfelchen, *C. maraena* or *C. fera* by Wagler (1941: 394). As understood here, it is restricted to lake Konstanz and as there is no available name for it, it is formally named here. The species is described in Wagler (1941: 394; 1951) and Steinmann (1950b: 483). Nümann (1978: 507) wrote that the species was becoming rare. It has sometime been considered extinct; actually it is still extant but for various reasons (mainly fishing grounds and fishing gears) it is usually not appearing in fishermen's catches (M. Douglas, pers. comm.).

Etymology. From the Latin adjective *arenicolus*, meaning living on or in the sand, a reference to the local name.

13.1.19 *Coregonus gutturosus* (Gmelin, 1818) [kilch]

Salmo Muraena [sic] *gutturosa* Gmelin, 1818: 305 (available by description and by indication to Wartmann, 1783: 431 [Kropffelche, Sandfelche] and Bloch [1784: 164, end of description of *S. wartmanni*]; restricted here to Kropffelche of Wartmann; type locality: lake Konstanz, Switzerland – Germany – Austria; type material: NT ?)

Salmo maraena media Hartmann, 1827: 145 (type locality: lake Konstanz at Ueberlingen, Langenargen and Konstanz, Germany; type material: NT ?)

Caregonus [sic] *Hartmannianus* Gistel, in Gistel & Bromme, 1850: 344 (nomen nudum).

Coregonus acronius Rapp, 1853: 158 (type locality: Langenargen and Ueberlingen, lake Konstanz, Germany; syntypes: LU)

Systematic notes. Extinct (Ruhlé & Kindle, 1992: 403; C. Ruhlé, pers. comm. 1994; J. Hartmann, pers. comm., 1995).

Nomenclatural notes. *Salmo maraena gutturosa* Gmelin (1818) is available by indication to the accounts of kropffelche and sandfelche by Wartmann (1783: 431); Gmelin's account, by the mention of the small size and of the goitre clearly refers to the kropffelche, latter known as kilch. I restrict here *C. gutturosus* to the kropffelche of Wartmann. This is the earliest available name for the kilch.

13.1.20 *Coregonus macrophthalmus* Nüsslin, 1882 [gangfisch]

Coregonus macrophthalmus Nüsslin, 1882a: 164, fig. 2 (type locality: lake Konstanz, especially in Untersee, Germany [-Austria-Switzerland]; syntypes: SMNS 3123 [3], R. Fricke, in litt., NMW 75065 [1])

Coregonus macrophthalmus var. *Steckbornensis* Nüsslin, 1882b: 208 (type locality: outlet of Untersee near Steckborn, lake Konstanz, Germany; syntypes: LU)

Coregonus exiguus Klunzinger, 1884: 110 (unnecessary replacement name for *Coregonus macrophthalmus* Nüsslin, 1882)

Coregonus restrictus Nüsslini Fatio, 1885: 662, pl. 22 I.D.8 (type locality: lake Konstanz; Switzerland [-Germany-Austria]; syntypes: MHNG 715.94 [2])

Coregonus exiguus Nusslinii var. *Bodensis* Fatio, 1890: 173 (infrasubspecific, name not available; locality: lake Konstanz, Switzerland [-Germany-Austria])

13.1.21 *Coregonus wartmanni* (Bloch, 1784) [blaufelchen]

Salmo Wartmanni Bloch, 1784: 161, pl. 105 (type locality: lake Konstanz, Switzerland – Germany – Austria; holotype: ZMB lost, H.-J. Paepke, in litt., 1995)

Salmo Ferra Walbaum, 1792: 76, 714 (binominal as from index, p. 714; available by description and indication to Wartmann [1777: 210, 1783: 431, Weisfelche & Adelfisch], Bloch [1784: 164; end of description of *Salmo wartmanni*], Journal Helvétique A[nno ?] **1741**, Gesner [1560: 341, "ein Grosse Art der Felchen ..."; includes "ferra, lavaret, bizola, wyssfisch, blawlingen"]; type locality: lake Konstanz, Switzerland – Germany – Austria; lectotype [by present designation]: the holotype of *Salmo wartmanni* Bloch, 1784, then in ZMB, now lost, H.-J. Paepke, in litt., 1995)

Salmo Muraena [sic] *Ferra* Gmelin, 1818: 305 (available by description and by indication to Wartmann [1777: 210, Adelfisch, Weissfisch, Weissfelchen] and Bloch [1784: 164, end of description of *S. wartmanni*]; type locality: lake Konstanz, Switzerland – Germany – Austria; lectotype [by present designation]: the holotype of *Salmo wartmanni* Bloch, 1784, then in ZMB, now lost, H.-J. Paepke, in litt., 1995; a primary junior homonym of *Salmo ferra* Walbaum, 1792)

Coregonus Wartmanni acutirostris Fatio, 1885: 660, pl. 22 I.A.1 (type locality: lake Konstanz, Switzerland [-Germany-Austria]; type material: NT)

Coregonus Wartmanni coeruleus Fatio, 1890: 116 (unnecessary replacement name for *C. w. acutirostris* Fatio, 1885)

Coregonus lavaretus natio *bodanensis* Steinmann, 1950b: 490 (infrasubspecific, name not available; locality: lake Konstanz, Switzerland, Germany and Austria; originally included five stocks)

Nomenclatural notes. *Salmo ferra* Walbaum (1792) is available from the Index, p. 714. It is based on a collection of earlier literature references, most of them themselves based on earlier works. The name is potentially a senior synonym of most coregonid stocks then known. As part of the description of *S. wartmanni* by Bloch (1784) is (ambiguously ?) included in Walbaum's account, I designate the holotype of *S. wartmanni* as lectotype of *S. ferra* and the two names are objective synonyms.

Salmo maraena ferra Gmelin (1818) is not available as it is a junior homonym of *S. ferra* Walbaum (1792). It is based in part on the same indication, including part of the description of *S. wartmanni* by Bloch (1794) and the holotype of *S. wartmanni* is designated as lectotype of *S. maraena ferra* and the two names are objective synonyms. The purpose of these two lectotype designations is to eliminate the risk that the overlooked name *S. ferra* becomes the valid name for another species and leads to confusion with or threatens the stability of *C. fera* Jurine (1825), a species from lake Genève whose name has been consistently used since. The two names differ by one letter and are therefore not homonyms [ICZN art. 57(f)].

13.1.22 ? *Coregonus* sp. [migratory stock]

Systematic notes. Ruhlé & Kindle (1992) report a morphologically distinct migratory species from lake Konstanz entering the Rhine for spawning. It is tentatively considered as a distinct, unnamed species. A formal description is not possible as I have not been able to obtain material. It also remains to be demonstrated that no introduced stock is involved; *C. maraena* had been introduced in lake Konstanz at the end of the 19th century (Nümann, 1972: 835).

An other riverine stock may have existed in the Rhine near Strasbourg and Basel (Valenciennes, in Cuvier & Valenciennes, 1848: 471), possibly the rheinschnäppel, *C. nilssoni*. There is apparently no recent record of the species in this area (Köhler & Lelek, 1992: 73, 75). The Rhine coregonids cited by Fehlmann (1936) result from an introduction in Eglisau reservoir of "blaufelchen" from Rapperswil (lake Zürich).

DANUBE BASIN IN GERMANY AND AUSTRIA

I am treating the lakes of the upper Danube basin as a single unit, not because I am convinced or because it is demonstrated that they share the same stocks, but because they share the same lack of sound comparative data. One would expect that Wagler, who was based in München, would have reasonably treated them, but the stocks of this area are possibly those for which his data are the least detailed. He recognised there his 'standard' four species occurring in various combinations in the different lakes (e.g., Wagler, 1950: 18, table). Dottrens (1959: 21) noted that the samples he examined from different lakes did not exhibit the diversity reported by Wagler and he commented that some of Wagler's stocks could not be objectively recognised. Dottrens recognised four species in the material he examined, plus one species (*C. acronius* of Wagler) of which he had no material.

In lake Chiemsee, Wagler (1937: 381, 1950: 12) records three species in his table, although in the text (1950: 16) he mentions four; Dottrens (1959: 21) obtained a single species corresponding to the *C. maraena* of Wagler (1941: 394). He commented that the *C. acronius* of Wagler might be present but had not been obtained. A comparison of Wagler's monograph (1941) and his paper on Chiemsee coregonids (1932: 282) reveals that he did not report any data indicative that he actually had examined three species in this lake. In 1932, he mentioned that earlier authors (Vogt & Hofer, 1909) reported only 2 species from Chiemsee (schwebrenke and bodenrenke) and that a third one (kilch) had been confused with young of schwebrenke and the paper provides data on both stocks. Data on the bodenrenke (*C. maraena* sensu Wagler, 1941) are not provided in this paper and I could not even find an indication that Wagler had seen material of it. Actually, Vogt & Hofer (1909: 335) wrote that bodenrenke had been introduced in 1876 but had not developed well and was rare. In 1941, Wagler did not include any information on Chiemsee kilch in his *C. acronius* account but all the data for Chiemsee *C. macrophthalmus* in the tables (pp. 391–394) are the same as for his 1932 (table 2) kilch. This change is apparently nowhere explained. Part of the 1941 data for the Chiemsee '*C. macrophthalmus*' and '*C. wartmanni*' in the tables (pp. 386–394) disagree with those in the key (pp. 380–382) which I suspect is based only on data of lake Konstanz stocks. The whole pattern is quite confusing; two species may be present, but I cannot find unambiguous data supporting this hypothesis and this deserves further study. Meanwhile, I am left with no choice but to follow Dottrens and tentatively recognise a single species in Chiemsee, *C. hoferi*. Wagler's views have also been doubted by Steinmann (1951: 64).

The same comments apply to Ammersee, except for the presence of Wagler's *C. acronius*. Wagler (1950: 16) recognises three species from Tegernsee and Würmsee [Starnbergersee], where Dottrens (1959: 21) sees only one, and Vogt & Hofer (1909) two. Two species occur in both Traunsee and Attersee (Dottrens, 1959: 20; Steinmann, 1951: 65, 66; Heckel, 1852a: 376). Altogether, I tentatively recognise five species in this area.

13.1.23 *Coregonus atterensis* Kottelat, 1997, new species

[reinanke (lakes Attersee, Mondsee, etc.)]

Coregonus lavaretus fera natio *atterensis* Berg, 1932a: 129 (infrasubspecific, name not available; locality: Attersee, Austria; based on Lechler, 1929a)

? *Coregonus lavaretus fera* natio *lacus-lunae* Berg, 1932a: 129 (infrasubspecific, name not available; locality: Mondsee, Austria; based on Lechler, 1929b [see also Lechler, 1930b])

Diagnosis. *Coregonus atterensis* occurs sympatrically in lake Attersee with *C. renke* (kröpfling). They are distinguished by number of gill-rakers on the first arch (21–31, mean 25.5 in *C. atterensis*, vs. 30–38, mean 34.6 in *C. renke*), spawning season and depth (from late January to mid-March, 20–40 m in *C. atterensis*, vs. from October to December, 80–100 m in *C. renke*), and apparently maximum size (up to 400 mm total length in *C. atterensis*, vs. 320 in *C. renke*) (Lechler, 1929a, 1930a).

Syntypes. 53 specimens on which Lechler's (1929a) account of reinanke is based. This material is not known to have been preserved.

Systematic notes. This is the species called reinanke by Lechler (1929a) and Vogt & Hofer (1909: 328).

Nomenclatural notes. The two names proposed by Berg (1932a) are unavailable because infrasubspecific and a new name is proposed for these stocks which apparently represent a distinct species.

Berg's *atterensis* was based on the account by Lechler (1929a), whose material apparently has not been preserved. The coregonid material in NMW from lake Attersee which I have examined did not include this species and I have not been able to locate museum material of it. Recent material would be available, but considering that the lake has been stocked with fishes from other lakes, I consider that such material is not suitable for a formal description of the original stock. It has thus not been possible to examine material of the species and to write a diagnosis on the basis of this material.

The species is occasionally referred to in the literature and appears to have no valid name; the purpose of the present action is to create a valid scientific name for it in order to ease unambiguous discussion of the species. This does not constitute a taxonomic revision as advocated p. 20 which is still badly needed. Although not elegant, this procedure respects the provisions of the ICZN and to me is justified by the existence of an earlier, invalid name.

13.1.24 *Coregonus bavaricus* Hofer, 1909 [kilch (lake Ammersee)]

Coregonus acronius var. *bavarica* Hofer, in Vogt & Hofer, 1909: 332 (type locality: lake Ammersee, Germany; type material: NT)

13.1.25 *Coregonus danneri* Vogt, 1908 [riedling (lake Traunsee)]

Coregonus exiguus var. *danneri* Vogt, in Vogt & Hofer, 1908: pl. 14 fig. 4 (available by indication, ICZN art. 12(b)(7) [plates published in 1908, text pages 332–333 in 1909]; type locality: lake Traunsee, Austria; holotype: NT)

Systematic notes. Riedling and reinanke are sympatric in lake Traunsee. They do not seem to differ much by gill-raker counts (34–36, vs. 35–39, according to Berg, 1932a: 123), but riedling is a dwarf stock.

13.1.26 *Coregonus hoferi* Berg, 1932 [schwebrenke (lake Chiemsee)]

Coregonus lavaretus hoferi Berg, 1932a: 130 (type locality: Chiemsee, Germany; available by indication to Schwebrenke, *C. wartmanni* var. of Vogt & Hofer, 1909: 333; syntypes [material of Vogt & Hofer]: LU, probably lost)

13.1.27 *Coregonus renke* (Paula Schrank, 1783) [kröpfling (lake Attersee), renke, reinanke (lakes Starnbergersee, Tegernsee, Traunsee, etc.)]

Salmo Renke Paula Schrank, 1783: 427 (type locality: lake Starnberg, Germany; syntypes: ZMB?)

Coregonus Reisingeri Valenciennes, in Cuvier & Valenciennes, 1848: 496 (type locality: river Danube in Austria [mention of Wien does not mean that the specimen has been collected in Wien but that it has been sent from the museum in Wien]; actually lake Traunsee, Austria, according to Heckel, 1852a: 376; holotype: MNHN)

Coregonus steindachneri Nüsslin, 1882d: 279, fig. 7 (type locality: "lake Traunsee in Salzburg", Austria; syntypes: NMW 64818 [1])

Coregonus hiemalis var. *austriaca* Vogt, in Vogt & Hofer, 1909: 330 (type locality: lake Attersee, Austria; type material: NT)

Coregonus lavaretus wartmanni natio *wagleri* Berg, 1932a: 124 (infrasubspecific, name not available; locality: Tegernsee, Germany; based on Wagler, 1930a)

Coregonus lavaretus wartmanni natio *ammerensis* Berg, 1932a: 125 (infrasubspecific, name not available; locality: Ammersee, Germany; based on Wagler, 1930b)

Systematic notes. Data on the Traunsee stock called reinanke is needed to determine its identity. Steinmann (1951: 67) counted 28–36 gill-rakers on first gill arch, but his figure are often 4 units less than those obtained by other authors (see discussion for *C. alpinus*, 13.1.10) and could agree with the 31–39 reported by Wagler (1930a–b) for the Ammersee and Tegernsee stocks and the 31–45 by Dottrens (1959: 24) for the Starnbergersee stock (as Würmsee). Nüsslin (1882d: 280) also gave counts of 35–39 for the Traunsee stock (as *C. steindachneri*).

The species also called reinanke from Attersee and Mondsee, with 21–32 gill-rakers on the first gill-arch, seems to be a distinct species, called here *C. atterensis*.

SCANDINAVIA

For Scandinavian stocks, I largely follow Svärdson's (1979) argument and recognise ten species (including *C. pidschian* which seems to be known in Europe only in the White Sea basin). A problem with Svärdson's system is that the discussion is often confused by the use of too many different (usually vernacular) names for the same species and ambiguous nomenclature. More important is that his system has to rely on too many complicated scenarios which are not supported by a phylogenetic study and that he hypothesised a few ancestral species dispersing from the east and 'evolving' into the present stocks through introgressions. The status of all stocks should be revised on the basis of their intrinsic characters, not on the basis of a speculated evolution. Phylogeny has to be derived from a study of the species, not the species limits derived from a postulated phylogeny.

As stated in the family introduction (p. 100), the taxonomic resolution of Scandinavian coregonids is not as fine as for other areas, as a result of the non-availability of the needed information.

Three Scandinavian species (*C. maraena*, *C. widegreni*, *C. nilssoni*) also occur in eastern Europe; for clarity, their complete synonymy is listed under the present heading.

13.1.28 *Coregonus albula* (Linnaeus, 1758)

Salmo Albula Linnaeus, 1758: 310 (based on Artedi [1738: gen. 9 [40], syn. 13 [18], spec. 40 [9], Coregonus edentulus ...; actual material from Sweden] and Linnaeus [1746: 119, n. 313]; type locality: "in Europa"; type material: NT)

Salmo Vimba Linnaeus, 1758: 311 (based on Linnaeus [**1747: 231**, Wimba]; type locality: "in Waenero Sveciae"; type material: NT)

? *Cyprinus muraenula* Wulff, 1765: 48 (type locality: "in lacubus stagnantibus Poloniae Borussicae" [lakes of Poland and Prussia]; type material: NT)

Salmo Maraenula Bloch, 1779: 84, pl. 4 fig. 2 (type locality: Mark Brandenburg [lakes Grundlar and Würz near Lindow] / lake near Wandliz, Mühlenbeck / lake Liepeniz, Bernauschen Heide / Altenhof, Biesenthal / lake Werbelin, Merzischen Forst, Gute Zerlanck / lakes Dabelow and Brückentin, Badingen / near Rutenberg and Reinsberg / lake near Draz, Ruppin / lake near Mulkow, Wusterhausen / Soldin and Lippehne, Wusterhausen, Pommern [lake Lagower, Murin and Madui], Germany and Poland]; syntypes: ZMB 3753 [2])

Coregonus albula var. *norvegica* Günther, 1866: 193 (type locality: Norway; syntypes: BMNH [4])

Coregonus albula var. *finnica* Günther, 1866: 193 (type locality: Gulf of Finland; syntypes: BMNH [2])

Coregonus brevis Mäklin, 1869: 20 (type locality: Ekenäs village of Nyland [district ?] on the coast of Pojo-viken inlet of the Gulf of Finland [from Berg, 1948: 322]; syntypes: LU [2])

? *Coregonus albula* var. *perejaslawica* Polyakov, **1874: xxxi** (nomen nudum; lake Pereslavskoe, Russia) from Berg, 1948: 326

? *Coregonus albula* natio *pereslawicus* Borisov, **1924: 64** (infrasubspecific, name not available; lake Pereslavskoe, Russia) from Berg, 1948: 326

? *Coregonus albula olonensis* Borisov, **1924: 66** (lakes Segozero and Vygozero, river Vyg basin, Karelia, Russia) from Berg, 1948: 318

? *Coregonus sardinella vessicus* Drjagin, **1932: 23** (lake Belozero, Karelia, Russia) from Berg, 1948: 333

? *Coregonus albula pereslavicus* Berg, **1932a:120** (lake Pereslavskoe, Russia) from Costa Pereira, in litt.

? *Coregonus albula* infrasp. *ladogae* Pravdin, Golubev & Belyaeva, **1938: 216** (infrasubspecific, name not available; southern part of lake Ladoga, Russia) from Berg, 1948: 324

? *Coregonus albula vodlosericus* Lukash, **1939: 130** (lake Vodlozero, Karelia, Russia) from Berg, 1948: 326

? *Coregonus albula* infraspecies *ladogensis* Berg, 1948: 323 (infrasubspecific, name not available; replacement name for *Coregonus albula* infrasp. *ladogae* Pravdin et al., **1938** considered to be junior homonym of the [unavailable] *Coregonus lavaretus baeri* natio *ladogae* Pravdin, **1931**)

? *Coregonus albula* natio *topozeri* Novikov, **1947: 60** (infrasubspecific, name not available; locality: lake Topozero, Karelia, Russia) from Berg, 1948: 318

Systematic notes. See Svärdson (1979: 87–88) for discussion.

13.1.29 *Coregonus maraena* (Bloch, 1779) [älvsik]

Salmo Maraena Bloch, 1779: 62, pl. 4 fig. 1 (type locality: lake Madü, Pommern [now lake Miedwie, Poland]; holotype: ZMB 3764)

Coregonus lloydii Günther, 1866: 174 (type locality: lake Wenern [Vänern], Sweden; syntypes: BMNH [10])

Coregonus lapponicus Günther, 1866: 181 (type locality: river Munio, Lapland, Sweden and Finland; syntypes: BMNH [4])

Coregonus maraena pommerana Thienemann, 1916: 98 (unnecessary replacement name for *Coregonus maraena* Bloch, 1782 which was split into two subspecies; *C. m. pommerana* is equivalent to what would now be recognised as a nominotypical subspecies, but Thienemann was avoiding tautonymies [e.g., *C. maraena maraena*])

Coregonus lavaretus vaetterensis Thienemann, 1921: 183, 188 (type locality: lake Vättern, Sweden; syntypes: LU)

? *Coregonus lavaretus* forma *baltica* Thienemann, 1922: 455 (type locality: river Schlei, Germany; syntypes: LU)

Coregonus holsatus forma *vigrensis* Lityński, 1923: 97, pl. 6 figs. 1, 3 (type locality: lake Wigry near Suwalki, Poland; syntypes: LU)

Coregonus amnipetens Freidenfeldt, 1928: 92, fig. 2 (type locality: lake Vänern, Sweden; syntypes: LU)

Coregonus lavaretus mediospinatus Pravdin, **1931a: 189** (Neva, Gulf of Finland) from Berg, 1948: 364

Coregonus lavaretus bergi Pravdin, **1931b: 42, fig. 18** (Neva, Gulf of Finland) from Berg, 1948: 364

? *Coregonus lavaretus vygensis* Pravdin, **1948b** (lake Vygozero, Karelia, Russia) from Berg, 1948: 1324

? *Coregonus lavaretus vygensis* natio *telekinae* Pravdin, **1948b** (infrasubspecific, name not available; lake Vygozero and river Telekina, Karelia, Russia) from Berg, 1948: 1324

Systematic notes. See (Svärdson, 1979: 86–87, as *C. lavaretus*) for discussion. The species is now extinct in lake Miedwie, the type locality (Heese, 1992: 493).

Nomenclatural notes. "*C. aregonus Maraena*" in Gistel & Bromme (1850: 344) is a misprint for "*Caregonus Maraena*".

13.1.30 *Coregonus maxillaris* Günther, 1866
[storsik]

Coregonus maxillaris Günther, 1866: 189 (type locality: lake Wenern [Vänern], Sweden; syntypes: BMNH [2])

Systematic notes. See Svärdson (1979: 85) for discussion.

13.1.31 *Coregonus megalops* Widegren, 1863
[blåsik]

Coregonus megalops Widegren, 1863: 589, pl. 11 fig. 15 (type locality: lake Storsjön, Indalsäven river system, Sweden; syntypes: NRM)

Coregonus pachycephalus Malmgren, 1864: 350 (type locality: lake Vänern, Sweden; available by indication to *Coregonus fera* from lake Vänern of Widegren, 1863: 580; syntypes: NRM ?)

Coregonus humilis Günther, 1866: 190 (type locality: lake Wenern [Vänern], Sweden; syntypes: BMNH [4])

Coregonus lavaretus lavaretoides Polyakov, **1874: xxxi** (nomen nudum; lake Onega, Russia) from Berg, 1948: 377

Coregonus lavaretus forma *bullarensis* Malm, 1877: 547 (type locality: Bullarsjön, Sweden; syntypes: GNM)

Coregonus lavaretus forma *bolmensis* Malm, 1877: 546 (available by indication to *Coregonus lavaretus* of Nilsson, 1855: 458; type locality: lake Bolmen, Sweden; syntypes: LU)

Coregonus lavaretus forma *ringsjöensis* Malm, 1877: 546 (available by indication to *Coregonus nilssonii* of Nilsson, 1855: 460; type locality: Ringsjön, Sweden; syntypes: LU)

? *Coregonus bolmeniensis* Smitt, 1883: 38 or Smitt, in Anonym, 1883: 190 (type locality: Ljusdal in Helsingland, Hammerdal in Jemtland, Bolmen, Åsnen, Yxkullsund, Willingsberg and Wenern [Vänern], Sweden; syntypes: NRM 35656 [1])

Coregonus lavaretus lavaretoides Berg, **1916: 91, fig. 84** (lake Onega, Russia) from Costa Pereira, in litt.

Coregonus lavaretus chibinae Krogius, in Berg, 1932: 847 (type locality: lake Imandra, Russia [Berg, 1948: 412]; syntypes: LU)

Coregonus wartmanni forma *borealis* Järvi, 1928: 29, pl. 3 figs. 16–18 (type locality: lake Inari at Palttoniemi and Virtaniemi, Finland; syntypes: LU [36])

Coregonus lavaretus lavaretoides natio *sunensis* Pravdin, **1929: 12, pls. 1–6** (infrasubspecific, name not available; river Suna, lake Onega, Russia) from Berg, 1948: 379

Coregonus lavaretus lavaretoides natio *lacustris* Pravdin, **1931a: 214, 227** (infrasubspecific, name not available; lakes Logmozero and Ukshezero, Surguba Bay, Russia) from Berg, 1948: 383

? *Coregonus lavaretus mediospinatus* natio *mustasiiska* Pravdin, **1948a: 76** (infrasubspecific, name not available; lake Ladoga, Russia) from Berg, 1949: 1323

Coregonus lavaretus arnoldi Pravdin, **1948b: 64, fig. 2** (lake Vygozero, Karelia, Russia) from Berg, 1949: 1324

Coregonus lavaretus lavaretoides natio *schuensis* Pravdin, **1949: 42** (infrasubspecific, name not available; river Shuya, lake Onega basin, Russia) from Berg, 1949: 1323

Coregonus lavaretus olonensis Pravdin, **1949: 43** (rivers Suna and Shuya, lake Onega basin, Russia; junior primary homonym of *Coregonus albula olonensis* Borisov, **1924**) from Berg, 1949: 1324

Coregonus lavaretus oronensis Kalashnikov, 1968: 516 [of translation] (type locality: lake Oron, right bank of river Vitim, about 554 km from the mouth, Siberia; syntypes: LU [46])

Systematic notes. See Svärdson (1979: 83–84) for discussion.

13.1.32 *Coregonus nilssoni* Valenciennes, 1848
[planktonsik]

Coregonus Nilssoni Valenciennes, in Cuvier & Valenciennes, 1848: 497, pl. 631 (type locality: lake Bolmen, Småland, Sweden; Norway; syntypes: MNHN)

Coregonus generosus Peters, 1875: 791, fig. (type locality: lake Puls, near Bernstein, Neumark, Poland; syntypes: ZMB 8704 [1], 8706 [3], 8707 [3], 8709 [1])

Coregonus nilsonii manocentrus Berg, 1948: 378 (listed in synonymy, name not available)

Coregonus nilsonii pycnocentrus Berg, 1948: 378 (listed in synonymy, name not available)

Systematic notes. See Svärdson (1979: 81–82) for discussion of part of synonymy.

Nomenclatural notes. *Coregonus nilssonii manocentrus* Smitt, 1886 and *C. n. pycnocentrus* Smitt, 1886 have occasionally appeared in the literature (e.g., Berg, 1948: 378; Fowler, 1974: 79, 81); manocentrus and pycnocentrus were actually intended as collective descriptors and are not available species-group names from this publication.

13.1.33 *Coregonus pallasii* Valenciennes, 1848

[aspsik]

Coregonus Pallasii Valenciennes, in Cuvier & Valenciennes, 1848: 483 (type locality: specimens received from St. Petersburg, Russia; syntypes: MNHN)

Coregonus aspius Smitt, 1883: 38 (type locality: Piteå Lappmark, Sweden; syntypes: NRM)

? *Coregonus lavaretus multispinatus* Pravdin, **1948b: fig. 3** (lake Vygozero, Karelia, Russia) from Berg, 1949: 1324

? *Coregonus lavaretus multispinatus* natio *longiusculus* Pravdin, **1948b** (infrasubspecific, name not available; lake Vygozero, Karelia, Russia) from Berg, 1949: 1324

? *Coregonus lavaretus multispinatus* natio *nasutus* Pravdin, **1948b** (infrasubspecific, name not available; lake Vygozero, Karelia, Russia) from Berg, 1949: 1324

? *Coregonus lavaretus exiguus* Pravdin, **1949: 42** (lake Syamozero and other lakes of the Shuya basin, Russia; junior primary homonym of *Coregonus exiguus* Klunzinger, 1884) from Berg, 1949: 1325

? *Coregonus lavaretus pallasi* natio *exilis* Pravdin, 1954: 105 (infrasubspecific, name not available; type locality: lake Onega, Russia; syntypes: LU)

Systematic notes. See Svärdson (1979: 79–81) for discussion of part of synonymy.

13.1.34 *Coregonus peled* (Gmelin, 1788)

Salmo Peled Gmelin, 1788: 1379 (based on Lepechin, **1780: 226, pl. 12**; type locality: "Russia boreali"; syntype: ZMB 23555 [1], Svetovidov, 1978: 22, fig. 40)

Salmo cyprinoides Pallas, 1814: 412 (type locality: river Lena at Tungusis, Siberia; syntypes: LU)

Salmo Pelet Pallas, 1814: 412 (type locality: estuary of river Ienissei, Siberia; syntype: ZMB 23555, Svetovidov, 1978: 22, fig. 40)

Coregonus rudolphianus Valenciennes, in Cuvier & Valenciennes, 1848: 531 (based on *Coregonus pelet* of Pallas, 1814: 412; type locality not stated, but river Ienissei, Siberia; holotype: ZMB 23555, Svetovidov, 1978: 22, fig. 40)

Systematic notes. The stock from lake Storvindeln is reportedly the only known natural, relict population of *C. peled* in the area covered here (Svärdson & Filipsson, 1994). This stock was reported as *C. pallasi* in Svärdson (1979: 79–81). The terminology used in these papers is confusing and it is sometimes difficult to understand which is which. Awaiting a clear description and explicit statements, I tentatively follow Svärdson & Filipsson.

Coregonus peled also occurs in European Russia in rivers Mezen and Pechora (Reshetnikov, 1980).

13.1.35 *Coregonus pidschian* (Gmelin, 1788)

Salmo Pidschian Gmelin, 1788: 1377 (available by indication to Pallas, 1776: 705; type locality: not clearly stated, but river Ob, Siberia, is implied by statement in the description of *Salmo nasus* in Pallas, 1776: 705; syntypes: ZISP ?)

Salmo Polcur Pallas, 1814: 400 (type locality: from the Arctic Ocean migrates to the river Ob somewhat above Berezov, Siberia; syntypes: LU)

Coregonus sikus Cuvier, 1829: 308 (type locality: rivers of Norway; syntypes: MNHN)

? *Coregonus smitti* Warpachovski, 1900: 414, pl. 13 fig. 1 (type locality: lake Teletskoe, Ob basin, Siberia; syntypes: ZISP 11486 [3], 11487 [4], 11488 [6], 11489 [6])

Coregonus fera forma *inarensis* Järvi, 1928: 29, pl. 4 figs. 19–20 (type locality: lake Inari at mouth of rivers Juutuan and Niipi and at Virtaniemi, lake Muddus, Finland; syntypes: LU)

? *Coregonus lavaretus pidschianoides* Pravdin, **1931a: 232** (rivers Vyg and Kem, Karelia, Russia) from Berg, 1948: 395

? *Coregonus lavaretus pidschian* natio *bergiellus* Svetovidov, 1934: 344 (infrasubspecific, name not available; river Kara, Kara Bay, Russia)

? *Coregonus lavaretus pidschianoides* natio *soldatovi* Pravdin, in Pravdin & Berg, **1948: 15, fig. 14** (infrasubspecific, name not available; lake Kildin, Kola basin, Russia) from Berg, 1948: 398

Nomenclatural notes. The author of *C. pidschian* is sometimes erroneously indicated as Pallas (1776: 705). In that publication, Pallas consistently indicated in the headings both the Latin and local names. The local names were all preceded by the name of the populations using them. Thus the heading for pidschian reads "*Salmo* an *Lavareti* varietas ? Ostiacis *Pidschian*. Samoiedis *Polcur*" [a *Salmo* variety related to *lavaretus* ? Pidschian in Ostiac language, Polcur in Samoyed language]. The name

C. pidschian clearly is not available from Pallas (1776).

13.1.36 *Coregonus trybomi* Svärdson, 1979

Coregonus trybomi Svärdson, 1979: 71, figs. 30–31 (type locality: lake Ören, Sweden; holotype NRM 35748)

Systematic notes. This is the *C. baunti* of Svärdson (1957). *Coregonus sardinella baunti* Mukhomediyarov (1948) is known from the lakes of the upper course of river Tsipikan, Vitim basin, Baunt, Siberia. Genetic data of Finnish stocks show that spring-spawning coregonid stocks are probably not each-other closest relative (Vuorinen et al., 1981), that is, spring spawning possibly evolved independently in different lineages.

Nomenclatural notes. *Coregonus baunti* Karasev, 1987 (p. 54) is an invalid primary homonym of *C. sardinella baunti* Mukhomediyarov, 1948.

13.1.37 *Coregonus widegreni* Malmgren, 1863

[sandsik]

Coregonus Widegreni Malmgren, 1863: 52 [German translation: 1864: 325] (type locality: northern part of lake Ladoga, Finland [now in Russia]; syntypes: MZH ?)

Coregonus Baerii Kessler, 1864: 138, pl. 2 (type locality: Volkhov, Ilmen, Msta, Syas, Russia [from Berg, 1948: 365]; syntipes: ZISP ?)

Coregonus gracilis Günther, 1866: 182 (type locality: Gestrickland, Sweden; syntypes: BMNH [4])

? *Coregonus tscholmugensis* Danilevskii, **1873: 69** (Cholmuga Bay, lake Onega, Russia) from Berg, 1948: 377

? *Coregonus ludoga* Poljakov, **1874: xxx** (nomen nudum; lake Ladoga, Russia) from Berg, 1948: 372

? *Coregonus ludoga* var. *swirensis* Polyakov, **1874: xxx** (nomen nudum; river Svir, lake Ladoga basin, Russia) from Berg, 1948: 368

? *Coregonus ludoga* var. *verchoswirka* Polyakov, **1874: xxx** (nomen nudum; lake Onega near source of river Svir and upper Svir, Russia) from Berg, 1948: 370

Coregonus ludoga var. *kessleri* Polyakov, **1874: xxx** (unnecessary replacement name for *Coregonus widegreni* Malmgren, 1863) from Berg, 1948: 374

? *Coregonus widegreni ludoga* Berg, 1916a: 97 (in part; type locality: lake Ladoga, Russia [Berg, 1948: 372]; syntypes: LU)

Coregonus maraena holsata Thienemann, 1916: 99 (type locality: lake Selenter near Lütjenburg, Holstein, Germany; syntypes: LU)

Coregonus holsatus forma *suecica* Thienemann, 1921: 177 (type locality: northern part of lake Vättern near Motala, Sweden; syntypes: LU [10 heads])

Coregonus holsatus forma *scallensis* Thienemann, 1921: 177 (type locality: lake Schaal, Mecklenburg, Germany; syntypes: LU)

Coregonus lavaretus forma *okoniensis* Kulmatycki, 1927: 288, 325 (type locality: lake Wielkie-Okoninskie, Poland; syntypes: ? IZPAN [22])

Coregonus lavaretus forma *polonica* Kulmatycki, 1927: 295, 328 (type locality: Putziger Wiek [Zatoka Pucka], western part of Gulf of Danzig, Poland; syntypes: ? IZPAN [18], Gasowska, 1960: 483)

Coregonus holsatus forma *anarensis* Järvi, 1928: 29, pl. 4 fig. 21–23 (type locality: lake Inari at Palttoniemi, lakes Tiais and Tshuolis, Finland; syntypes: LU)

? *Coregonus lavaretus baeri* natio *ladogae* Pravdin, **1931a: 195** (infrasubspecific, name not available; lake Ladoga, Volkhov Bay, Russia) from Berg, 1948: 370

? *Coregonus lavaretus baeri* natio *swirensis* Pravdin, **1931a: 201, 204** (infrasubspecific, name not available; river Svir, lake Ladoga basin, Russia) from Berg, 1948: 368

? *Coregonus lavaretus poljakovi* Pravdin, **1931a: 208, 227** (lake Onega, opposite source of river Svir, Russia) from Berg, 1948: 370

? *Coregonus lavaretus ludoga* natio *onegi* Pravdin, **1931a: 208, 227** (infrasubspecific, name not available; lake Onega, Russia) from Berg, 1948: 373

? *Coregonus lavaretus poljakovi* natio *werchoswirka* Pravdin, **1931a: 212, 227, pl. 11** (infrasubspecific, name not available; lake Onega, river Svir, Russia) from Berg, 1948: 370

Coregonus lavaretus widegreni natio *onegi* Pravdin, **1931a: pl. 10** (infrasubspecific, name not available; lake Onega, Russia) from Berg, 1948: 376

Systematic notes. See Svärdson (1979: 85–86) for discussion.

Nomenclatural notes. The specimen considered the holotype of *C. widegreni* Malmgren, 1863 by Berg (1948: 374) cannot be the holotype as Malmgren did not explicitly state that he had a single specimen. From his text, it seems that he examined more than one specimen and they are thus syntypes.

POLAND, NORTHERN GERMANY, DENMARK, NETHERLANDS, BELGIUM

Six species occur in this area. The synonymy of *C. maraena*, *C. widegreni*, *C. nilssoni* and *C. albula* have already been listed under Scandinavia, where these species also occur. The synonymies follow mostly discussion in Svärdson (1979) which is sometime confusing (e.g., p. 51, 82, his discussion of *C. lavaretus baltica* is ambiguous and it is not clear if he means it is the same as his *C. nilssoni*, *C. lavaretus*, *C. oxyrinchus* or a distinct species).

Coregonus albula (Linnaeus, 1758) [kleine maräne]

See above under Scandinavia, 13.1.28

13.1.38 *Coregonus lucinensis* Thienemann, 1933

[quietschbükers (lake Lucin)]

Coregonus albula lucinensis Thienemann, 1933: 655, figs. 1–2 (type locality: lake Breiten Lucin, Mecklenburg-Strelitz. Germany; syntypes: LU [72])

Systematic notes. Thienemann (1933) described two sympatric stocks from lake Breiten Lucin which are morphologically distinct and do not interbreed; they are thus two distinct species. One is the widespread *C. albula* and the other, *C. lucinensis*, a small deep-water and big-eyed species apparently endemic to three small lakes of Mecklenburg, northern Germany. Svärdson (1979: 88) considered it as possibly conspecific with *C. vandesius*, but this is apparently based on zoogeographic or evolutionary speculations only as he provides no taxonomically relevant data.

Coregonus maraena (Bloch, 1779) [maräne]

See above under Scandinavia, 13.1.29

Coregonus nilssoni Valenciennes, 1848 [rheinschnäppel, edelmaräne]

See above under Scandinavia, 13.1.32

13.1.39 *Coregonus oxyrinchus* (Linnaeus, 1758)

[houting, nordseeschnäppel]

Salmo Oxyrinchus Linnaeus, 1758: 311 (based on Artedi [1738: gen. [spec.] 10, syn. 21, Coregonus maxilla superiore longiore conica...; material from "Flandria, Batavia"], Gronovius [1754: 18, n. 48, idem; material from "Mare Septentrionale"]; type locality: "in Oceano Atlantico"; syntype: BMNH 1853.11.12:160 [1], Wheeler, 1958: 208)

Salmo Thymallus latus Bloch, 1782: 170, pl. 26 (type locality: Danzig, Pommern [Poland] / Hamburg, Germany / Denmark / Sweden; holotype: ZMB 33749 [although he lists many localities, Bloch apparently had a single specimen, without locality information; H.-J. Paepke, in litt., 1995])

Tripteronotus hautin La Cepède, 1803: 48 (type locality: Anvers, Belgium [based on Rondelet, 1555: 195, oxyrynchis piscibus]; type material: NT)

Salmo Rostratus Shaw, 1804: vol. 5 (1): 86 (unnecessary replacement name for *Salmo thymallus latus* Bloch, 1782)

Coregonus widegreni Malmgren, 1863 [Selenter-maräne, Schalsee-maräne]

See above under Scandinavia, 13.1.37

BRITISH ISLES

The latest revision based on direct examination of material of all stocks from the British Isles is by Regan (1908). Subsequent studies have been based on some of the populations only and are very contradictory (see Maitland, 1970 for a brief summary and distribution data; Beaumont et al., 1995, for genetic data of some species; species accounts below for some of the conclusions).

13.1.40 *Coregonus clupeoides* La Cepède, 1803

[powan (Loch Lomond)]

Coregonus clupeoïdes La Cepède, 1803: 698 (type locality: island Inchtonachon, Lochlomoud [Loch Lomond], Scotland; syntypes: LU)

Coregonus Lacepedei Parnell, 1838a: 162, pl. 6 (type locality: Loch Lomond, Scotland, U.K.; syntypes: LU)

Coregonus microcephalus Parnell, 1838a: 163 (type locality: Loch Lomond, Scotland, U.K.; syntypes: LU)

Coregonus Cepedii Valenciennes, in Cuvier & Valenciennes, 1848: 503 (unjustified emendation of *Coregonus lacepedei* Parnell, 1838)

Systematic notes. Svärdson (1979: 83–84) considered the powan as a subspecies of the Scandinavian *C. megalops* on the basis of its assumed phylogeny (see general comment under introduction to Scandinavian coregonids, p. 115).

Gasowska (1965) examined the powan from Loch Lomond (*C. clupeoides*), the gwyniad of Llyn Tegid (*C. pennantii*) and the schelly of Haweswater and Ullswater (*C. stigmaticus*). She concluded that they all belong to a polytypic *Coregonus lavaretus* sensu lato (sensu Berg, 1948; see *Coregonus* introduction, p. 97). She concluded that the powan and the gwyniad were morphologically distinct and should be recognised as subspecies, but did not reach any conclusion about the schelly. The gwyniad and the powan are morphologically distinct and satisfy the definition of the species as understood here. The status of the schelly is still not clear and I tentatively treat it as valid species, *C. stigmaticus*. Beaumont et al. (1995: 887) report that the gwyniad from Llyn Tegid is genetically "quite distinct ... because they exhibit unique alleles at quite high frequencies".

Ferguson (1974) considered *C. clupeoides*, *C. pennantii* and *C. stigmaticus* as conspecific on the base of their genetic similarity. As discussed in the Introduction (p. 19) and under *Alosa alosa* (4.1.3), there is no theory to demand that species have to differ electrophoretically or that stocks not distinguishable electrophoretically are conspecific.

13.1.41 *Coregonus pennantii* Valenciennes, 1848

[gwyniad (Llyn Tegid, Bala)]

Coregonus Pennantii Valenciennes, in Cuvier & Valenciennes, 1848: 507 (based on Willughby [1686: 183, Guiniad, "in lacu Pimblemeer ... proprie oppidum Bala in comitatu Merionethensi Walliae, non autem in fluvio Dea qui eum perfluit"], Pennant [1769: vol. 3: 267, pl. 16) and Yarrell [1836: vol. 2: 85, Gwyniad, Llyn Tegid (Fair Lake) at Bala]; type locality: "lac de Fer" [Fair Lake], Llyn-Tegid, Wales, U.K.; type material: NT ? [material of these authors])

Systematic notes. Gasowska (1965) commented on Dottrens's (1959: 30) record of the presence of two species in Llyn Tegid that only one species is present in her material and that the other is only known from old museum specimens. She concluded that this second species might have been an introduced stock which became extinct since, but did not provide evidence for it; neither did she consider the possibility of a second native species which either is extinct or has not been seen by her. More information is needed on this before reaching a conclusion.

Svärdson (1979: 81) considered that *C. pennantii* "seems" to be the same as *C. nilssoni* "judging by the gill-raker counts, around 38". In the absence of more substantial information and comparison, they are considered distinct. If *C. nilssoni* and *C. pennanti* were considered conspecific, they would be simultaneous synonyms and *C. nilssoni* would have priority by decision of the first reviser (Svärdson, 1979: 82).

13.1.42 *Coregonus pollan* Thompson, 1835 [pollan]

Coregonus Pollan Thompson, 1835: 78 (type locality: Lough Neagh, Ireland; syntypes: BMNH ?)

Coregonus elegans Thompson, 1839: 422, pl. 16 fig. 5 (type locality: river Shannon near Killaloe-lakes, Ireland; syntypes [total 2]: BELUM [1], Regan, 1908b: 487)

Coregonus altior Regan, 1908b: 486 (type locality: Lough Erne, Fermanagh, Ireland; syntypes: BMNH [14], BELUM [2])

Systematic notes. Ferguson et al. (1978) and Svärdson (1979: 6, 81) considered this species as conspecific with the Arctic *C. autumnalis* (Pallas, 1776) (p. 705; type locality: rivers Petchora and Ienissei, river Angara and lake Baikal, river Tubam and lake Madsharem, Siberia; includes probably several species). Bodaly et al. (1991: 37) considered that *C. autumnalis* [from Siberia and Canada], *C. artedii* [from Canada] and *C. pollan* "appear to be conspecific on the basis of genetic distances" obtained by electrophoretic studies. The non-significance of such distances for deciding systematic status or species distinctness has been discussed above (pp. 18, 19, 101).

Ferguson et al. (1978) found no electrophoretic difference between the two stocks. They considered this to "confirm Behnke's (1972) view that [the two] are the same species and merit, at most, sub-specific separation" (p. 228). Behnke (1972: 664) effectively stated that he could find no difference, but I could not find actual data or information on the examined material. In this context, the statement "I would consider the Irish population as no more than a subspecies of *C. autumnalis*" is somewhat puzzling. Similarly, Ferguson et al. (1978: 230) considered that "since the name *pollan* is well established in the literature and since the Irish populations show a number of structural and behavioural differences from the Arctic populations it is probably advantageous to regard pollan as a subspecies of *C. autumnalis*". Either the two stocks are identical (then I see no point at distinguishing subspecies, especially on the ground that a name is established in the literature) or they can be diagnosed ["structural and behavioural differences" ?] and as they obviously are different lineages, they should be considered species under the PSC. In the absence of data demonstrating that a single species is involved, I see no advantage in considering the land-locked Irish stocks conspecific with the anadromous *C. autumnalis* of the Arctic Ocean in Siberia, Alaska and north-eastern Canada. Electrophoretic identity in some alleles is not in itself evidence of conspecificity. Zoogeographic hypotheses or speculations (Behnke, 1972: 664; Ferguson et al., 1978: 229) should follow a phylogenetic construction but cannot be used as argument for reaching a taxonomic conclusion.

There are two more reasons to consider that this synonymy is premature or unjustified with the available data. First the *C. autumnalis* stock used for comparison is a hatchery stock of unstated origin ["USSR"] said to be *C. autumnalis*, but the source or reference for identification is not stated. Second, "there is evidence of the existence of several partially isolated populations in Lough Neagh" (Ferguson, 1974: 314); the status of these should be elucidated first. It might be that several species are involved. The formal synonymy of *C. pollan* and *C. autumnalis* requires first an unambiguous identification of both stocks.

Regan (1911b: 120) considers that *C. pollan*, *C. altior* and *C. elegans* are distinct; Dottrens (1959: 57) considered the stocks of Lough Neagh (*C. pollan*) and Lough Erne (*C. altior*) as representing two different species. See also Gasowska (1964).

13.1.43 *Coregonus stigmaticus* Regan, 1908 [schelly (Haweswater and Ullswater)]

Coregonus stigmaticus Regan, 1908b: 489 (type locality: Haweswater, Cumberland, and Ullswater, Westmoreland, U.K.; syntypes: BMNH [12])

13.1.44 *Coregonus vandesius* Richardson, 1836

[vendace]

Coregonus vandesius Richardson, 1836: 213 (type locality: Salway Firth, Lochmaben and Castle Loch, Scotland, U.K.; syntypes: LU)

Coregonus Willughbeii Jardine, 1840: pl. 6 (type locality: Castle Loch, Lochmaben, Dumfrieshire, Scotland, U.K.]; syntypes: ? BMNH, Günther, 1866: 194)

Coregonus gracilior Regan, 1906: 181, pl. 7 (type locality: lake Derwentwater, Cumbria, U.K.; syntypes: BMNH [1], Keswick Museum [4])

Systematic notes. Ferguson et al. (1978) considered *C. vandesius* as conspecific with *C. albula*, a point of view not shared by Svärdson (1979: 88). Bodaly et al. (1991: 37) considered that *C. albula* (including *C. vandesius*) and *C. sardinella* [from Siberia, Alaska and Canada] "appears to be conspecific" on the basis of genetic distances obtained by electrophoretic studies. The non-significance of such distances for deciding systematic status or species distinctness has been discussed above (pp. 18, 19, 101).

The author of *C. willughbii* is often erroneously indicated as Jardine (1831). Regan (1911b: 117) considers *C. vandesius* and *C. gracilior* as distinct species.

13.1.46 Names of unclear status:

The status of the following names which appear in the literature cannot be elucidated at present:

Coregonus lavaretus microps Smitt, 1883: 39 or Smitt, in Anonym, 1883: 191 (type locality: lake Wenern [Vänern] [restricted by Berg, 1932a: 127]; syntypes: NRM 35647-35652 [6], 35662 [2], 35687 [1], 35688 [2])

Coregonus lavaretus microcephalus Smitt, 1883: 39 or Smitt, in Anonym, 1883: 192 (type locality: Ångermanelfven, Sweden; syntypes: NRM 35659 [1], 35660 [1]; junior homonym of *C. microcephalus* Parnell, 1838)

Coregonus maraena maraenoides Polyakov, **1874: xxxi** (nomen nudum) from Berg, 1948: 385

Coregonus nordmanni Mela, 1882: 350, fig. 200 (type locality: northern part of lake Ladoga, Finland [now Russia]; holotype: LU ?)

Coregonus maraena maraenoides Berg, 1916a: 94, fig. 86 (type locality: lakes Chud [Peipus] and Pskov, Estonia and Russia [Berg, 1948: 385]; syntypes: ZISP ?; junior primary homonym of *C. asperi maraenoides* Fatio, 1885)

Coregonus lavaretus forma *norvegica* Thienemann, 1922: 458 (type locality: lake Mjören and its outlet, stream Vormen, Norway; syntypes: LU; restricted to the form spawning in December and January by Berg, 1932a: 128)

Coregonus lavaretus forma *lapponica* Järvi, 1928: 37, pl. 3 fig. 15 (type locality: lake Vuontis, Finland; syntypes: LU; junior homonym of *C. lapponicus* Günther, 1866)

Coregonus lavaretus gruppe *orientalis* Kulmatycki, 1928: 44 (infrasubspecific, name not available; locality: lakes Wielkie-Gluche, Wielkie-Tuczno and Gorynskie, Poland)

Coregonus lavaretus gruppe *pulsensis* Kulmatycki, 1928: 44 (infrasubspecific, name not available; locality: lakes Puls and Raakow, Poland; based on data in Thienemann, 1928])

Coregonus lavaretus gruppe *danica* Kulmatycki, 1928: 44 (infrasubspecific, name not available; locality: lakes: Tjele Langsö, Glenstrup Sö, Klejtrup Sö and Nipsaa, Denmark; based on Otterstrøm, 1922])

Coregonus lavaretus holsatus forma *karelica* Pravdin, **1931a: 221, 226, pl. 12** (infrasubspecific, name not available; lakes Pyalozero and

Syamozero, Karelia, Russia) from Berg, 1948: 383

Coregonus lavaretus prawdini Berg, 1932a: 125 (replacement name for *Coregonus lavaretus* forma *lapponica* Järvi, 1928; type locality: lake Vuontis, Finland; syntypes: LU)

Coregonus lavaretus järvii Berg, 1932a: 126 (replacement name for *C. wartmanni* sensu Järvi, 1928; type locality: lakes Leppävesi, Lievestuore and Keitele, Finland; syntypes: LU)

Coregonus lavaretus angermanensis Berg, 1932a: 127 (replacement name for *C. microcephalus* Smitt, 1883; type locality: Ångermanelfven, Sweden; syntypes: NRM)

Coregonus lavaretus norvegicus natio *thienemanni* Berg, 1932a: 129 (infrasubspecific, name not available; locality: lake Mjören and river Vormen, Norway; reference to the September-November spawning form of *C. lavaretus norvegicus* Thienemann, 1922)

Coregonus lavaretus imandrae Krogius, in Berg, 1933: 847 (type locality: lake Imandra, Murmansk, Russia [Berg, 1948: 389]; syntypes: LU)

Coregonus lavaretus imandrae infrasubspecies *pelagicus* Krogius, in Berg, 1933: 847 (infrasubspecific, name not available; lake Imandra, Murmansk, Russia [Berg, 1948: 389])

Coregonus lavaretus imandrae infrasubspecies *knipowitschi* Krogius, in Berg, 1933: 847 (infrasubspecific, name not available; lake Imandra, Murmansk, Russia [Berg, 1948: 389])

Coregonus lavaretus imandrae natio *umbrae* Krogius, in Berg, 1933: 847 (infrasubspecific, name not available; lake Umbozero, Murmansk, Russia [Berg, 1948: 390])

Coregonus lavaretus imandrae natio *umbrae* infranatio *pelagicola* Krogius, in Berg, 1933: 847 (infrasubspecific, name not available; lake Umbozero, Murmansk, Russia [Berg, 1948: 390])

Coregonus lavaretus vimbaeformis Pravdin, in Pravdin & Berg, **1948: 11, fig. 8** (lake Vuljavr, Ponoi river basin, Kola, Russia) from Berg, 1948: 390

Coregonus lavaretus pidschian natio *lovensis* Pravdin, in Pravdin & Berg, **1948: 12, fig. 9** (infrasubspecific, name not available; lake Lovozero, Kola, Russia) from Berg, 1948: 391 and Costa Pereira, in litt.

Coregonus lavaretus lavaretoides natio *voronjensis* Pravdin, in Pravdin & Berg, **1948: 12, fig. 10** (infrasubspecific, name not available; basin of lake Lovozero, Kola, Russia) from Berg, 1948: 392 and Costa Pereira, in litt.

Coregonus lavaretus bergianus Pravdin, in Pravdin & Berg, **1948: 12, fig. 11** (lake Ondomozero, Kola, Russia) from Berg, 1948: 390

Coregonus lavaretus lovensis Berg, 1948: 391, fig. 229 (type locality: lake Lovozero, Kola, Russia; syntypes: ZISP ?)

Coregonus lavaretus voronjensis Berg, 1948: 392, fig. 230 (type locality: basin of lake Lovozero, Kola, Russia; syntypes: ZISP)

Coregonus lavaretus neschka Pravdin, **1950: 74** (lake Segozero, Russia) from Costa Pereira, in litt.

Coregonus lavaretus palloni Pravdin, **1950: 75** (lake Segozero, Russia) from Costa Pereira, in litt.

Coregonus lavaretus kilone Pravdin, **1950: 77** (lake Segozero, Russia) from Costa Pereira, in litt.

Coregonus lavaretus melga Pravdin, **1950: 77** (lake Segozero, Russia) from Costa Pereira, in litt.

Coregonus tapinorhynchus Fowler, 1974: 79 (listed in synonymy, name not available; refers to *tapinorhynchi* Smitt, 1895: 900 which was not intended as a specific name)

Coregonus hypselorhynchus Fowler, 1974: 79 (listed in synonymy, name not available; refers to *hypselorhynchi* Smitt, 1895: 902 which was not intended as a specific name)

Coregonus stenorhynchus Fowler, 1974: 79 (listed in synonymy, name not available; refers to *stenorhynchi* Smitt, 1895: 902 which was not intended as a specific name)

Coregonus euryrhynchus Fowler, 1974: 79 (listed in synonymy, name not available; refers to *euryrhynchi* Smitt, 1895: 902 which was not intended as a specific name)

Salmonidae

14.1.1 *Acantholingua ohridana* (Steindachner, 1892)

Salmo ohridanus Steindachner, 1892: 379, pl. 3 figs. 1–3 (type locality: lake Ohrid, FYROM; syntypes: NMW 58154 [1], 65592–603 [31], 65611 [1], 66021 [1], 66447 [2])

Systematic notes. Systematic position follows Stearley & Smith (1993: 14). Eschmeyer (1990: 10) considered that *Acantholingua* is not available from Hadzisce (1960: 47, 1961: 790) because two species are included and none is designated as type species (ICZN art. 13(b)). Actually, in both papers, Hadzisce explicitly included a single species (*A. ohridana*) in *Acantholingua*; it is type species by monotypy (ICZN art. 68(d)) and the name is available from Hadzisce (1960).

14.2.1 *Hucho hucho* (Linnaeus, 1758)

Salmo Hucho Linnaeus, 1758: 309 (based on Artedi [1738: gen. [spec.] 12, syn. 25, Salmo oblongus dentium ...; based on Gesner, **1556: 1075** [1604: 1015; 1558: 1213; Bavaria, Carinthia], 1563 [and 1575]: 173, and Willughby, 1686: 199; "Viennae, Austriae"]; type locality: "..", type material: NT)

Hucho germanorum Günther, 1866: 140 (listed in synonymy, name not available)

Systematic notes. Hensel & Holčík (1983) recognise two subspecies, *H. h. hucho* from the Danube basin and *H. h. taimen* (Pallas, 1773) in Russia, whose range extends from the Kama and Pechora rivers eastwards to the Jana and Amur basins. Figures 6–7 in Holčík et al. (1988) show distinct cranial osteology and their figure 6 shows a cladogram where *taimen* forms a monophyletic lineage with *H. perryi* and *H. ishikawai* (two East Asian species), this lineage forming an unresolved trichotomy with *H. hucho* and *H. bleekeri* (a species from the Yangtze); *H. hucho* as understood by these authors would then be polyphyletic. Considering that each taxon is diagnosable, that they occupy two distinct and not contiguous areas, they are regarded as two species.

Nomenclatural notes. Linnaeus (1758) did not indicate a type locality for his *Salmo hucho*. Linnaeus's diagnosis is actually based on Artedi (1738), itself based on Gesner and Willughby. Artedi gives the locality as "Viennae, Austriae"; this is the locality given by Willughby. Gesner's (1558) observations are based on material from Bavaria and Carinthia.

Berg (1948) included *Salmo lossos* Günther, 1866 (p. 140; type locality: Baltic Sea, rivers Kama, Kolva, Wolga, Petschow, Vitchegda, and Muilwa, Caspian Sea; syntypes: lost ? [material of *Salmo hucho* in Pallas, 1814: 344]) and *S. fluviatilis* Pallas, 1814 (p. 359; type locality: tributaries of rivers Ob and Irtis, river Lena and tributaries, lake Baikal, Siberia; holotype: ZMB 23561) in the synonymy of *H. hucho*. It does not seem that any of the mentioned localities is within the known distribution range of *H. hucho* and these nominal species are considered to be synonyms of *H. taimen*. See also Svetovidov (1978: 21, figs. 34–35).

Oncorhynchus mykiss (Walbaum, 1792) introduced

Systematic notes. This species was formerly known as *Salmo gairdneri* Richardson, 1836. Smith & Stearley (1989) showed that the relationships of this species lies with the Pacific salmons (genus *Oncorhynchus*) and not with the trouts and Atlantic salmon (genus *Salmo*). This species naturally occurs in North America and Kamchatka and the earliest available name for it is *O. mykiss*, based on material from Kamchatka.

Salmo

The existence of ecological morphs of the trouts have been much discussed, usually focusing on whether the marine, lacustrine and brook stocks were different species, subspecies or morphs. Most authors were only concerned with their national waters and paid little or no attention to inter-basin variability. The earlier authors had recognised the marine, lacustrine and brook stocks as different species (e.g., Linnaeus, 1758; Günther, 1866), but as early as 1825, Jurine already considered lake and brook trouts to be a single species. In this century, the tendency has been to consider them as subspecies of a single species or as morphs. In my point of view, these discussions suffer from several weaknesses, the main one being that the authors implicitly considered the trout (or the three species or subspecies) as an homogenous entity all over its (their) range, neglecting the possibility that the situation of a population in a given basin a priori could not be extrapolated to other areas. Nümann (1967) and Balon (1968) already pointed out that a classification of trouts into three species, subspecies or forms *trutta*, *lacustris* and *fario* was unlikely to be a correct phylogenetic interpretation of the evolution of European trouts as, for example, each lake stock is most likely independently derived from different riverine stocks; thus a '*S. lacustris*' including all European lake trouts would be polyphyletic, thus not acceptable. The data now becoming available confirm this view (see below).

Ecological morphs or species ? *There is evidence that in some basins different morphs constitute a single genetic pool while in other basins different morphs are genetically distinct.* We must consider, population by population, three alternatives:

1) the different morphs are genetically distinct and reproductively isolated; they obviously are different species;

2) the different morphs are not distinguishable genetically [or more objectively, the techniques used did not lead to differences being observed] but are reproductively isolated; if they can be diagnosed, they conform to the definition of species and are distinct species;

3) the different morphs are not distinguishable genetically and are not reproductively isolated; they constitute a single species.

Sympatric stocks which are genetically distinct and reproductively isolated (alternative 1) are known from lake Bunnersjöarna, Sweden (Ryman, 1979), Lough Melvin, Ireland (Ferguson & Mason, 1981: Ferguson & Fleming, 1983; Ferguson, 1986; Ferguson & Taggart, 1991; McVeigh et al., 1995), Lough Neagh, Ireland (Crozier & Ferguson, 1986), and lake Sevan, Armenia (Dorofeyeva & Rukhyan, 1982). There are no data on morphological characteristics of the two stocks of lake Bunnersjöarna (as well as most of Scandinavia). In Lough Melvin, three morphologically distinct stocks (known as sonaghen, gillaroo and ferox) occur together and have been documented for over 200 years; beside morphological differences, they differ in allele frequencies, spawning grounds and seasons, intrabasin distribution and feeding habits (Ferguson & Mason, 1981; Ferguson, 1986; Cawdery & Ferguson, 1988; Ferguson & Taggart, 1991; McVeigh et al., 1995). In the Lough Neagh river system, two to four stocks are recognised (ferox, gillaroo, dollaghan and salmon-trout) of which only the last two appear to be common and well documented (Crozier & Ferguson, 1986: 461). Nyman (1967: 8, 19) reports electrophoretic differences between anadromous and "brook locked" trouts in river Indalsälven basin, Sweden. Skaala & Naeval (1989) found significant genetic differences between anadromous and sedentary trouts in three adjacent small river basins in Norway, as well as significant differences between the three basins. Skaala & Jørstad (1987, 1988; Skaala et al., 1991) found two genetically distinct stocks identifiable by colour pattern in lake Svartavasstjønn on the Hardangervidda plateau, southern Norway; except for differences of colour pattern, no morphological character has been analysed; the fine spotted trout is probably a distinct species under the PSC; its whole spawning area is limited to less than 20 m^2 and it is badly threatened by acid rains and stocking with allochtonous stocks. Two genetically distinct stocks (anadromous and non-migratory) have been found in an unspecified stream of the British Isles (Ferguson, 1989: 42).

In the case of genetically indistinguishable populations, very few unequivocal data on reproductive isolation (or its absence) are available. Noteworthy is Guyomard et al. (1984) who report that individuals resulting from a single introduction to the (fishless) freshwaters of the Kerguelen Islands rapidly developed a sedentary and a migratory morphs. The same had been reported from Chile (Riegel, in Nümann, 1967: 281) and New Zealand (Day, 1887: 183), but this last case is not very clear as the original stock might have been a mixture from different localities. Cligny (1907) discussed a population of sea trout which cannot return to freshwaters and where recruitment apparently results only from juveniles drifted from upstream.

Guyomard (1989: 129) commented that the coexistence of sedentary and migratory individuals in a single basin likely does not result from the sympatry of two species or subspecies but from a phenotypic variability within a population. While this is certainly correct in many cases, it should not be considered as a universal rule. Three points should be noted. First, even under the BSC, two subspecies cannot be sympatric [but this is not really relevant as with the PSC used here, subspecies are not recognised]. Second, there is no reason to think that morphological differentiation (and speciation) is always reflected by genetic differentiation (or more accurately by differentiation in that little part of the genome which we are able to analyse; see pp. 16, 19; see also Mayden & Wood, 1995: 85). The species flocks of African cichlids are known to exhibit very little genetic differentiation (Meyer et al., 1990; Moran et al., 1994), despite the fact that within each lake several hundreds of morphologically, ecologically, and ethologically distinct species are involved. Species flocks, or explosive speciation, are known to have occurred in a variety of tropical lakes (see Echelle & Kornfield, 1984 for general discussion; several additional cases have been documented since, e.g., Stiassny et al., 1992; Nagelkerke et al., 1994; Kottelat & Chu, 1988; Kottelat, 1990b, 1991) within a relatively short time span and there is no reason to think that this could not happen in temperate or Nordic waters (admittedly the pace could be lower as the concerned species mature later). Third, there are cases where it is definitely known that two or more species are involved (see above).

Skrochowska (1969) studied migrations of sea and brook trouts. Out of the recovered offspring of brook trouts, 6.4% were migrating, vs. 65.7, 55.1, 15.9 and 31.5% of the F1 to F4 offspring of sea trouts (p. 130). The variation of the recapture rates of the sea trout is not discussed, but may have depended of season of release, water temperature (p. 183) and intensity of other fisheries (p. 160). Sea trouts which did not migrate were those with a lower growth rate. Males which were already mature at the time of release did not migrate (p. 184). The paper is not very clear on this, but it seems that most females migrated; it is not stated whether females which did not migrate are able to successfully reproduce in nature (pond-kept individuals are successfully propagated by aquaculture techniques). These figures may support a hypothesis that, at least in the studied population, the migratory behaviour might be an hereditary character. Unfortunately Skrochowska was mainly interested in the demography and timing of migrations, and did not discuss them in relation to ancestor stock and did not document possible morphological changes (except a very laconic statement p. 148).

The case of lake trouts is more difficult to handle. Possibly, one should first distinguish between stocks inhabiting large, old, natural lakes and those appearing in recent and smaller lakes. It seems that 'lake trout' is a concept understood in different ways by different authors and it remains to be demonstrated that 'lake trouts' from a minor and recent reservoir can be handled in the same way as lake trouts from major lakes. Until this is demonstrated, I am treating them as two distinct cases. There are numerous reported cases where brook trout stocks developed into 'lake trouts' after damming streams or rivers (e.g., Sihlsee, Switzerland [Steinmann, 1944: 168]; Hnilec and Orava Valleys, Slovakia [Holčík et al., 1965: 106, 137; Mišík, 1959; Balon, 1968: 8]; and possibly Mavrovo, Radika basin, FYROM [S. Karaman, 1957; M. Karaman, 1966: 24]). The first two cases seem genuine; but problems with many similar cases of reported evolution from brook trouts into 'lake trouts' include: 1) the difficulty of being sure that there has really not been any stocking after damming; 2) the lack of comparison with naturally-occurring lake form(s) from natural lakes in the same basin; and 3) the possibly plesiomorphic nature of the 'lake trout' phenotype (see below).

For the present discussion, I shall restrict myself to those stocks inhabiting natural lakes; they usually have obvious spawning migrations, but within a lake, different sub-populations can be recognised (see, e.g., Steinmann, 1944; Ruhlé et al., 1984: 273; Büttiker & Matthey, 1986). Typical examples are the stocks of the large sub-Alpine lakes (e.g., lake Konstanz, lake Genève). To resolve their taxonomy the two main questions are: 1) are the lake and brook trouts stocks within a single basin conspecific; 2) are the stocks of the different lakes conspecific ? From the published evidence there is no conclusive answer to question 1 (both yes and no are still reasonable answers). The second question has apparently never been really addressed. Here, as in other cases, one should avoid generalisation because the situation in one lake is not necessarily representative of other lakes. Finally, we know several lakes where two or more sympatric, diagnosable and evolutionarily distinct stocks co-occur.

There have been experiments in which brook trouts transplanted into the sea developed the sea trout morph (see Neresheimer, 1941) and brook trouts transplanted into lakes developed the lake trout morph (Nümann, 1967). Although they seem to yield obvious results, these experiments actually are difficult to interpret; the results of many of them cannot be doubted, but results from one population should not hastily be considered as a rule applying to all trout populations or species. One of the problems is to know how homogeneous the brook trout stock used is. This is particularly important when dealing with large river basins. The material used for Nümann's experiments originated from a pond stock (whose precise origin is not stated), probably from an area immediately adjacent to the lake in which the brook trouts have been transplanted (that is, within the reach of migratory stocks). Would the results be the same if brook trouts from further upstream were used, where no lake trout ever migrated ? Which proportion of the riverine population in these localities migrates, or is it definitely known that only a part of the population migrates while the rest (both sexes) is permanently sedentary ? To be meaningful, this experiment should have included at least two different samples with precise origin, one from parents who spent all their life in brooks and one from migratory parents. The tags used could have a negative effects on recovery rate in streams and this should be estimated (while the tag is unlikely to cause problems to fish in lake midwaters, in streams the fishes can easily get caught in obstacles; also the used string type can get more easily abraded and torn in streams). And the different stocks (and controls) should be submitted to a detailed morphological analysis (Nümann basically discusses only the presence of red spots and this is too superficial to be conclusive – and to be called a morphological analysis).

The result of this kind of transplantation experiment is also difficult to interpret and incorporate in a systematic analysis: anadromy and the silvery lake (or sea) morphs could be plesiomorphic character states for the whole family Salmonidae (or even the suborder Salmonoidei) or an atavism, if one follows Stearley (1992: 627) who considers that the plesiomorphic salmonid habitat type is freshwater. On the reverse, different colour marks seem to be reliable apomorphies (which even allow some sub–basins to be distinguished). [While plesiomorphic character states may be valuable for identification, they are useless for phylogenetic analysis; p. 11]. While coloration can be a specific diagnostic character, it is also a common experience that any colourful fish from clear waters under stress or kept in lake or murky waters for a long period will loose part or all of its coloration and become more or less silvery [the way specimens are fixed, preserved and stored may influence coloration and colour pattern; material used for fisheries and genetic work is rarely fixed in a way allowing optimal use for systematic analysis]. While growth, maximum size and size at maturity can also be diagnostic characters, it must be kept in mind that in many instances they are at best indicative because growth and size at maturity depend on available food and space and maximum size depends on available space and the presence of competitors.

The reverse, that is a demonstration that any lake or sea trout can develop into a brook trout, would be much more significant because of the apomorphic nature of the details of the colour patterns. Obviously, this demonstration cannot be the result of simple transplantation experiments as both sea and lake trouts spawn in rivers where they spend their first months or years (various authors disagree about the duration but again, their experience is gained from different basins), then move downriver. If re-transported upriver, they are likely to move downriver again and such an experiment would necessarily be inconclusive too. But the release of marked fry of lake trouts in the normal spawning grounds of lake trouts as well as upriver could show whether or not the lake trout stock has the potential to stay permanently in head-waters with a brook trout phenotype throughout its life. While it seems likely that the lake (or sea) trouts and those from nearby rivers constitute a single stock (entirely or partially migrating), it also seems likely that those from further upriver do not migrate at all, and the potential for different species to inhabit a single basin actually exists. Some of the data in Champigneulle et al. (1993) seem to indicate that the sedentary and anadromous trouts in some tributaries of lake Genève are distinct stocks, while others of their data (p. 42) indicate that some of the offspring of the lake stock can reproduce without going through a lacustrine phase. Büttiker et al. (1987: 3325) report that lake and brook trout occur in sympatry in tributaries of lake Genève. In the mtDNA analysis of Bernatchez et al. (1992), specimens of lake trout from the stream Aubonne (Swiss slope of lake Genève) belong to the Atlantic group (see below) while the brook trout from the stream Dranse (French slope; several dams on this stream prevent upstream migration of lake trouts, but the exact location of collection is not stated) belong to the Adriatic group (and not to the Mediterranean one as other stocks of the Rhône basin); Guyomard's (1989) electrophoretic study of apparently the same populations does not show differences; transplantations or dispersal along man-made canals could be an explanation, but at this stage it cannot be ruled out that migratory and sedentary trouts are distinct species in lake Genève. Steinmann (1952) was considering lake and brook trouts [of unspecified lakes] as conspecific, but at the same time was implying that they represent different phyletic lines.

At least some stocks of lake trouts in Scandinavia (e.g., Lake Vättern) are morphologically distinguishable from brook trouts, mature later, grow larger, etc.; these character states are inherited (Alm, 1939, 1949). Alm (1939: 81) reports that in Sweden eggs and juveniles of lake trouts are larger than those of brook trouts. So, in Scandinavia too, it still cannot be excluded that lake and brook trouts are different species under the PSC. Schnakenbeck (1942) reports that brook, lake and sea trouts have different pigmentation ontogenies (the origin of the stocks is not stated).

Sea trouts introduced in Swiss rivers in 1933 and 1934 grew faster than local trouts for 3 years, but without showing signs of gonad development, then disappeared (Geiger, 1961: 302).

Some stocks from high altitude lakes in the Swiss and Austrian Alps have been called lake trouts, but clearly they are not related to the large lowland lake trouts. They only reach a small size, grow slowly and reportedly are morphologically distinguishable from sympatric brook trouts (e.g., lake Silsee, Switzerland; Steinmann, 1944: 286). If one follows Steinmann and considers that they are reproductively isolated, then they are distinct species under the PSC. This remains to be demonstrated.

Heuristic conclusions. At least in the trout species of the Atlantic drainage (*S. trutta*) the existence of several ecological morphs in *some* populations is demonstrated. This, however, should not be taken as a demonstration applying to all trout stocks. There are strong indications that in *some* populations this is not true and there are instances where the alternative hypothesis (that the morphs indeed are species) is at least as likely. More research is needed to solve the status of several stocks, keeping in mind that no result from one population can be automatically extrapolated to other populations without demonstration. What is true for one population may not be true for others. While the potential to develop a lacustrine morph in dammed rivers seems well corroborated, work is needed to unambiguously demonstrate whether offspring of brook trout, lake trout and sea trouts really have the potential to develop into any other form. The migratory lake trouts of large lakes are not equivalent to 'lake trouts' of recent, man-made lakes.

This may apply to some other species (e.g., *S. cenerinus*) but definitively does not apply ipso facto to all.

Geographic variation. Once the problem of the number of species in a given (sub-) basin is answered, the major problem is to relate them to what is known from other basins and there are too few studies addressing this topic. Let us imagine that there are two species in basin A, one migratory species in basin B, one species with two morphs in basin C, two species in basin D, etc. What is the total number of species. Are species 1 and 2 in basins A and D the same ? Is the monomorphic species in basin B conspecific with the bimorphic one in basin C ? Is one of the species in basin A the same as the single species in basin B ?

These questions are significant not only for systematics but they are also relevant to effective resource management and conservation. Krieg & Guyomard (1985: 239) and Guyomard (1989: 132) report the case of the river Orne (France). The original population apparently consisted of a single, sedentary morph. Two stocks have been introduced: a migratory one from Dunajec (Vistula basin, Poland, occasionally stocked in the 1960s) and a migratory hatchery one from Etrun (Pas-de-Calais, France) which is regularly stocked (it is not stated if a sedentary morph is also present in this last stock). Sea trouts returning to freshwaters for spawning have been genetically identified as the Etrun stock. If the two stocks do not or cannot interbreed, we could theoretically be dealing with distinct species (unfortunately, the reverse situation, interbreeding, is an inconclusive observation in the present context; see Introduction, p. 15). The fact that introduced stocks are involved makes the case more complicated and other factors could play a role in determining the anadromous or non-migratory behaviours, like early environment of the stocked trouts, artificial conditions, etc. (Krieg & Guyomard, 1985; Guyomard, 1989).

The genetics of trout populations in France have been discussed by Guyomard (1989) and Presa et al. (1994: 197) on the basis of electrophoretic data. They recognised two genetically distinct subspecies on the mainland, one in basins draining to the Atlantic Ocean and one in those draining to the Mediterranean. Atlantic stocks exhibit inter-population variability, possibly suggesting interbasin differentiation, while the Mediterranean stocks constitute a homogeneous group. Populations from Corsica are derived from two ancestral stocks, the Mediterranean one (in the North) and another stock (in the South) not yet known from other areas, but comparable data are missing for Sardegna, Sicily and southern Italy (Krieg & Guyomard, 1983: 1094, 1985: 238; Berrebi, 1994b). The Atlantic, North Sea and Baltic Sea stocks seem to constitute a monophyletic lineage distinct from the Mediterranean one.

These results are congruent with mtDNA data of Bernatchez et al. (1992) for trouts of 24 European localities and Giuffra et al. (1994) for trouts of the Po basin, northern Italy. Bernatchez et al. found a well characterised Atlantic group. This group has also been observed in the Mediterranean and the Danube basins. For the Mediterranean, Bernatchez et al. concluded that it is due to transplanted Atlantic stocks. This might be true for several stocks, but unlikely for their population from stream Aubonne, lake Genève basin. Allozyms data of Largiadèr et al. (1996) also show the great affinity of lake Genève trouts with Atlantic stocks and they considered stocking as a possible explanation; they point, however, to the fact that the upper Rhône was completely covered by glaciers during the Würmian glaciations and that recolonisation of the basin by trouts of the Atlantic stocks is a likely alternative. Lake Genève is separated from the middle Rhône by the Bellegarde falls (Perte du Rhône) which apparently inhibited upstream colonisation of many species known from the rest of the Rhône basin; the complex evolution of the many glaciers meeting in this area in late Würmian (Hantke, 1980: 495–543, 1993: 117–123, 349) probably resulted in many headwater captures, stream reversals, lake formations and disparitions, occasionally connecting the Rhine basin with the upper Rhône. Such connections could have been used by fish colonists, including coregonids and *Salvelinus* which are not known from the rest of the Rhône basin (except lake Bourget) (Steinmann, 1951: 76). Museum specimens collected at the beginning of the 19th century (supposedly before introductions started), could be included in future analysis to confirm or refute the natural occurrence of Atlantic group trouts in lake Genève.

Similarly, the presence of Atlantic group trouts in the upper Danube (two populations in Germany and Austria examined by Bernatchez et al.) might reflect stocking and/or earlier connections and river captures between the Rhine and the upper Danube (Hantke, 1993: 112–115, 226). (Noteworthy is that an underground connection between the upper Danube and tributaries of lake Konstanz still exists near Aach, Germany; see, e.g., Balon et al., 1992: 3).

Hamilton et al. (1989) hypothesise that present Atlantic group populations are the result of colonisation by two races at different periods and that the earlier race is still present in a few basins, usually isolated from the sea (from where the second colonist arrived) by waterfalls. They also report that populations identifiable as this earlier race tend to live longer and reach larger sizes than those of the recent race. Trouts of the Rhine basin should be examined in this context; a testable hypothesis is that the lake trout of lake Konstanz belong to this earlier race. Hamilton et al. called them "ancestral" and "modern" races; I do not use this terminology, because it implies an as yet undemonstrated ancestor-descendant relationship; the two 'races' could as well have no immediate phylogenetic relationships. Data in Hynes et al. (1996) suggest that the colonisation history of north-western European waters was more complex.

Data in Bernatchez et al. (1992), Giuffra et al. (1994) and Berrebi (1994) confirm that *S. marmoratus* is a distinct lineage; as it is diagnosable, it is considered here as a distinct species (Giuffra et al. and Berrebi call it a subspecies of *S. trutta*), as had been recognised, e.g., by Gandolfi et al. (1991). The remaining northern Italian stocks studied belong to an Adriatic group, also including trouts from Corsica and lake Ohrid (Albania–FYROM); the northern Italian *S. 'trutta'* seems to belong to two different lineages. Unfortunately, trouts from the rest of Italy have not been investigated in this study. Known past connections between both sides of the Adriatic (Bianco, 1990a: 178, 1992: 183; Bianco & Miller, 1990: 1298; van Straaten, 1971) lead to the prediction that the same group could occur at least on the Adriatic slope of Italy. The topography of the Mediterranean basins during the Mediterranean Salinity Crisis (some 6 MYA; Hsü et al., 1973, 1977) suggests that Corsican freshwaters were draining to a western Mediterranean sub-basin to the west (also draining the Rhône basin) and a Thyrrenian sub-basin to the east (also draining the western slope of Italy). Bernatchez et al. and Giuffra et al. found no differences between *S. carpio*, an endemic of lake Garda, and other Po basin *'S. trutta'*; it would have been interesting if their material had included the original sympatric lake Garda *'S. trutta'* as well, but it is now extinct.

Patarnello et al. (1994) also analysed mtDNA sequence variation in Italian trouts; they more or less analysed the same Po basin stocks as Giuffra et al. (1994), but also *S. 'macrostigma'* from Sardegna and *S. fibreni*. The number of examined specimens is low (1–3 per locality). The differences between the different stocks are less contrasting and there is apparently no difference between *S. carpio*, *S. fibreni* and *S. 'macrostigma'*. Differences between these and *S. marmoratus* and some *S. 'trutta'* are slight. The dichotomy in northern Italian *S. 'trutta'* observed by Giuffra et al. (1994) is apparently also present (but the sample includes one population of each lineage). They found no difference between southern Italian and Sardinian *S. 'macrostigma'* and no differences between the sympatric *S. 'macrostigma'* and *S. fibreni*. The low molecular differentiation between the different stocks is uninformative in a systematic framework (see Introduction, p. 19) and does not affect previous conclusions on the specific distinctness of *S. carpio*, *S. 'trutta'* and *S. marmoratus*. *Salmo 'macrostigma'* and *S. fibreni* occur in the same basin (but not in syntopy), are (as far as known) non-interbreeding, are morphologically diagnosable and are thus considered here as distinct species; the lack of differentiation by any given technique does not indicate that they are conspecific. Alternative explanations are that the technique is useless or that the examined characters are uninformative; in the case of this pair of stocks, morphological analysis and field observations (ecology and ethology) are apparently more informative (see p. 20).

Information on Greek stocks include electrophoretic data (Karakousis & Triantaphyllidis, 1989; Apostolidis et al., 1996), karyotypes (Karakousis et al., 1992) and unpublished mtDNA data (Apostolidis, pers. comm.). These studies show that *S. peristericus* from endorheic lake Prespa is conspicuously distinct. Besides, two groups of populations are recognised. One includes stocks from western Greece and the western Mediterranean basin (Spain and France), the other one includes stocks from northern and southern Greece and lake Ohrid (a single stock examined). The morphological analysis by Karakousis et al. (1991) is not very informative.

Electrophoretic and mtDNA analyses of stocks from the former USSR, the Danube, the Black Sea, Caspian Sea and Aral Sea basins also showed that the Atlantic (Baltic) stocks and the south-eastern European and west Asian ones represent distinct lineages (Osinov, 1984; Bernatchez & Osinov, 1995; Largiadèr & Scholl, 1995; Riffel et al., 1995). Genotypes of both lineages occur in the upper Danube basin. Electrophoretic data for two stocks in Turkey show that they are conspicuously distinct (Togan et al., 1995).

There is one point on which I disagree with several of these genetic analyses, however brilliant their results may be. They often report e.g., "the utility of morphological criteria ... is hampered by their phenotypic plasticity" (Bernatchez et al., 1992: 170), "phenotypic plasticity ... limits the usefulness of morphological characters" (p. 161), "this could eliminate a purely morphological approach" (Patarnello et al., 1994: 73), etc. This might be true, but the published data do not support this conclusion because there have been so few detailed morphological descriptions (or comparisons) of stocks (and especially non-Atlantic stocks) during this century (see also p. 20). As stressed in the Introduction, 'taxonomic' research on western European fishes (and especially salmonids and coregonids) has been almost exclusively done by fisheries biologists without a theoretical and practical background in systematics; systematic concepts have been misunderstood (e.g., Steinmann's [1951, 1952] version of BSC) and morphological analyses were generally superficial, rudimentary and non-standardised, often restricted to very few characters of limited information content or irrelevant for systematic analysis (but of fisheries interest, like growth patterns, circumference or fork length); the overemphasis on meristic characters (i.e. countable characters like fin rays, gill-rakers, etc.) over morphometry, descriptive morphology, anatomy and osteology is diagnostic of a situation where lay systematists prefer characters which are counted because they seem more reliable than those which have to be described (it is easier to count 23 gill-rakers than to describe the shape of a bone, the structure of the lips, the coiling of the intestine or subtleties of the colour pattern, especially in a foreign language).

The dramatic dearth of decent and critical morphological analysis should be kept in mind before commenting about the supposed limitations of morphological criteria, especially if this cannot be supported by real data as is often evidenced by implicit or explicit statements that all that has been seen of the fish are tissue samples shipped by collaborators. Beside showing that such statements on morphological characters are premature, I want to point to the need for voucher specimens on which to check identifications. To contribute significantly to systematics, genetic studies should be linked with original morphological work or at least with accessible voucher material. The voucher material also should be prepared in a way that allows morphological analysis; it is a too common experience that voucher material is in such a state that it precludes any reasonably reliable identification, not to mention that it is useless for a morphological definition of the stock. To me, a lack of congruence between genetic and taxonomic data is more often due to the lack of recent, competent systematic revision or to misidentified material than to any other reasons. Genetic analysis and classical morphological examination of well-preserved (or live) specimens of fish previously not distinguished or considered as a wide-ranging and very variable species by fisheries biologists and earlier systematists yielded almost simultaneously the same results in the south-east Asian catfish *Hemibagrus nemurus* (Lim et al., 1990; Ng & Ng, 1995; Dodson et al., 1995; Kottelat & Lim, 1995).

But I endorse the conclusion of these genetic studies when conservation and management of trout stocks or species are concerned. Actual stocking programs all over Europe are threatening genetic integrity of most local populations and may push several overlooked species towards extinction. The conclusion of M. Karaman's (1966:

36) would-be systematic analysis of 'southern European' salmonids (actually just trouts of a small part of former Yugoslavia) is a good demonstration of the irremediable damage which can result from poor concepts: "According to taxonomic and historico-evolutive facts clarified in this study, it is possible, without reservation, to transplant new forms of the genus *Salmo* in this basin [apparently lake Ohrid basin], without fearing possible undesired results of hybridisation. Similarly, it is possible to transplant these forms in other basins, because all European trouts belong to the superspecies *S. trutta* [apparently meaning that they are all equivalent]". (S. Karaman's [1938: 138–139] conclusion was opposite to M. Karaman's above quoted one !).

Available data actually show that many stocks are potentially distinct species and that stocking should be done exclusively with parents from the same basin; individuals which cannot be unambiguously identified as belonging to the local stock should not be used for stocking programs.

Systematic and taxonomic hypotheses. Considering the available data (and often the lack of detailed and relevant data), I am presenting alternative nomenclatures which correspond to different, alternative (and admittedly simplified) situations.

The first hypothesis, which I would qualify as the Simplistic Trout Concept, is to consider tentatively all the brook, lake and sea trouts of northern and western Europe as constituting a single species. There is strong evidence that at least in some small coastal basins sea and brook trouts belong to the same breeding pool or that in interior basins lake and brook trouts are conspecific (see above). Under this hypothesis, *S. trutta* is the valid name of the trout. I do not favour this hypothesis because it hides much of what is now known of trout diversity.

The second hypothesis, a Multispecific Trout Concept, recognises the Atlantic, Baltic and North Sea stocks as one species, including sea trouts and brook trouts. The western Euro-Mediterranean stocks would constitute a second species. Noteworthy, sea trouts have long been virtually unknown in the Mediterranean and their recent increased frequency (Allardi & Keith, 1991: 50) might actually be the result of introduced anadromous stocks (all cultivated stocks in France are of Atlantic origin; Presa et al., 1994); alternative explanations do exists (e.g., high Mediterranean salinity and temperature, effect of competitors). In the Atlantic trouts it remains to be demonstrated that a single species occurs throughout large river basins, i.e. that the populations in the coastal areas belong to the same species as those from the interior. For example, in the Rhine basin, it is known that the migratory sea trout reaches (reached ?) upriver only to the rivers Main and Moselle (Fatio, 1890: 369). Are the interior, sub-Alpine and Alpine non-migratory stocks conspecific with the coastal ones ? Is the lacustrine stock resident in lake Konstanz (and migrating upriver in the Rhine; Ruhlé et al., 1984) conspecific with the lower Rhine one and with those from other pre-Alpine lakes which, although situated in the Rhine basin, are separated from lake Konstanz by the Rhine falls in Schaffhausen ? The same questions also apply to the Rhône basin above Bellegarde falls (including lake Genève; see above).

Under this second hypothesis, the name *S. trutta* is to be restricted to the Atlantic species. The name of the western Euro-Mediterranean species depends of the status of the trout of lake Genève. If considered as conspecific with the western Euro-Mediterranean species, the first valid name for it would be *S. lemanus* Cuvier, 1829 as this species was originally based on material from lake Genève. But, as mentioned above (p. 129), this stock does not seem to belong to the same lineage as the lower Rhône ones and the name does not therefore come into consideration. The name *S. punctatus* Cuvier, 1829, is simultaneous to *S. lemanus* but Cuvier's description is very short ("dotted with black and red spots") and hardly qualifies as a description (but, formally speaking, under the ICZN, it is a description); the locality data are vague ("all around the Alps") and obviously include stocks other than the Mediterranean one; fortunately Cuvier also includes the *S. alpinus* of Bloch (1784: 158, pl. 104) in his *S. punctatus*; Bloch's account is based on a drawing and on various literature accounts, including Linnaeus's original description of *Salvelinus alpinus*. *Salmo punctatus* is here formally restricted to Linnaeus's account of *Salvelinus alpinus* and can thus be eliminated from the synonymy of *S. trutta* sensu lato [this conforms to earlier practice, e.g., Gistel, in Gistel & Bromme, 1850: 344]. *Salmo rhodanensis* Fowler, 1974 is the earliest available name for the western Euro-Mediterranean species.

The brook trout of the Adriatic basin should be called *S. cenerinus* Chiereghini, 1847, which is the oldest available name. From the available data, *S. 'macrostigma'* still can be recognised as a distinct and diagnosable lineage, and is thus treated as a valid species; its correct name however is *S. cettii* Rafinesque Schmaltz, 1810; it remains to be demonstrated whether the stocks from southern Italy, Sardegna, Sicilia and Corsica constitute a single species and whether they are conspecific with the North African *S. macrostigma* (it also remains to be demonstrated whether the different North African nominal species constitute a single species; I hypothesise they are [were] not). I doubt that the Balkan stocks referred to as *S. macrostigma* are conspecific with the western Mediterranean ones.

The migratory trouts of the Black Sea and lower Danube basins have classically been distinguished as a distinct species or subspecies *S. labrax* (e.g., Berg, 1948; Bănărescu, 1964; Lelek, 1988) and I tentatively recognise it here as a distinct species. It migrates from the Black Sea only as far upriver as Calarasi, Romania (about 400 river-km from the sea; Bănărescu, 1964: 264). Balon (1968) considers *S. labrax* as conspecific with *S. trutta*, but he mentions only two characters (vertebrae and gill-raker counts) and the argument is very speculative and sometime confusing. The material he refers to as *S. t. labrax* originates from the Danube basin in Slovakia and it remains to be demonstrated that it is conspecific with the migratory Black Sea species. On the basis of the data in Bernatchez et al. (1992) and Bernatchez & Osinov (1995), it seems that *S. trutta* and a second species (which might be *S. labrax*) occur in the upper Danube headwaters. I tentatively list the nominal taxa described from the middle and upper Danube populations as conspecific with the Black Sea *S. labrax*, following Holčík (1969, *S. t. labrax*); the primary types of all these taxa should be examined to confirm their identification. Clearly more populations should be examined from the upper Danube, where it cannot a priori be excluded that more than one species co-occur. The status of the stocks of the high Alpine lakes of the Danube basin in Austria and Switzerland should also be investigated (the name *S. excelsus* Fatio, 1890 is available for them should they deserve a distinct taxonomic treatment), but it might be too late to find pure stocks (see Largiadèr & Scholl, 1995). The presence of 'real' *S. trutta* in the upper Danube may result from stocking (Largiadèr & Scholl, 1995; Riffel et al., 1995).

Unfortunately, the available data on Balkan trouts are limited. Modern morphological work has been scanty and genetic data are available only for some Greek stocks (see above). Sound and compatible data on several key populations from former Yugoslavia are badly missing. The status of some nominal species seems clear (e.g., *S. peristericus*), but for others, unless they have been demonstrated to be synonyms by earlier authors, I have no other objective way to treat them than to accept them at face value as valid. Brief morphological examination of several Greek populations suggests that several species occur in the country, some possibly unnamed. Future studies should include comparative material from adjacent areas; material from eastern Macedonia and Thrace should be compared with *S. labrax* from the Black Sea basin. The northeastern group of population recognized by Apostolidis et al. (1996: 554) is tentatively recognised as *S. macedonicus*. The western Greece stocks have sometime been called *S. macrostigma* (here *S. cettii*), but there is presently no evidence that they are conspecific with it or that they represent only one species; they might be conspecific with one or several of the trouts described from Albania and former Yougoslavia.

Finally, I doubt that any of the Caucasian and western Asian stocks (as far East as Afghanistan) referred to as *S. trutta* would be conspecific with the Atlantic species. Much more work is needed to assess the number and identity of the involved species.

In the cases of sympatric occurrence of two non-interbreeding stocks, they are considered as distinct species. This applies to the following documented cases: lake Garda (?*S. cenerinus*, *S. carpio*; Malfer, 1927; Nümann, 1953: 307–309), lake Posta Fibreno (*S. cettii*, *S. fibreni*; Zerunian & Gandolfi, 1990), Lough Melvin (*S. stomachicus*, *S. nigripinnis*, *S. ferox*; Ferguson, 1986; Ferguson & Taggart, 1991), Lough Neagh (*S.* sp. 'dollaghan', *S.* sp. 'salmon-trout'; Crozier & Ferguson, 1986) and lake Ohrid (*S. letnica*, *S. aphelios*, *S. balcanicus*, *S. lumi*). Outside Europe, this probably also applies to the trouts of lake Sevan, Armenia (Dorofeyeva & Rukhkyan, 1982; Osinov, 1989 [p. 1213 of translation]; Savvaitova et al., 1989). In Lough Melvin and Lough Neagh, one of the sympatric species is possibly *S. trutta*, but the available data neither allow to confirm this hypothesis nor to decide which of the sympatric species could be *S. trutta*; thus they are all treated as distinct species awaiting data or material to solve this question. In the case of lake Garda, the larger species which spawned in winter in the tributaries and outlet of the lake possibly belonged to *S. cenerinus* of the Po basin and the smaller one which spawns in the lake twice a year (December–January, July–August; Gandolfi et al., 1991: 314) is the endemic *S. carpio*. The present large lake trout of lake Garda is apparently an introduced stock as all the original lake trout stocks of northern Italian lakes went extinct more than 30 years ago (Schöffmann, 1994: 98); the lakes have been re-populated with stocks from northern Europe.

Balon (1968: 15–16) recognises a deep-water stock from lakes Attersee, Traunsee and Fuschlersee, Austria, as a distinct infraspecies *schiefermuelleri*, locally named mayforelle (May trout) because it is only caught in May when it comes into shallower waters (Heckel & Kner, 1858: 264; apparently, no original data have been published since), possibly for spawning, while sympatric lake trouts reproduce in November–December (Heckel, 1851b: 287) as is known for most other trouts (mostly November; Ruhlé et al., 1984: 276). Heckel (1851b: 286–287) further reports that it differs from the sympatric lake trout in lake Attersee by head shape, coloration, white eggs (vs. yellow) "never larger than millet seeds" (vs. "pea size"), more deciduous scales and greater difficulty to keep it alive. On the basis of Heckel's data and in the absence of any published contrary information, I tentatively accept *S. schiefermuelleri* as specifically distinct.

The common classification of the trouts into three subspecies is incorrect under any species concept. The ESC and PSC do not recognise subspecies by definition (see Introduction) and, under the BSC, two subspecies cannot occur sympatrically except in the exceptional case of a contact zone; in the present case, there is no contact zone but a broad or complete overlap. In addition, we know that in several cases these are not subspecies but variants of a single population.

The alternative classical classification as a single species with three morphs is not retained because it artificially oversimplifies, it overlooks well documented cases which prove it wrong and it arbitrarily generalises a few peculiar cases. Unquestionably, in several instances there are different morphs and these can be recognised if one wishes to. But these morphs should be recognised by names other than names used in the formal scientific nomenclature: the three classically-recognised morphs (fario, lacustris, trutta) are derived from species-group names which have different type localities. As discussed above, the classical trout might have to be divided into different species and there is a great likelihood that one or the other of these names might have to be re-used for one of these species. The use of the same name for a species and for a morph of another species can only lead to confusion (e.g., if lake Konstanz trout is considered as a distinct species, it must be called *S. lacustris* and it would be confusing if a lake morph from any reservoir in Europe is called *S. trutta* m. lacustris). Additionally, as morph names have (technically speaking) no value in formal nomenclature, infrasubspecific names should not mimic species names, should not be latinised and should not be printed in italics in order to avoid confusion. I find that descriptors like sea trout, lake trout or brook trout or their translation in any language are self-explanatory, much more informative and less ambiguous than fario, lacustris and trutta. Finally, I find it misleading to use the same three morph names (especially if they have the formalised appearance of Latin names) all over Europe for trouts which have nothing in common and belong to different lineages (species).

14.3.1 *Salmo aphelios* Kottelat, 1997, new name

Salmo letnica aestivalis Stefanovic,1948: 190, 2 figs. (type locality: lake Ohrid; syntypes: LU; junior primary homonym of *Salmo ischchan aestivalis* Fortunatov, 1927)

Systematic notes. See comments under *Salmo letnica*.

Nomenclatural notes. *Salmo* is a masculine name (Eschmeyer, 1990) and species names, if adjectives, have to agree in gender.

Salmo letnica aestivalis Stefanovic, 1948 is preoccupied by *S. ischchan aestivalis* Fortunatov (1927: 114, pl.; type locality: lake Sevan, Armenia: syntypes: LU [111]; possibly already available from Fortunatov, **1926: 243**, cited by Berg, 1948: 261) and the name must be replaced.

Etymology. From the Greek apo- (far, remote) and helios (sun). The aphelion is the astronomic term for the point of the orbit where a planet is at its greatest distance from the sun (early July for the Earth).

14.3.2 *Salmo balcanicus* (Karaman, 1927)

Trutta balcanica Karaman, 1927: 253, fig. 1 (type locality: lake Ohrid, FYROM; syntypes: LU)

Systematic notes. See comments under *Salmo letnica*.

14.3.3 *Salmo carpio* Linnaeus, 1758

Salmo Carpio Linnaeus, 1758: 309 (based on Artedi [1738: gen. [spec.] 13, syn. 27 [24], Salmo pede minor ...; Benaco, Cambria]; type locality: lake Garda, Italy, by neotype designation [originally: "in Angliae, Vallesiae fluviis"]; neotype: NRM 28000, present designation)

Salmo lacustris var. *Benaci* Malfer, 1927: 130 (type locality: lake Garda, Italy; type material: NT)

Systematic notes. Stearley & Smith (1993: 14) suggest that future research might show that *S. carpio* belongs to *Salmothymus*, which seems contradicted by the study of Giuffra et al. (1994) and Patarnello et al. (1994) cited above (p. 129). Giuffra et al. (1996: 217) hypothesised that *S. carpio* might have resulted from the hybridisation between *S. marmoratus* and *S. cenerinus*, but did not provide unambiguous evidences. Their data apparently could as well be interpreted as an unresolved trichotomy in a study involving 3 lineages only. To lead to results usable in a phylogenetic analysis, such a study has to include more lineages (especially representatives of the many nominal species described from the eastern slope of the Adriatic basin) and the conceptual basis needs to be clarified.

Admitting that *S. carpio* might have an hybrid origin, this does not negate its recognition as a species under the PSC as it is an independent and diagnosable lineage. Several such cases are well documented and supported; see Stauffer et al. (in press) for a brief review.

Giuffra et al. (1996) also discuss whether there was reproductive isolation between *S. carpio* and the migratory trout stock of lake Garda (*S. cenerinus* ?, *S. marmoratus* ?). While the discussion may make sense under the BSC, it is not really relevant here under the PSC. Anyway, there is apparently no evidence that they were not isolated. Giuffra et al. compared the lake Garda trout stocks with Scandinavian *Salvelinus* stocks. Although such a reference is common in the literature, it is a gross oversimplification of a diversity of non-homologous cases and this partly results from poorly defined concepts, as discussed below (p. 144), and the comparison is irrelevant here.

Nomenclatural notes. Linnaeus (1758) apparently had no material of *S. carpio* and based his description on Artedi who apparently had not examined the species either but based it on earlier accounts. He obviously included two species and gave (1738; also in Walbaum, 1792: 62) the localities as "Carpio lacus Benaci Auctorum. Gilt Charre Westmorlandorum in Anglia". Lacus Benacus is lake Garda (Italy). Although Linnaeus mentioned only one locality ("Angliae, Vallesiae fluviis"), as the name is available by indication, it also includes the lake Garda stock. The first reviser apparently is Heckel (1852a: 361–367) who clearly restricted the name *S. carpio* to the lake Garda species. Mohr (1786: 80) redescribed the species from Iceland, but did not act as first reviser. Specimen NRM 28000, 143 mm SL, is here designated as neotype; it is from a wild-caught stock grown up by Istituto Sperimentale San Michele al Adige in order to establish a captive breeding stock of the species.

14.3.4 ? *Salmo cenerinus* Chiereghini, 1847

Salmo Cenerinus Chiereghini, in Nardo, 1847: 125 (type locality: not far from the sea in rivers [draining to the lagoon of Venezia, Italy]; syntypes: LU); see also Ninni, 1872: 40

Salmo lacustris A,*b*, fécond, var. *meridionalis* Fatio, 1890: 351, 354 (infrasubspecific, name not available; locality: lakes Lugano, Maggiore and Como, Switzerland and Italy, lake Poschiavo and stream Poschiavine, creek Soveglia, Switzerland)

Nomenclatural notes. The name of this species is still uncertain as the types of all nominal species described from northern Italy are missing. I tentatively retain *S. cenerinus* as the valid name for the native species usually called *S. trutta* or *S. fario* in northern Italy (see pp. 129, 131). The original description is very vague and could apply to about any salmonid. A problem is that the type locality ("not far from the sea in rivers") could indicate that Chiereghini possibly had *S. marmoratus* (see next paragraph); it may as well be drifted individuals of the present species. In the absence of evidence for one or the other hypothesis, as first reviser I retain the name for the 'northern Italian fario'. The alternative is to treat *S. cenerinus* as a synonym of *S. marmoratus*; there would then be no available name for the present species and it should be either listed as *Salmo* sp. or a new name should be created for it. For clarity, I feel it is straightforward to re-introduce here the name *S. cenerinus* with a more precise meaning. A neotype designation should definitively fix the name.

According to Sommani (1948: 144; 1960: 45) and Gandolfi et al. (1991: 281, 295), in northern Italy, '*S. trutta*' is sedentary and lives in Alpine brooks, whereas *S. marmoratus* has a more migratory life-style and is found further downstream. In this, Chiereghini's account of *S. cenerinus* could fit better with *S. marmoratus*. Beside the above-listed names, *Trutta adriatica* may also come into consideration, but its original description is uninformative. It was described from the sea (Kolombatovic, 1890: 165), and it seems thus to be based on *S. marmoratus* and is listed under this species.

Trutta fario marmoratus Siebold, 1863 apparently also applies to *S. marmoratus*; anyway, the name is preoccupied in *Salmo* by *S. marmoratus* Cuvier, 1829, and thus is not available. *Salmo lacustris* var. *meridionalis* Fatio, 1890 is infrasubspecific, thus not available; the name probably is based on a mixture of the present species and *S. marmoratus*.

Some of the poorly described nominal species from Croatia may belong to this species.

14.3.5 ? *Salmo cettii* Rafinesque Schmaltz, 1810

Salmo cettii Rafinesque Schmaltz, 1810b: 32, 55 (type locality: Val Demone and Val di Noto, Sicilia; type material: NT ?)

? *Salmo macrostigma* Duméril, 1858a: 161 (type locality: Oued-el-Abaïch, Kabylie, 40 km W of Collo, Algeria; syntypes [total 2]: MNHN A-7285 [1]); description also appeared in Duméril, 1858b: 398, pl. 10 (reproduced in Pomini, 1940: 35) and 1858c: 445

? *Salmo Lapasseti* Zill, 1858: 127 (type locality: El-Abaïch, a tributary of Oued-Z'hour entering the Mediterranean about 30 km west of Collo, Algeria; syntypes: LU)

? *Salmo Pallaryi* Pellegrin, 1924a: 971 (type locality: lake (Aguelman) Sidi Ali or Mohamed, about 30 km north-west of Itzer, Middle Atlas, Morocco; syntypes: MNHN 1923-66 [2]); description also appeared in 1924b: 181, fig. 1

? *Salmo Trutta* var. *Pellegrini* Werner, 1931: 262, pl. 1 fig. 1 (type locality: stream Ourika near Timishi, Grand Atlas, Morocco; syntypes: NMW 19546 [1])

Salmo ghigii Pomini, 1941: 39, figs. 4–8 (type locality: stream Sagittario [Aterno-Pescara basin], Abruzzo, Italy; syntypes: LU)

Systematic notes. As discussed above, this species is tentatively considered as distinct. Bianco (1994b: 440) treats *S. cenerinus* (as *S. trutta*), *S. cettii* and *S. fibreni* as a single species.

This species is usually referred to as *S. macrostigma*, originally described from Algeria; various populations from Corsica, Sardegna, Sicilia, Italy, the Balkan peninsula and Turkey have later been referred to this taxon. The real identity of all these populations is to be considered as doubtful: none of them has been compared directly with Algerian material or with material from any of the other populations. It seems unlikely that all these disjunct populations would be conspecific. Karaman (1966: 5) claims to have compared some and concluded that they differ, but he did not provide supporting data. Schöffmann (1993: 166) and Doadrio (1994: 26) report that the Algerian populations are now extinct. Data on Moroccan populations in Bernatchez (1995) support the view that they do not belong to the same lineage as the Italian ones; but assuming that these are indigenous stocks, it still cannot be excluded that at least some of the Moroccan trouts are not conspecific with the *S. macrostigma* from north-eastern Algeria. The figures of Moroccan trouts in Schöffmann (1993: 146) seem to represent a *S. macrostigma*-like individual (fig. 2) and a *S. pellegrini*-like one (fig. 3). These stocks are threatened by habitat alteration, introduction and hybridisation and restocking by local hatcheries.

Nomenclatural notes. The oldest available name for the Corsican, Sardinian, Sicilian and southern Italian group of populations is *S. cettii* Rafinesque Schmaltz, 1810 (see also Bianco, 1994b: 442; Zava et al., 1996: 416). Rafinesque used the spelling *cetti* on p. 32 and *cettii* on p. 55 and as first reviser I retain *cettii*.

Duméril's description of *S. macrostigma* appeared three times in 1858 and I have not tried to find out which one has priority. The 1858a is the only one mentioned in Zill (1858) and is possibly the oldest one. Behnke (in Daget et al., 1984: 125) indicated the publication date as 26 July 1858 but this is the date at which the paper has been read at the academy, not the publication date (which is not stated). Behnke lists a specimen as holotype, but it is a syntype as Duméril clearly stated that he had two specimens; the second specimen was in the collection of the Société d'Acclimatation (Duméril, 1858b: 398).

Salmo macrostigma and *S. lapasseti* have been published in 1858 and *S. macrostigma* has priority because it appeared first as indicated in a footnote by the editor in the description of *S. lapasseti*.

Salmo pallaryi has been considered a synonym of *S. macrostigma*, but a comparison of both descriptions suggests that they are very distinct species; this should be confirmed by a detailed examination of Pellegrin's material. They are reminiscent of *Salvelinus*, as already suggested by Pellegrin (1924b: 183). This species is now extinct (Schöffmann, 1993: 164).

Salmo ghigii apparently is a synonym of *S. cettii*. Pomini (1941) reported that 3 'forms' are present at the type locality, not distinct from those from Sardegna (Bianco, 1994b: 442; pers. comm.).

14.3.6 ? *Salmo dentex* Heckel, 1852

Salar dentex Heckel, 1852a: 371, pl. 10 (type locality: stream Kerka [Krka] near Knin, stream Cettina [Cetina] near Sign [Sinj] and stream Narenta [Neretva], Dalmatia; syntypes: NMW 16505 [1], 65887 [9], 65888 [4], 65894 [4], 92806 [1], NRM 25000 [1])

14.3.7 ? *Salmo farioides* Karaman, 1938

Salmo farioides Karaman, 1938: 136, fig. 3 (type locality: river Krka near Knin and Skradin, river Neretva near Prenj, Obod, river Radika near Rostusa, river Bistrica near Pec, small tributaries of lake Ohrid, creeks Cijevna and Crnojevica Reka (tributaries of lake Scutari), FYROM; syntypes: LU)

? *Salmo trutta macrostigma* morpha *lacustris* Poljakov, Filipi & Basho, 1958: 68 (infrasubspecific, name not available; locality: Shkodrës, Albania)

Systematic notes. Karaman (1966: 15) noted that *S. farioides* differs from *S. letnicus* by the number of gill-rakers (among other characters). He concluded that this difference is caused by food differences. The conclusion (p. 24) that in reservoir Mavrovo, shortly after dam completion, the fish showed a great morphological change is not supported by the data in his table 3 which compares two populations but not the same population before and after completion of the dam. Additionally when one reads how many populations have been transplanted (and certainly more transplantations are involved which are not documented) in lakes situated on international borders (with no information about what other countries are doing) one is sceptical about how the results could be interpreted. Much good faith is needed to believe that such variability exists in the absence of hard data. Awaiting more conclusive data, I am left with no alternative but to treat *S. farioides* as a valid species.

14.3.8 *Salmo ferox* Jardine, 1835

Salmo ferox Jardine, 1835a: 55 (type locality: Loch Awe, Loch Laggan, upper end of Loch Shin, Loch Loyal and Loch Assynt, Scotland, U.K.; syntypes: LU; author indicated as Jardine & Selby, but Jardine alone is actual author)

Systematic notes. This name has been used for the ferox, a large trout from Scotland and Ireland. It is one of the three sympatric *Salmo* species of Lough Melvin and one of the four of Lough Neagh, Ireland. It is treated as subspecies *S. trutta ferox* by Ferguson & Taggart (1991) and as species by Ferguson (1986: 1) and Cawdery & Ferguson (1988: 276). See above for discussion. See also Hamilton et al. (1989: 658) and McVeigh et al. (1995) for additional data. It remains to be demonstrated that the Lough Melvin and Lough Neagh stocks are conspecific and, as the species has originally been described from various lakes in Scotland, that the Irish stocks are conspecific with those from Scotland. Cawdery & Ferguson (1988: 274) report that genetically similar populations are found in many isolated mountain lakes in Scotland, but do not provide details. Data on some Irish and Scottish populations in Hynes et al. (1996: 62) do not suggest close similarity, at least not in the investigated populations.

14.3.9 ? *Salmo fibreni* Zerunian & Gandolfi, 1990

Salmo fibreni Zerunian & Gandolfi, 1990: 523, figs. 2–3 (type locality: lake Posta Fibreno, Italy; holotype: MSNM Pi 3723)

Systematic notes. Zerunian & Gandolfi (1990) described *S. fibreni* from the lake Posta Fibreno basin, Italy. They report that *S. cettii* occurs in sympatry and that the two stocks differ by size at maturity (11 cm in males *S. fibreni*, vs. 17 in *S. cettii*; 13, vs. 28 in females), spawning season (December–January, vs. February–March [data actually not in original description; from Gandolfi et al., 1991: 302]) and number of parr marks (7–9, vs. 9–13) and spots (15–20, vs. 20–60) on the sides. Their table 3 shows an almost complete overlap for all meristic data and their table 2 comparing morphometric data seem to indicate differences in maximum body depth, length of anal fin and eye diameter but as only the mean and standard deviation are given, we have no real idea of the actual overlap and variability. *Salmo fibreni* is reported to spawn in deep waters, in springs in underwater caves (see also Chiappi, 1924: 4–5), while *S. cettii* spawns in the outlet of the lake (P. G. Bianco, pers. comm.). Bianco (1994b: 442) considers *S. fibreni* as a dwarfed population of *S. cettii* (which Bianco does not consider as distinct from *S. trutta*); this cannot yet be ruled out, but as the species is cultivated (P. G. Bianco, pers. comm.) this could be easily investigated.

14.3.10 ? *Salmo labrax* Pallas, 1814

? *Salmo Fario* varietas *alba* Meidinger, 1794: iv, pl. 46 (type locality: "in valle Breinina, circa novem Ecclesias, Scotto-Viennam, Neobergam, ad Waltersdorf & Schwanendorf in Fischa", Austria; type material: NT ?; junior primary homonym of *Salmo albus* Bonnaterre, 1788)

Salmo labrax Pallas, 1814: 346 (type locality: Sevastopol and river Biyuk-ozen / Chersonesus / Ochakov, Crimea, Ukraine; syntypes: LU)

? *Salmo Fario* var. *niger* Fitzinger, 1832: 339 (available by indication to Marsili [1726: 78, pl. 26 fig. 2, Trutta nigra, "in Austriam nostram inferiorem"], Bloch [1782, "*Salmo Fario sylvaticus*", actually a Walbaum, 1792 name, based on Waldforelle in Bloch, 1782: 157, pl. 23] and Paula Schrank [1798: 320, *Salmo saxatilis*]; type locality: lower Austria [Marsili], Norway / Berlin, Germany / Danzig [Gdansk], Poland [Bloch], Bavaria, Germany [Paula Schrank], rivers Schwarza and Glocknitz, Austria [Fitzinger]; syntypes: NMW ?, ZMB ?)

? *Fario Marsilii* Heckel, 1851a: 146 (type locality: lakes of upper Austria [Oberösterreich]; syntypes: NMW [not yet located; B. Herzig, in litt., 1995]); predates Heckel, 1851b: 286

? *Salmo microlepis* Günther, 1866: 85 (type locality: Pohorella [Pohorelá], Hungary [now in Slovakia]; syntypes: BMNH [3])

Salmo pallasii Günther, 1866: 112 (type locality: Chersonesus [Kherson], Crimea, Ukraine; syntypes: LU [material of *S. trutta* in Pallas 1814: 347])

? *Salmo lacustris* var. *excelsa* Fatio, 1890: 355 (type locality: sources of river Inn, lakes Sils, Silvaplana, Campfer and St.-Moritz, Danube basin, Switzerland; syntypes: MHNG 816.09 [2])

Salmo trutta labrax morpha *fario* Berg, 1916a: 47 (infrasubspecific, name not available)

Salmo trutta labrax morpha *lacustris* Berg, 1932a: 113 (infrasubspecific, name not available)

? *Trutta Ungeri* Vásárhelyi, 1940: 187, fig. 2 (type locality: creek Várvölgy in Bükk Range, Kom. Borsod, Hungary; syntypes: LU [3])

? *Salmo trutta labrax* infraspecies *danubicus* Holčík, 1969: 227 (infrasubspecific, name not available; locality: river Danube in Bratislava, Slovakia)

Systematic notes. As discussed above (pp. 129, 132), the status of brook trouts from the upper Danube basin cannot be solved with the available data and names based on material from this area are tentatively listed as synonyms of *S. labrax*. Examination of the type material is needed.

Nomenclatural notes. The earliest available name for this species is apparently *Salmo fario albus* Meidinger (1794) but the name is preoccupied by *S. albus* Bonnaterre, 1788 and cannot be used. The next available name is possibly *S. saxatilis* Paula Schrank (1798); the name was based possibly on actual material from Bavaria (Danube basin) and the description of material from Atlantic basin localities by Bloch (1782: 157). I restrict here the usage of the name to Bloch's material from Berlin and the name *S. saxatilis* is thus a synonym of *S. trutta* and is not available for the Danube species. Bloch's material is lost (H.-J. Paepke, in litt., 1995). A neotype designation could be needed to definitively fix the synonymy. I decided not to designate a neotype here: in case future research shows that the upper Danube species is distinct from the lower Danube, migratory *S. labrax*, the name *S. saxatilis* could be used for it by a judicious neotype designation.

Although Heckel described *Fario marsilii* in 1852a (p. 349, figs. 6–8), his 1851a account makes the name available.

Vásárhelyi (1940: 188) reports differences in body and mouth shape and coloration between '*Salmo ungeri*' and *S. trutta* [here *S. labrax*] from adjacent basins. He also indicates differences in egg size, incubation time and that hybridisation experiments failed. In 3 years of experimentation, fecundation was possible but the eggs always died after a few days. I could not find later reference on this species and I understand that subsequent authors have doubted these data. But there is no objective published data to confirm or refute them and this would be worth a critical study.

14.3.11 *Salmo letnica* (Karaman, 1924)

Trutta letnica Karaman, 1924b: 20 (type locality: lake Ohrid, FYROM; syntypes: LU)

Salmo letnica typicus Stefanovic, 1948: 181, 4 figs. (unnecessary replacement name for *Trutta letnica* Karaman, 1924)

Systematic notes. Three or four stocks with different ecology and spawning places and seasons occur in lake Ohrid (for a brief summary, see Stankovic, 1953: 482, 1960: 202–205). The '*letnica*' and '*aestivalis*' stocks occur along the eastern shore and spawn in the lake near sub-lacustrine springs, '*letnica*' in January–February, '*aestivalis*' in June–July. The '*balcanica*' stock occurs in the north-west of the lake and spawns at and in the outlet of the lake in December. The 'fluviatile' stock of Stankovic is probably the '*lumi*' of Albanian authors and occurs along the northern and western shores, spawns in tributaries and at their mouths around February. The four stock reportedly differ morphologically and these character states are inherited (Stankovic, 1953: 482; Rakaj & Flloko, 1995: 197). Osteological differences between three stocks are illustrated and discussed by Dorofeyeva et al. (1983). Their figures show salient differences (e.g., orbit region). *Salmo balcanicus* is treated as a valid species by Vukovic & Ivanovic (1971). Available (published) data suggest that these four stocks are species under the PSC and they are here treated as such: *S. letnica*, *S. aphelios* (earlier *S. aestivalis*), *S. balcanicus* and *S. lumi*.

14.3.12 *Salmo lumi* Poljakov, Filipi & Basho, 1958

Salmo letnica lumi Poljakov, Filipi & Basho, 1958: 67 (type locality: ? Tushemishtit, Volorekës, Linit, Piskupatit, Hudënishtit and Pogradec, Albania; syntypes: LU)

Systematic notes. See comments under *Salmo letnica*. Schöffmann (1994: 99) doubt that *S. lumi* is still extant in Albania.

14.3.13 *Salmo macedonicus* (Karaman, 1924)

Trutta fario var. *macedonica* Karaman, 1924b: 16 (type locality: estuary of river Treska, Vardar basin, FYROM; syntypes: LU)

? *Trutta fario macroptera* Chichkoff, 1939: 121, pl. 2 fig. 4 (type locality: lakes Gorno Ribno Esero [Ezero] and Dolno Ribno Esero [Ezero], river Struma basin, Rila range, Bulgaria; syntypes: LU)

14.3.14 *Salmo marmoratus* Cuvier, 1829

Salmo marmoratus Cuvier, 1829: 304 (type locality: lakes of Lombardia, Italy; syntypes: MNHN ?)

Salar genivittatus Heckel & Kner, 1858: 260, fig. 144 (type locality: stream Sala, a tributary of the Isonzo, Dalmatia; holotype: NMW [not yet located; B. Herzig, pers. comm., 1995])

? *Trutta Fario* var. *marmorata* Siebold, 1863b: 187 (type locality: all brooks of the Alps draining to the south to rivers entering the Adriatic Sea; syntypes: ? ZSM, now lost [pers. obs.]; preoccupied in *Salmo* by *S. marmoratus* Cuvier, 1829)

? *Trutta adriatica* Kolombatovic, 1890: 165 (type locality: Adriatic Sea at Vranjic, Croatia; holotype: LU)

? *Salmo trutta marmoratus* morpha *lacustris* Poljakov, Filipi & Basho, 1958: 69 (infrasubspecific, name not available; locality: Shkodrës, Albania)

Nomenclatural notes. The author of *S. marmoratus* is often given as Cuvier (1816). Actually it was first named by Cuvier (1829: 304). See *S. cenerinus* for discussion of *Trutta adriatica* and *Trutta fario marmoratus*.

14.3.15 *Salmo nigripinnis* Günther, 1866

Salmo nigripinnis Günther, 1866: 96 (type locality: Lough Melvin; Ireland, by lectotype designation; lectotype: BMNH 1865.9.18:11, present designation)

Systematic notes. This is the sonaghen, one of the three sympatric *Salmo* species of Lough Melvin, Ireland. Treated as subspecies *S. trutta nigripinnis* by Ferguson & Taggart (1991) and as species by Ferguson (1986: 1) and Cawdery & Ferguson (1988: 276). See *Salmo* discussion (pp. 125, 132).

Nomenclatural notes. Günther (1866: 96) based this species on material from four localities: Lough Melvin, Llyn Beguilin, Llyn Gadr and river Towey; it remains to be demonstrated that these four stocks are conspecific. Specimen BMNH 1865.9.18:11, 230 mm SL, from Lough Melvin, is designated as lectotype; thus, the name is definitively linked with the Lough Melvin sonaghen.

14.3.16 ? *Salmo pelagonicus* Karaman, 1938

Salmo pelagonicus Karaman, 1938: 133, fig. 1 (type locality: creek Bela Reka, Kajmakcalan range, east of Bitolj-Monastir, Vardar basin / creeks Zlokucanska Reka and Dihovska Reka, north-eastern Perister range, west of Bitolj, Vardar basin, FYROM; syntypes: LU [3])

14.3.17 *Salmo pestericus* Karaman, 1938

Salmo macedonicus pestericus Karaman, 1938: 133 (type locality: lake Prespa and creek Brajcinska Reka flowing from Perister range to lake Prespa, FYROM; syntypes: LU [5])

14.3.18 *Salmo rhodanensis* Fowler, 1974

Salmo trutta forma *major* facies *rhodanensis* Roule, 1923: 291 (infrasubspecific, name not available; river Rhône [near Valence ?], France)

Salmo eriox rhodanensis Fowler, 1974: 62 (available by indication to *Salmo trutta* forma *major* facies *rhodanensis* Roule, 1923: 291; type locality: river Rhône [near Valence ?], France; syntype: MNHN 1922-164 [1], discarded in 1947, J.-C. Hureau, pers. comm., 1996)

Systematic notes. See *Salmo* discussion (pp. 128, 131). Populations from the northern part of the Rhône basin have a colour pattern apparently met in no other trout, consisting of three broad, dark, transverse bands on the posterior part of the body. It remains to be demonstrated if these populations are conspecific with material from the lower Rhône on which Roule (1923) and Fowler (1974) based *S. rhodanensis*.

Populations of *S. trutta* and *S. rhodanensis* from streams on both sides of the water divide between the Doubs (upper Rhône basin) and the Rhine can be distinguished very easily on the basis of external characters, especially colour pattern.

14.3.19 *Salmo salar* Linnaeus, 1758

Salmo Salar Linnaeus, 1758: 308 (based on Artedi [1738: gen. 11 [48], syn. 22, spec. 48 [11], Salmo rostro ultra ...; based on various references but actual material described from Baltic Sea] and Linnaeus [1746: 115, n. 306]; type locality: "in Oceano Europae, parit in fluviis"; type material: NT)

Salmo nobilis Olafsen, 1772: 65 [German translation 1774: 35] (available by indication to Artedi [1738: gen. 9 [actually spec. 11], Salmo nobilis]; type locality: Sweden [Artedi], Heller-Aa, Kortolfstade-Aa, Lar-Aa, Iceland [Olafsen]; type material: NT)

Salmo Goedenii Bloch, 1784: 155, pl. 102 (type locality: Baltic Sea in Rügenwalde, Hinterpommern [now Darlowo, Poland]; holotype: ZMB 3710); synonymy follows H.-J. Paepke's examination of the holotype (in litt., 1995)

Salmo Salmulus Walbaum, 1792: 61, 64, 720 (based on Pennant [**p. 303, pl. 59**, edition not stated; 1769: vol. 3: 253; 1776: vol. 3: 265 n. 148, pl. 59; The Samlet] and Ray [**1710: 63**]; type locality: rivers Wye, upper Severn and tributaries, north of England and Wales, U.K.; type material: NT)

Salmo caerulescens Schmidt, 1795: 65 (nomen nudum; locality: river Moldau [Vltava], Czech Republic)

Salmo renatus La Cepède, 1803: 224 (type locality: river Moselle, France; holotype: MNHN ?)

Salmo rilla La Cepède, 1803: 224, pl. 5 fig. 3 (type locality: river Rille, a tributary of river Seine, France; type material: NT)

Salmo nobilis Pallas, 1814: 342 (type locality: Baltic, Arctic and White Seas, in streams of Livonia [now Estonia and Latvia], Estonia, northern Russia; syntypes: LU; junior homonym of Olafsen, 1772: 65)

Salmo hamatus Cuvier, 1829: 303 (type locality: "mouth of our rivers" [France]; also available by indication to Bloch, 1784: pl. 98; syntypes: MNHN ?)

Salmo Ocla Nilsson, 1832: 4 (type locality: Baltic Sea, where it ascends river Dalelfven / Elfkarlby [Älvkarleby on river Dalälfven, north of Uppsala], Sweden; syntypes: LU)

Salmo Salmo Valenciennes, in Cuvier & Valenciennes, 1848: 169, pl. 614 (type locality: numerous localities cited, but examined material from: Dieppe, Fécamp, Abbeville, France, markets of Belgium, Netherlands, England and Berlin; syntypes: MNHN)

Salmo Salar var. *lacustris* Hardin, 1862: 382 (type locality: lake Venern [Vänern], Sweden; syntypes: LU; junior homonym of *Salmo lacustris* Linnaeus, 1758)

Trutta relicta Malmgren, 1863: 59 [German translation: 1864: 333] (type locality: lake Ladoga at Kexholm, Finland [now in Russia]; syntypes: MZH ?)

Salmo gracilis Couch, 1865: 216, pl. 216 (type locality: harbour of Fowey, U.K.; holotype: BMNH; primary junior homonym of *Salmo gracilis* Valenciennes, in Cuvier & Valenciennes, 1848: 265)

Salmo hardinii Günther, 1866: 107 (type locality: lake Wenern [Vänern], Sweden; syntypes: BMNH [1])

Salmo brevipes Smitt, 1883: 32 or Smitt, in Anonym, 1883: 182 (type locality: Arkangel, Russia; syntypes: NRM)

Salmo salar brevipes morpha *relictus* Berg, 1932a: 112 (infrasubspecific, name not available; locality: landlocked in lakes Segosero and Wygosero, river Wyg basin, Russia; junior homonym of *Trutta relicta* Malmgren, 1863)

Salmo salar infraspecies *biennis* Berg, **1912: 137** (infrasubspecific, name not available) from Berg, 1934: 714, 1948: 206, 212

Salmo salar saimensis Seppovaara, 1962: 78 (type locality: Iso-Saimaa, Finland; syntypes: LU)

Salmo salar europaeus Payne, Child & Forrest, 1971: 251 (type locality: Europe; type material: NT)

Systematic notes. European and North American salmons are distinguished by chromosome numbers, enzymatic patterns and DNA analyses (Guyomard, 1994: 147; Taggart et al., 1995) and they constitute distinct lineages. Payne et al. (1971) concluded that there is no gene exchange between them and treated them as different subspecies. They can unambiguously be treated as two species under the PSC.

There are no known significant genetic differences between anadromous and land-locked salmons in Europe. However, anadromous and lacustrine stocks exist sympatrically in lakes Ladoga and Onega (Russia) (L. S. Berg, 1948: 233; O. K. Berg, 1985: 810). Permanent freshwater stocks also exist(ed) in lake Vänern (Sweden), lake Bygglandsfjord and rivers Namsen and Nidelva (Norway) and lakes Saimaa and Pielinen basins (Finland) (L. S. Berg, 1948: 233; O. K. Berg 1985) and as they have independent histories, their status should be investigated independently of the Ladoga stock. The stock from lake Saimaa reportedly has a different chromosome number (Seppovaara, 1962: 30). Actual descriptive (morphological and genetic) work on these stocks would be more informative than research on speculated evolution and ad hoc zoogeographic fancy. Sound evolutionary hypothesis have to rely first on hard facts of the animals before interpreting geological and paleogeographical data.

Nomenclatural notes. *Salmo salar mas* Bloch, 1784 (p. 146, pl. 98) is sometimes erroneously cited as a nominal species (e.g., Fowler, 1974:

58). The original text reads "*Salmo Salar.Mas*" which means "*Salmo salar*, male". Bloch (1782: pl. 20) also labelled a plate "*Salmo Salar.Foem[ina]*" (*Salmo salar*, female). These were obviously not intended as scientific names.

Day (1887: 51) lists *Salmo gracilis* as available from Couch (1859), where this name is not mentioned. It is first available from Couch (1865).

The nomenclature of Payne et al. (1971) (*S. s. europaeus* and *S. s. americanus*) grossly violates the Code. If recognised distinct, the European species retains the name *S. salar* (a subspecies should be called *S. s. salar*). I have not tried to trace the oldest available name for the American species but there definitively are several available names. An early name apparently is *S. omiscomaycus* Walbaum (1792: 65, 714) which is available (as *S. omiscomaycus*) from the Index (p. 714) (the text, p. 65, does not make the name available because the species group name is published as separate words; ICZN art. 11(v)).

14.3.20 ? *Salmo schiefermuelleri* Bloch, 1784

Salmo schiefermülleri Bloch, 1784: 157, pl. 103 (type locality: various lakes of Austria, restricted by Valenciennes, in Cuvier & Valenciennes, 1848: 287, 344 [other locality: Wipperstrohm and shores of Baltic Sea]; syntypes: ZMB, probably lost)

? *Salmo schiefermülleri argenteus* Reisinger, 1830: 39 (type locality: lakes of Hungary; type material: NT ?)

Salmo argenteus Fowler, 1974: 61 (listed in synonymy, name not available; reference to Bonnaterre, 1788: 160, pl. 67 [saumon argenté]; localities: Baltic Sea and lakes of Austria)

Systematic notes. See discussion under *Salmo* above (p. 133). Available (but somewhat outdated) data seem to indicate that it is a distinct species. Balon (1968) wondered if the original stock still survives; only the stocked *S. trutta* is now recorded from these lakes (B. Herzig, pers. comm., 1995). It is not mentioned for Attersee and Fuschlersee by Haempel (1930: 180–184) who records only 'normal' lake trout. For lake Traunsee, Haempel (1930: 191) considers the mayforelle to be a sterile form without further discussion; Heckel (1851b: 287) explicitly stated that his mayforelle had developed ova. Accurate and up-to-date information is needed, but it is probably too late as the original stock seems to be extinct (B. Herzig, pers. comm., 1995), and it is not clear whether museum material is still extant.

Nomenclatural notes. The name to be attributed to Heckel's mayforelle is not very clear. Balon (1968: 15–16) called it *S. schiefermuelleri*. Bloch's (1784) original description of *S. schiefermuelleri* is based on two very dissimilar populations, one from Austria and one from the Baltic Sea. Valenciennes (in Cuvier & Valenciennes, 1848) acted as first reviser and restricted the type locality to Austria: p. 287, he stated that Bloch mixed a silberlachs of the Baltic and a Danubian trout under *S. schiefermuelleri* and p. 344 he used that name only for the Austrian species.

Two specimens in ZMB (3720, 3721) are labelled as syntypes of *S. schiefermuelleri* (H.-J. Paepke, in litt.). The associated locality data say that they are from Switzerland. As Bloch explicitly based his description on the above-mentioned material from Austria and the Baltic Sea, these specimens cannot be syntypes (or erroneous data have subsequently been introduced on the labels). Bloch (1784: 158) mentions the rheinanken or illanken from Switzerland (lake Konstanz trout) which, on the basis of a drawing, he cannot distinguish from the common salmon. Clearly, Bloch had no material of this rheinancken and he was not considering it as conspecific with *S. schiefermuelleri*. In the absence of material of both Bloch and Heckel, I tentatively consider that Heckel's material is conspecific with Bloch's one.

14.3.21 *Salmo stomachicus* Günther, 1866

Salmo stomachicus Günther, 1866: 95 (type locality: Lough Melvin, Ireland; syntypes: BMNH [[3])

Systematic notes. This is the gillaroo, one of the three sympatric *Salmo* species of Lough Melvin. It is treated as subspecies *S. trutta stomachius* [sic] by Ferguson & Taggart (1991) and as species by Ferguson (1985: 1) and Cawdery & Ferguson (1988: 276). See above for discussion (p. 125, 132).

A stock from Lough Neagh, Ireland, has also been called gillaroo but it remains to be demonstrated if it is really conspecific. Data in Ferguson (1986: 7) and Crozier & Ferguson (1986: 461) suggest that the presence of the gillaroo in Lough Neagh is not well documented; this might be misidentified individuals of other stocks.

14.3.22 ? *Salmo taleri* (Karaman, 1932)

Trutta taleri Karaman, 1932: 2 (type locality: upper river Zeta at Niksic, lake Skadar basin, Montenegro; syntypes: LU)

? *Trutta likana* Karaman, 1932: 3 (type locality: stream Jesenice in Lika, river Save basin, Croatia; syntypes: LU)

14.3.23 *Salmo trutta* Linnaeus, 1758

Awaiting a satisfactory resolution of the relationships among the lake and brook trouts of the Atlantic basin, I tentatively consider them as conspecific. If the lake trout is considered different, or if it is demonstrated to be distinct, it should be called *S. lacustris*; its synonymy is listed separately. Similarly, the synonymy of the three main lake-trout stocks, lake Genève, lake Konstanz and lakes Vänern and Vättern, are listed separately. If considered valid, their respective names should be *S. lemanus*, *S. lacustris* and *S. truttula*.

14.3.23.1 Marine, riverine and brook stocks [*Salmo trutta* Linnaeus, 1758 if recognised as a distinct species]

Salmo Trutta Linnaeus, 1758: 308 (based on Linnaeus [1746: 116, n. 308, Salmo ocellis nigris ...], Artedi [1738: gen. 12 [51], syn. 14 [24], spec. 48 [12], Salmo latus, maculis rubris nigrisque, cauda aequali; based on Willughby, (**1686: 193**), Ray (**1710: 63**, Northumbria) and material from Sweden] and Gronovius [1756: 12, n. 164, Salmo latus, cauda ...; locality: river Rhine near Basel, Switzerland]; type locality: "in fluviis Europae"; type material: NT)

Salmo Eriox Linnaeus, 1758: 308 (based on Artedi [1738: gen. 12 [–], syn. 23, spec. 50 [12], Salmo maculis cinereis ...; based on Ray [**1710: 63**, Grey], Willughby [1686: 193, Grey, "Septentrionalibus Angliae"] and material from Sweden [Grälax]] and Linnaeus [1746: 116, n. 307]; type locality: "in Oceano Europae, parit in fluviis"; type material: NT)

Salmo Fario Linnaeus, 1758: 309 (based on Artedi [1738: gen. 12 [51], syn. 23 [24], spec. 51 [12], Salmo maxilla inferiore paulo longiore, maculis rubris] and Linnaeus [1746: 117, n. 309, idem]; type locality: "in Sveciae, Helvetiae fluviis"; type material: NT)

Trutta marina Duhamel, **1771: 200** (not binominal, rejected, ICZN, Opinion 859, 1968: 92)

Trutta fluviatilis Duhamel, **1771: 202**(not binominal, rejected, ICZN, Opinion 859, 1968: 92)

? *Trutta Salmonata* Rutty, 1772: 357 (work not consistently binominal, name not available (ICZN art. 11(c)); locality: river Liffey, Dublin County, Ireland)

? *Trutta salmanata* Strøm, 1784: 123 (type locality: Eger, Buskerud district, Norway; type material: NT)

Salmo albus Bonnaterre, 1788: 161 (based on Pennant [British Zoology, edition not stated, **vol. 3: 302**, White and Whiting]; type locality: river Esk, England, U.K. / Carolina, U.S.A.; type material: NT ?)

Salmo sylvaticus Gmelin, 1788: 1367 (based on Bloch, [1782: 157, pl. 23; Wald- oder Steinforelle]; type locality: Norway / Berlin, Germany / Danzig [Gdansk], Poland; syntypes: lost, H.-J. Paepke, in litt., 1995)

? *Salmo Stroemii* Gmelin, 1788: 1374 (available by indication to Strøm [1762: 292]; type locality: "Denmark" [actually Søndmør, now in Norway]; type material: NT ?)

Salmo Fario Loënsis Walbaum, 1792: 61 (type locality: "lacu Lo Cornubiensi" [lake Lo in Cornwall, U.K.]; based on Borlase [**1758: 263**, The Lo-Trout]; type material: NT ?)

Salmo cornubiensis Walbaum, 1792: 65 (type locality: "lacu Lo Cornubiensi" [lake Lo in Cornwall, U.K.]; based on Borlase [**1758: 263, pl. 76 fig. 1**, The Lo-Trout]; type material: NT ?)

Salmo albus Walbaum, 1792: 76 (based on Pennant [British Zoology, edition not stated, **vol. 3: 302**, White and Whiting; **1784: suppl. 140**]; type locality: river Esk, England, U.K. / Carolina, U.S.A.; type material: NT ?; junior primary homonym and objective synonym of *Salmo albus* Bonnaterre, 1788: 161)

Salmo saxatilis Paula Schrank, 1798: 320 (available by diagnosis and indication to Bloch, 1782: 157, pl. 23, Wald- oder Steinforelle]; type locality: Berlin, Germany, by present restriction [originally: Bavaria, Germany (Paula Schrank) / Norway / Berlin, Germany / Danzig (Gdansk), Poland (Bloch)]; syntypes: lost, H.-J. Paepke, in litt., 1995)

Salmo faris var. *Forestensis* Bloch, in Schneider, 1801: 400 (available by diagnosis and indication to Bloch, 1782: pl. 23 [Wald- oder Steinforelle]; type locality: Norway / Berlin, Germany / Danzig [Gdansk], Poland; syntypes lost, H.-J. Paepke, in litt., 1995)

Salmo gadoïdes La Cepède, 1803: 224, 228 (type locality: pond in Trouville near Rouen, France; type material: NT)

Salmo cumberland La Cepède, 1803: 696 (type locality: lakes of Cumberland and Scotland, U.K.; type material: NT)

Salmo cambricus Donovan, 1806: pl. 91 (type locality: Glamorganshire and Carmarthenshire, Wales, U.K.; type material: NT ?)

Salmo Phinoc Shaw, 1804: vol. 5 (1): 54 (based on Pennant [British Zoology, edition not stated, **vol. 3: 302**, White and Whiting]; type locality: river Esk, England, U.K.; type material: NT ?)

Salmo Levenensis Neill, 1808: 541 (nomen nudum; locality: Loch Leven, Scotland, U.K.; authorship usually attributed to Walker, but Neill is actual author)

Salmo Levenensis Walker, 1812: 373 (nomen nudum; locality: Loch Leven, Scotland, U.K.)

Salmo Taurinus Walker, 1812: 373 (nomen nudum [but the indication "as red in the fish as salmon" could be interpreted as a description]; locality: Loch Leven, Scotland, U.K.)

Salmo Montana Walker, 1812: 374 (nomen nudum; locality: Loch Leven, Scotland, U.K.)

Salmo caecifer Parnell, 1838b: 306, pl. 30 (type locality: Loch Leven, Scotland, U.K.; syntypes: LU); also Parnell, 1839b: 154, pl. 8

Salmo Levenensis Yarrell, 1839: suppl. vol. 2: 9, fig. (type locality: Loch Leven, Scotland; syntypes: LU ?; author indicated as Walker, but this refers to *Salmo levenensis* Neill, 1808: 541 which is a nomen nudum)

Fario argenteus Valenciennes, in Cuvier & Valenciennes, 1848: 294, pl. 616 (based on specimens of unstated locality and on several earlier accounts; here restricted to Atlantic drainage of France; syntypes: MNHN)

Salar Ausonii Valenciennes, in Cuvier & Valenciennes, 1848: 319, pl. 618 (type locality: several streams of Normandie entering the sea near Dieppe and Caen, France; several other localities listed pp. 323–325; syntypes: MNHN)

Salar spectabilis Valenciennes, in Cuvier & Valenciennes, 1848: 340 (type locality: Russia; syntypes: MNHN [3])

Salar Gaimardi Valenciennes, in Cuvier & Valenciennes, 1848: 341 (type locality: Iceland; syntypes: MNHN)

Salar Bailloni Valenciennes, in Cuvier & Valenciennes, 1848: 342, pl. 619 (type locality: river Somme at Abbeville, France; holotype: MNHN)

Salmo Estuarius Knox, 1854: 29 (type locality: mouth of the Tyne of East Lothian in North Britain / river Nith of Dumfriesshire, between the bridge and the Solway Frith, Scotland / near Bute among the Western Isles, U.K.; syntypes: LU) from A. Wheeler, pers. comm.; also Knox, 1855: 4662

Salar Ausonii var. *semipunctata* Heckel & Kner, 1858: 251 (colour variety, not linked with any locality; infrasubspecific, name not available)

Salar Ausonii var. *parcepunctata* Heckel & Kner, 1858: 251 (colour variety, not linked with any locality; infrasubspecific, name not available)

Salmo fario var. *major* Walecki, 1863: 342, 362 (infrasubspecific, name not available; nomen nudum; locality: Poland)

Salmo brachypoma Günther, 1866: 87 (type locality: rivers Forth, Tweed and Ouse, England, U.K.; syntypes: BMNH [7])

Salmo gallivensis Günther, 1866: 88 (type locality: Ballinahibch fishery, Galway, Ireland; syntypes: BMNH [8])

Salmo orcadensis Günther, 1866: 91 (type locality: Loch Stennis, Orkney Islands, U.K.; syntypes: BMNH [2])

Salmo mistops Günther, 1866: 105 (type locality: river Eidfjord, Norway; syntypes: BMNH [4])

Salmo polyosteus Günther, 1866: 111 (type locality: Lapland; syntypes: BMNH [8])

Salmo Islayensis Thomson, 1873: 86, figs. 60–61 (type locality: Loch Na-Maorichen, Islay island, U.K.; syntypes: LU [at least 4])

Trutta marina Moreau, 1881: vol. 3: 537 (type locality: rivers Meuse, Seine and Loire, France; syntypes: MNHN)

Salmo lacustris forma *fecunda, minor* Fatio, 1890: 343 (infrasubspecific, name not available; locality: streams in Switzerland)

Salmo lacustris forma *fecunda, major* Fatio, 1890: 347 (infrasubspecific, name not available; locality: lakes in Switzerland)

Salmo lacustris var. *Rhenana* Fatio, 1890: 347 (type locality: basin of river Rhine downriver of the falls [of Schaffhausen], Switzerland, Germany and Austria; syntypes: MHNG 806.96 [1])

Salmo lacustris var. *septentrionalis* Fatio, 1890: 354 (unnecessary substitute name for *S. l.* var. *rhenana* Fatio, 1890: 347)

Salmo trutta forma *major* Roule, 1925: 98 (infrasubspecific, name not available; locality: France)

Salmo trutta forma *minor* Roule, 1925: 98 (infrasubspecific, name not available; locality: France)

Nomenclatural notes. See discussion of *Salmo saxatilis* under *S. labrax.*

Salmo punctatus Nilsson, 1832 (p. 6) sometimes incorrectly appears in the literature. The name is explicitly indicated as Cuvier's (1829) species by Nilsson.

Fowler (1974: 62) listed a "*Salmo eriox pallayeri* Hoyer & Michalski, 1915: 212" from "Cracow, Austria" [Krakow is in Poland]. This name is nowhere used by Hoyer & Michalski (1915). It is arguable whether the name *S. pallayeri* Fowler, 1974 might be available by indication to Hoyer & Michalski (1915), but I treat it as an erroneous subsequent spelling of *S. pallaryi* Pellegrin, 1924. Four lines below, Fowler lists, as a synonym of his *S. e. pellegrini*, "*S. pallayeri* Moyer and Michalski: Pellegrin ... 1924 ... (misidentification)". Pellegrin's (1924a) *S. pallaryi* is definitively not a misidentification; it clearly is an original name, is unambiguously named for the collector Paul Pallary, and nowhere refers to any paper by Hoyer & Michalski. Fowler apparently confused or mixed data from different sources.

14.3.23.2 Great European lakes [*Salmo lacustris* Linnaeus, 1758 if recognised as a distinct species]

14.3.23.2.1 Lake Genève [*Salmo lemanus* Cuvier, 1828 if recognised as a distinct species]

Salmo Lemanus Cuvier, 1829: 303 (type locality: lake Genève "and some neighbouring lakes", France and Switzerland; syntypes: MNHN)

Trutta variabilis Lunel, 1874: 146, pls. 16–18 (type locality: lake Genève and its tributary streams and outlet: Rhône, Versoix and London, Switzerland; syntypes: MHNG 816.06 [1], 816.07 [1], 807.35 [1])

Salmo lacustris var. *Lemani* facies *arvensis* Fatio, 1890: 350 (infrasubspecific, name not available; locality: river Arve, tributary of river Rhône in Genève, Switzerland)

Nomenclatural notes. "*Salmo fario* var. *profundus* Fuhrmann, 1903" listed by Fowler (1974: 64) does not exist. Fuhrmann (1903: 332) actually discussed *Salvelinus salvelinus* var. *profundus*.

14.3.23.2.2 Lake Konstanz [*Salmo lacustris* Linnaeus, 1758 if recognised as a distinct species]

Salmo lacustris Linnaeus, 1758: 309 (based on Artedi [1738: gen. 12 [–] syn. 25 [12], Salmo cauda bifurca ...; based on Rondelet (1555: 161; lake Genève), Gesner (no year given; in 1575: 189, localities: "Sitten in Wallis"[Sion, Valais], lakes Genève, Zürich and Konstanz), Aldrovandri, **1613**]; type locality: "in Helvetia", restricted here to lake Konstanz, a locality included in the account of Gesner, 1575: 189; type material: NT [Wheeler, 1989: 161])

Salmo Illanca Wartmann, 1783: 55 (type locality: lake Konstanz and river Rhine between lake Konstanz and Rheinwald, Switzerland; syntypes: ZMB ?)

Salmo rappii Günther, 1866: 82 (type locality: lake Konstanz, Germany, Switzerland and Austria; syntypes: BMNH [3])

Salmo lacustris var. *Rhenana* facies *Bodensis* Fatio, 1890: 348 (infrasubspecific, name not available; locality: lake Konstanz, Switzerland, Germany and Austria)

Salmo lacustris forma *sterilis lacustris* Fatio, 1890: 358 (infrasubspecific, name not available; locality: lakes Konstanz, Thun, Vierwaldstätter, Neuchâtel, Zürich and Genève, Switzerland)

14.3.23.2.3. Lakes Vänern and Vättern, Sweden [*Salmo truttula* Nilsson, 1832 if recognised as a distinct species]

Salmo Truttula Nilsson, 1832: 5 (type locality: sea around Göteborg and lake Vättern, Sweden; syntypes: LU)

Salmo microps Hardin, 1862: 383 (type locality: lake Venern [Vänern], Sweden; syntypes: LU)

Salmo venernensis Günther, 1866: 110 (type locality: lake Wenern [Vänern] and river Gotha [Göta älv], Sweden; syntypes: BMNH [7])

14.3.24 ? *Salmo visovacensis* Taler, 1950

Salmo visovacensis Taler, 1950: 118 (type locality: lake Visovac, lower river Krka, Dalmatia; syntypes: LU)

14.3.25 ? *Salmo zrmanjaensis* Karaman, 1938

Salmo farioides zrmanjaensis Karaman, 1938: 138 (type locality: river Zrmanja near Obrovac and Zegar, FYROM; syntypes: LU)

14.3.26 *Salmo* sp. 'dollaghan'

14.3.27 *Salmo* sp. 'salmon trout'

Systematic notes. These are two of the four sympatric species of Lough Neagh, Ireland, for which formal names are not yet available. See discussion, pp. 125, 132.

14.3.28 Names commonly placed in the synonymy of *Salmo trutta* but representing the Caucasian and western Asian lineage (probably several species). List not exhaustive, several species usually recognised as valid not included

Salmo spurius Pallas, 1814: 343 (type locality: river Terek, Caspian Sea basin, Russia; restricted by Berg, 1948: 242, 247 [material from river Neva, Russia, possibly not conspecific; Berg, 1948: 205]; syntypes: LU)

Salmo orientalis M'Clelland, 1842: 585 (type locality: "northern declivities of the Hindoo Koosh, and river Bamean, one of the tributaries of the Oxus, Afghanistan"; types: LU; junior homonym of *Salmo orientalis* Pallas, 1814: 367)

Salmo oxianus Kessler, **1874a: 35, pl. 5 fig. 1** (Alai, basin of the upper Amu-Darya [Tadzhikistan ?]) from Berg, 1948: 258

Salmo caspius Kessler, 1877a: 62 (type locality:

lower river Kura near Bozhii Promysel fishing ground, Azerbaidjan) [Berg, 1948: 242]; syntypes: LU)

Salmo lacustris var. *Romanovi* Kawraisky, 1896: 43,79, pl. 8 figs. 1–2 (type locality: lake Tabiszchuri, Transcaucasia; syntypes: ZMT ? [20])

Salmo trutta aralensis Berg, 1908b: 317 (type locality: Aral Sea at mouth of river Amu-Darja, Taldyk straight [near the Ulkun-Darya, one of the mouths of the Amu; Berg, 1948: 249], Kazakhstan; holotype: ZISP 14418)

Salmo trutta aralensis morpha *fario* Berg, 1916a: 47 (infrasubspecific, name not available; junior homonym of *Salmo fario* Linnaeus, 1758)

Salmo trutta caspius morpha *fario* Berg, 1932a: 113 (infrasubspecific, name not available; junior homonym of *Salmo fario* Linnaeus, 1758)

Salmo trutta caspius morpha *lacustris* Berg, 1932a: 113 (infrasubspecific, name not available; junior homonym of *Salmo lacustris* Linnaeus, 1758)

Salmo trutta ezenami Berg, 1948: 253 (type locality: lake Ezenam in Dagestan, Caucasus; holotype: ZISP 28356)

Salmo trutta abanticus Tortonese, 1954: 19, fig. 2 (type locality: lake Abant [Abant Gölü], Turkey; holotype: MSNM 5031, Conci & Michelangeli, 1974: 222)

Salmo trutta ciscaucasicus Dorofeyeva, 1967: 15 (type locality: river Keyranchay, eastern Ciscaucasia, Russia; holotype: ZISP 26244)

14.4.1 *Salmothymus obtusirostris* (Heckel, 1852)

Salar obtusirostris Heckel, 1852a: 367, pl. 9 (type locality: streams Zermagna and Salona, Spalato [Split], stream Verlica near Imosky, Dalmatia [Croatia]; syntypes: NMW 66413 [1], 66427 [1], 66456 [2], 78817 [1], ZMB 3722 [1])

Thymallus Microlepis Steindachner, 1874: 172 (type locality: hill stream near Vergoraz, Dalmatia; syntypes: NMW [not yet located; B. Herzig, pers. comm., 1995]; junior secondary homonym of *Salmo microlepis* Günther, 1866 when placed in genus *Salmo*); also Steindachner, 1875: 367, pl. 2

Salmo obtusirostris var. *oxyrhynchus* Steindachner, 1882a: 75, pl. 4 (type locality: rivers Narenta [Neretva] and Grupa near Metcovich [Metković], Croatia; syntypes: NMW 82297 [2]; junior homonym of *Salmo oxyrinchus* Linnaeus, 1758 [ICZN art. 58])

Trutta obtusirostris salonitana Karaman, 1927: 256 (type locality: river Jadro near Split, river Krka near Knin, Croatia; syntypes: LU)

Trutta obtusirostris krkensis Karaman, 1927: 259, fig. 4 (type locality: river Krka near Knin, Croatia; syntypes: LU)

Trutta montenigrina Karaman, 1933: 104 (type locality: river Morace, Montenegro; syntypes: LU)

Salmo zetensis Hadzisce, 1960: 49 (type locality: river Zeta near Danilovgrad, a tributary of Skadar lake, Montenegro; syntypes: MMNHS [3])

Systematic notes. According to Behnke (1968: 8) *Trutta montenigrina* could be a valid species of *Salmothymus*, while Karaman (1966: 31) seems to consider it a synonym of *Salmo farioides* or *S. taleri* (unless he means that some specimens are misidentified ?). Vukovic & Ivanovic (1971) treat it as a valid species of *Salmo*.

Karaman (1927) described two subspecies (*S. o. salonitana*, *S. o. krkensis*) with the same locality (river Krka near Knin). If this were real, it might be indicative that more than one species is involved.

Nomenclatural notes. Hadzisce (1960: 49) proposed *Salmo zetensis* as a replacement name for *Trutta obtusirostris letnica* of Karaman (1932: 2) which he considered preoccupied by *Salmo letnica* (Karaman, 1924). Karaman (1932) actually did not propose a new name but used a new combination of his 1924 name. Hadzisce considered that the two uses of the name applied to different species. I treat Hadzisce's action as the description of a new species.

Salvelinus

The main problem with the systematics of the genus *Salvelinus* is the existence of a diversity of stocks which have been variously called species, subspecies, forms, ecomorphs, etc. The classification adopted here roughly follows Behnke's (1972, 1980) ideas, but with many important modifications, in order to adjust to the PSC. A problem with Behnke's review is that it seems to be based on recognising the past existence of several distinct stocks which repeatedly colonised the area; this necessitates numerous elaborate, ad hoc zoogeographic explanations. In my view, species (diagnosable entities) should first be recognised before working out the evolution, phylogeny and zoogeography of the group. Another problem is that Behnke used the BSC (he pointed several times to problems resulting from a strict adherence to the BSC; e.g., 1972: 644) and this leads to some systematic decisions which cannot be followed, like accepting two sympatric and reproductively isolated stocks as conspecific. Behnke (1972: 644) was concerned that "each of the numerous sympatric sibling species could be recognised as a full species with a unique [name], resulting in a proliferation of names until they [become] meaningless" [note the semantic problem of using the word species with two potentially different meanings]. Similar concerns for keeping low the number of species have already been addressed above (see Subspecies, p. 17) and this argument is not objectively acceptable; if systematics aims at describing nature's diversity, it has to describe diversity regardless of how inconvenient or complex this diversity may be and should not artificially reduce it. If, using one or another species concept, one considers that there are, let us say 60 species in a genus, one has to handle 60 species and not to find ways of reducing their number. Some genera are speciose or have lineages quickly exhibiting striking differences once isolated, and we have to adjust our thinking to this and not to squeeze the fishes into what we want them to be. (Or why not suppress the recognition of hundreds of vintages because an untrained palate does not perceive differences ?).

A few lines further, Behnke (1972: 644) stated that "certainly from a fisheries management point of view, sympatric populations with ecological and life history distinctions should be treated as distinct species". To me, it does not make sense to recognise different stocks as biological species and to manage them as species, but not to call them species; the coherent way to handle the problem is that an entity recognised as species using one or the other species concept be called species and be handled as such in systematics, ecology and resources management.

The internal consistency of systematics requires that the basic principles be applied universally; to introduce ad hoc principles for the sake of the management of a single group may make sense in the context of national legislation, etc., but certainly not for global systematics. It is not to fisheries management rites and administrative rules to decide what a species is, but to taxonomy and biology (or, ideally, to the fish !). If fisheries management has a biological base (is not only an administrative exercise), undoubtedly it will be able to adapt.

Central Europe. Behnke (1980: 462) recognises the Alpine and Scandinavian groups of populations as distinct (diagnosable) lineages with independent histories. This corresponds to the present species concept and they are accepted here as distinct species.

In sub-Alpine and Alpine lakes, various stocks have traditionally been recognised. Up to three have been reported from a single lake. For example, wildfangsaibling, schwarzreuter and tiefseesaibling were originally recognised in lake Königssee. Schindler (1940) has shown that wildfangsaibling and schwarzreuter are most likely to be just different year classes of the same species (Heckel & Kner, 1858: 283, had already reached this conclusion). The deepwater stock (tiefseesaibling) has not been discussed by Schindler, but he considered it a distinct race without further discussion. Three stocks were also recognised in lake Attersee (Buresch, 1925: 108; Haempel, 1924: 130) of which a deepwater one survives now (Brenner, 1980). The Ammersee community has been considered similar to the Königssee one, but actually it does not seem to be. Haempel distinguishes a schwarzreuter and a wildfangsaibling, itself divided into a 'sterile' [pre-reproductive] midwater and a reproducing bottom forms and it seems that altogether a single stock was involved.

In cases of sympatry, this often involves a normal and a deepwater stock. Such cases have been reported at least from lakes Konstanz, Neuchâtel, Walchensee, Ammersee, Königssee, Tegernsee, Achensee, Plansee, Attersee and Traunsee (Buresch, 1925; Haempel, 1930: 82; Schindler, 1951; Behnke, 1972: 641), but some are dubious (see above comment on Attersee). In lake Konstanz, the two stocks differ in habitat, life history, external morphology (Schillinger, 1901; Dörfel, 1974) and osteology (Cavender, 1980; Behnke, 1980: 464), and Behnke (1980) recognised them as distinct species. While it seems possible that in several lakes deepwater and normal stocks are distinct species, it has never been demonstrated for any lake other than lake Konstanz and it has never been demonstrated that all the deepwater stocks belong to the same species. The likelihood that different deepwater species exist in different lakes cannot be excluded and this should be investigated as soon as possible. Actually, only few have been described with some detail (e.g., lake Neuchâtel; Quartier, 1951). Several of the deepwater stocks apparently are already extinct (e.g., lake Neuchâtel; Rubin & Buttiker, 1987; Buttiker, pers. comm., Feb. 1996) or seriously threatened. The way Haempel (1930: 184) suggested they be treated is typical of the fisheries practices of the time: "because of its small size (stunted form) it has no fisheries value and should be replaced by a fast-growing form". In lake Konstanz, it is the 'normal' stock which is becoming rare (Hartmann, 1994).

Some authors have assumed that the normal and deepwater species actually are merely "local forms [of a single species] created in response to different environmental and feeding conditions" (Brenner, 1980: 767, for the three forms of lake Attersee). I shall not discuss the semantic problem in the use of the word 'created'. If the two species were mere forms of a single species, any individual should have the potential to develop randomly into any stock. The fact that in lake Attersee two stocks disappeared and only the deepwater stock survived "as a result of overfishing" (Brenner, 1980: 770) could indicate that stocks can be fished to extinction (that is selectively removed) without recruitment from the offspring of the remaining (deepwater) stock. This could demonstrates that there were at least two stocks (deepwater and 'normal') which were diagnosably distinct and with a parental pattern of ancestry and descent; that is, two distinct species. The proof that extinction is effectively a consequence of overfishing should also be given; without monitoring of other possible factors, the conclusion is always open to question. An other explanation is the existence of alternative life-history styles, whose expression depends of environmental conditions; environmental changes might result in the expression of a single of the alternative life-history styles (see Balon, 1989; Bruton, 1989). To be acceptable, this explanation requires a demonstration, case by case, that the 'forms' represent alternative life-history trajectories of the same species; it certainly cannot be a theory automatically valid for all possible species. This has not (yet) been done for a single central European stock.

The status of populations of high-altitude lakes like lake Dösener (see Balon & Penczak, 1980) and other Alpine lakes is more difficult to evaluate, especially as it is likely that most of them are the result of stocking. [Contrary to Balon & Penczak (1980: 792), I do not see problems at accepting stocking as the origin of such populations. Balon & Penczak assume that "to reach a high altitude Alpine lake in the 16th century, with a heavy load [...], would have been even more difficult and adventurous than nowadays, for roads barely extended into the lower central valleys". I think that what might be considered adventurous for a contemporary tourist or untrained person was certainly not for a population which was living in and from the mountains, which was earning its livelihood from guarding herds in the mountains, from hunting or from carrying goods across passes (even nowadays, how much of the 'adventures' of modern, western travellers are just the normal life [often without alternative] of most of the world's population ?). They certainly were accustomed to using pathways probably more diverse and better maintained than nowadays, they used to carry heavy loads with unsophisticated equipment, as porters still do in mountainous parts of the world. The absence of records [accepting the 16th century as a possible stocking date, although later dates and repeated stockings cannot be excluded in many lakes; until the 16th century, climate was warmer and forest limit higher (Hantke, 1978: 382); Alpine glaciers reached a maximum historical extent in the period 1600–1650 (Holzhauser, 1982: 123)] is not only not surprising but also expected, as the decision of stocking is unlikely to have been taken by an administration or a centralised body but by individuals or small local communities; except for the possible clergy and officers (garrison and customs), these populations generally were illiterate. Today, stocking and introductions are going on all over the world for a variety of reasons by a variety of agencies and individuals and it is still difficult or impossible to find accurate records of these operations. People spending the summer guarding herds at high altitudes could certainly perceive the advantage of stocking fish to diversify their diet. Admittedly, this was all but an easy job. In order to accept a theory of natural colonisation of high altitude lakes, one would need to have a reasonable demonstration that a fish basically occurring in lakes would enter high gradient mountain streams and torrents]. Several of these high-altitude lakes are located at the edges of glaciers and are of very recent age. Longitudinal movements of several Alpine glaciers are quite well documented in historical ages. Alpine glaciers had a maximum extension in the 17th century and have significantly regressed in the last 150 years (see Hantke, 1978: 382–386 for general discussion, p. 64 for details of the 1480 m regression of Trient glacier between 1845 and 1956; 1980: 348–349, 640–642 for details of the 2200 m regression of Rhône glacier between 1818 and 1980; for further data see Maisch, 1982; Gamper & Suter, 1982; Holzhauser, 1982), so that one has to demonstrate that natural colonisation could happen given today's climates and topography (admittedly, stream beds have been profoundly altered by man during the last 100 years). Whichever theory is accepted, the key problem is to determine the origin of the transplanted or colonising stocks before arguing on their taxonomic status.

Scandinavia. In Scandinavia, normal, dwarf and anadromous stocks exist, in several cases in sympatry (see Johnson, 1980: 26–32, for an overview). They have been considered as either ecological polymorphism (Reisinger, 1953; Savvaitova, 1980: 291, 1983) or different species, evolved in sympatry (Savvaitova, 1983: 7), in sympatry from slightly different succeeding invaders (Behnke, 1972: 643) or allopatry (Nyman, 1972; Nyman et al, 1981). Behnke (1980: 459) stated that there are "numerous examples of sympatric and reproductively isolated forms [...] in many lakes". He considered that "sympatric occurrence with reproductive isolation is not sufficient evidence by itself for species recognition. Innate reproductive homing behaviour in salmonid fish can maintain reproductive isolation between two or more stocks with little genetic divergence" (p. 450). No species concept would recognise two sympatric and reproductively isolated stocks as conspecific. Furthermore, I disagree with the use of arguments like 'minor divergence' or 'major difference' because they are subjective. Stocks are either diagnosable or not; distinct lineages or not. But degrees, levels, ratios or distances are not acceptable arguments to decide if two stocks are conspecific or not, because "there is no theory to suggest that a trait must be of a certain quality or magnitude to provide historical information or to delimit species" (McKitrick & Zink, 1988: 10). "The only rule [for the 'systematic value' of characters] is that there is no rule or only rules with many exceptions" (Wagenitz, 1953: 94). There are no characters which are 'family characters' or 'species characters'. Morphological characters used to distinguish different dog races are of the magnitude of those characters used to distinguish genera or families in other animal lineages. (See also p. 12). Similarly, there is no theory to suggest that a species must have a minimum distribution area.

In this context, it is important to compare categories which can be compared. Two cases should be distinguished. Firstly, there are populations with two or more discrete stocks in which individuals permanently (that is as early as they can be recognised; we have no data on detailed morphology of fry and early juveniles) exhibit the same phenotype. Secondly, there are populations in which individuals of one of the morph (usually large piscivorous ['charr-ivorous'] individuals) first go through the normal stages of another morph (usually small planktivorous individuals); the Jan Mayen stock (Skreslet, 1973), the Salangen stock, northern Norway (Nordeng, 1983), the Königsee's schwarzreuter and wildfangsaibling (Schindler, 1940), and possibly the lake Tasersuaq, Greenland, stock (Riget et al., 1986) belong to this category. Obviously, these two categories of populations are not equivalent in the framework of a systematic discussion. [Clearly there are semantic problems resulting from the use of the word polymorphism for a variety of phenomena which may have very little in common. Clear concepts are needed and the discussion and analysis of 'polymorphism' could only benefit from introducing different words to designate different phenomena, e.g., 1) alternative appearances of a single species which a given individual will exhibit during all its life [genetic polymorphism apparently belongs here]; 2) the successive appearances which a given individual will obligatorily or facultatively displey durings its life, 3) sexual polymorphism, 4) colonial polymorphism, etc. I use here polymorphism for the first category only. Another problem is when authors compare polymorphism in different groups in which different species concepts are used; e.g., the comparison of polymorphism in some cichlids with polymorphism in some salmonids is questionable as it actually seems to be a comparison of morphs of a single species on the one hand with different, successive phases of a species or with several independent (possibly not each other closest related) species on the other hand].

Sympatric and supposedly genetically distinct stocks are reported from Båtsvatn reservoir, Norway (Klemetsen & Grotnes, 1980), lakes Sirdalsvatnet and Selura, Norway (Hindar et al., 1986), lakes Björkvattnet, Stora Rösjön and Yraf, Sweden (Nyman, 1972: 116–120; Nilsson & Filipsson, 1971; Svedäng, 1990).

Hindar et al. (1986: 271) refer to rearing experiments by Nordeng (1983) and life history studies by Skreslet (1973), Hindar & Jonsson (1982) and Jonsson & Hindar (1982) as "indicating that all of the naturally occurring morphotypes may be found in the offspring[s] from each of the parental types". Actually, Skreslet (1973) is uninformative in the present context, his limited data merely suggesting that a single stock exists in Jan Mayen Islands with some larger-growing individuals, and Hindar & Jonsson (1982) and Jonsson & Hindar's (1982) life history data do not contribute to this argument. Hindar & Jonsson (1982: 1043) merely concluded their study by referring to breeding experiments of Nordeng (1983) and by the hypothesis that "the occurrence of different charr morphs depends on the number of available niches during the growth season". Nordeng (1983) is usually quoted as having demonstrated through "rearing and transplantation experiments [that] three coexisting stocks belong to the same gene pool" and that the offspring of each stock can develop into any of the three. Even if this were the case, one should be cautious before extrapolating his results to all other cases of 'sympatric stocks'. Nordeng studied a stock from the Salangen basin, northern Norway (about 69°N) where three morphs were recognised (small resident, large resident, anadromous); they do not appear to be morphologically distinct. I think that Nordeng conclusively showed that in this population (and possibly others) the morphs are development stages of the same stock. But in the case of the Salangen population it was already known before the study that "some resident char transform into anadromous char after spawning 1–3 times (Nordeng, 1961)" (Nordeng, 1983: 1375, 1382) and this shed a different light on this local case. (Admittedly this is supposed to concern only 9% of the anadromous charrs). We are not told if and how the three 'morphs' differ morphologically and how the parents were classified. If the offsprings were mature in November-December and in the size range 10.5–21.9 cm they were called small resident and between 22.0 and 28.0 large resident; mature specimen were removed and the non-mature ones and smolts kept for one more year and checked again; we are not informed how they were classified as anadromous [probably smolt]. Table 3 is supposed to show that out of 2705 offsprings of two small resident parents 67.9 % were small residents, 10.8% large resident and 21.3% anadromous; to me, this table means that out of two small size parents, in November-December 67.9% of the offsprings were mature at a size of 10.5–21.9 cm, 10.8% at 22.0–28.0 cm and 21.3% belong to a category which is probably smolt; nothing more. Clearly, extrapolation of these results to areas with morphologically different, sympatric stocks is not defendable.

From somewhat similar breeding experiments with lake Stora Rösjön (Sweden) stocks, Svedäng (1990) concluded that dwarf and 'normal' charr forms "separate in several, partly inherited life-history traits". In this case too, the author is vague on the morphological definition of the stocks. These results, however, tend to support the hypothesis that what is true for the stocks of one lake cannot be automatically extrapolated to other stocks. Laboratory-rearing experiments of the lake Thingvalla (Iceland) 'morphs' indicate that morphological differences have a genetic basis (Skúlason et al., 1989: 296).

Hindar & Jonsson (1993) also concluded that 'dwarf' and 'normal' charr in lake Vangsvatnet (Norway) belong to a single population, but at the same time they refer to differences in mortality, growth rates and mouth shape. The morphological descriptors (presence/absence of parr marks and jaw lengths) are too few and presented in an inconclusive way (especially when raw jaw measurements in mm are compared [instead of standardised ratios], without precise anatomical definitions). Despite this reservation, I agree with most of their discussion, except their taxonomic conclusion which relies on "amount of genetic differentiation" (see below; also p. 19). Joensen & Tåning (1970: 71) mention that specimens from lake Leynavatn, Faroes, transferred to a reservoir changed "their growth and appearance", but did not provide details. In conclusion, available data indicate that a single polymorphic species is present in *some* lakes, but there is no argument to justify the extrapolation that a single (and the same) species is involved in all water bodies with several sympatric stocks.

On the basis of the allele frequency distribution at a single esterase locus, Nyman (1972) and Nyman et al. (1981) hypothesised that three species are involved which invaded Scandinavia after the last glaciation, some or all of them occasionally occurring in sympatry in some lakes while there has been introgression in other lakes. Behnke (1980) questioned this interpretation and pointed to the fact that each stock (in a pair of sympatric stocks) seems more closely related to the sympatric stock than to any allopatric stock. I doubt that allele frequencies at a single locus can be used alone to define species. Nyman's three species are not defined by any other character and his nomenclatural choices are weakly supported (we are not provided with sound argument to justify using the names *S. salvelinus* Linnaeus, 1758 [type locality Austria] and *S. stagnalis* Fabricius, 1780 [p. 175; type locality: Greenland "in aquis montanis remotioribus"] for Swedish material.

From an electrophoretic study of stocks from 15 Norwegian lakes, Hindar et al. (1986) conclude that a single species is involved. The methods and concepts used, and the presented data however, are very difficult to include in a systematic analysis. First of all, their species concept (if any) is not clear (they seem to accept that sympatric stocks with "restricted gene flow" are conspecific, p. 281). I already mentioned in the Introduction (p. 19) a general problem with genetic data presented as genetic distances: admittedly, they are sometimes informative in terms of chronology or relative dating of lineages, but they are uninformative in terms of lineage recognition as long as they cannot be analysed together with any other characters. Electrophoretic data of 10 populations from Sweden are reported by Andersson et al. (1983); they have examined material from a locality were two sympatric (but not morphologically distinct !) stocks had been reported and found a single population (p. 90). Their data do not support Nyman et al. (1981) three species theory (but their material came from different localities).

I think that, as for some other groups, one problem with *Salvelinus* is that some researchers have tried to find a global theory to explain all individual cases. Here again, what seems to be the same situation might have independent and different histories. It is possible that in lake Vangsvatnet normal and dwarf *Salvelinus* are 'morphotypes' of a single species which evolved in situ (as suggested by data in Hindar et al., 1986) or alternative life-history styles. But the electrophoretic data in Hindar et al. (1986) seem to indicate that the dwarf stock of lake Sirdalsvatnet is closely related to the normal stock of lake Selura, and the normal stock of lake Sirdalsvatnet is closely related to the dwarf stock of lake Selura. If this is confirmed, it means that in both lakes, the two stocks (which apparently are diagnosable) belong to two independent lineages which maintain genetic identity; that is, there is no interbreeding. With any species concept these have to be called two species. The key problem is to know if a given species is restricted to one basin or if it occurs outside. If the relationships among the stocks in lakes Sirdalsvatnet and Selura are confirmed, there are three alternatives: they can be considered as four, three, or two species. The situation where four species are recognised is trivial and does not need further discussion.

If three species are recognised, this would mean that one species would include the normal stock of one lake and the dwarf stock of the second lake, the two remaining stocks being two species. If two species are recognised, it would mean that the normal stock of one lake is conspecific with the dwarf stock of the second lake while the dwarf stock of the first lake is conspecific with the normal stock of the second lake. While these alternatives cannot be excluded on purely biological grounds, they are quite confusing for practical purposes especially as each stock is in any case diagnosable. In such a case, they should be considered as four species.

With the data now available, it could as well be hypothesised that the present *Salvelinus* species originate from several (at least two, put possibly more) ancestral stocks. They had (and most probably still have) the potential to develop two (or more ?) 'morphotypes' or life-history styles and in some cases they actually developed them in sympatry but in other cases (e.g., in presence of another species) a single 'morphotype' is developed. Under this 'model', one can understand (or predict) a great number of combinations, including monospecific monomorphic, monospecific dimorphic (one species with two morphs), bispecific monomorphic (two species with the same morph), bispecific dimorphic (two species, each with a distinct morph), bispecific trimorphic (two species, one with two morph, one with a single morph), bispecific quadrimorphic, trispecific polymorphic, etc. populations. On top of this, hybridisation might in some instances have made the pattern obscure. Under this 'model', the same two species could occur in sympatry possibly with each always developing the same 'morphotypes', although there is no theoretical reason why the 'morphotypes' could not be developed in a random or opportunistic way, lake by lake. Genetically, this hypothesis probably cannot be tested in terms of genetic distance but only with methods resulting in data compatible with standard systematic analysis, that is in terms of derived and primitive states of a given character (see p. 10).

I would imagine that it is possible (but expensive and labour intensive) to obtain this kind of data. With this data and individual biological information for the population of each water body, it should be possible, if not to understand the evolution of the whole group, at least to recognise the main lines. At this stage, I predict that a detailed morphological examination will allow a reasonable identification of the different species. Finally, I should note that despite the implicit acceptance by various authors that there have been detailed morphological or morphometric work done on fishes of this genus, I could find only very few which can compare with the kind of work needed for even the rawest systematic work (notable exceptions are: Cavender, 1980; Balon & Penczak, 1980; Smith & Stearley, 1993). Most discussion of 'morphology' rarely discuss anything but gill-raker and pyloric caeca counts presented in a more or less confusing way.

Iceland. Stocks from Iceland have usually been considered as conspecific with those from Europe, especially Scandinavia, but I could not find a real comparison. Lake Thingvalla is noteworthy for the sympatric occurrence of four stocks; most aspects of their biology have been the subject of detailed studies summarised by Sandlund et al. (1992), except their taxonomy which received only a simplistic treatment. The stocks differ in 'morphology', coloration, colour pattern (Skúlason et al., 1989; Snorrason et al., 1994), habitat (Sandlund et al., 1987), life history (Jonsson et al., 1988), food (Malmquist et al., 1992), feeding behaviour (Skulason et al., 1993), spawning season (Sigurjónsdóttir & Gunnarsson, 1989: 171), etc. Sandlund et al. (1992: 346) concluded that "the pronounced phenotypic and ecological differences and the fact that we have found no signs of interbreeding ... suggest reproductive isolation". Under any species concept this indicates that several species are involved. Despite this, they concluded (p. 345) that the small genetic distance indicates that the four stocks are conspecific (see also Magnusson & Ferguson, 1987). I have discussed above (pp. 19, 148) the non-significance of 'small' genetic distances in making taxonomic decisions. The data of Sandlund et al. (1992: 343) actually show that some alleles are unique to some stocks (e.g., *Gpi3*(92) is unique to SB stock, *Pgm2*(114) to SB and LB, etc.) and could be considered as apomorphies or synapomorphies *if* outgroup information were available.

A problem with most discussions on sympatric salmonid and coregonid stocks seems to be that some questions are not asked in the appropriate sequence, and this probably results from a lack of familiarity with the practice of systematics and its procedures. For some reasons (maybe because it is considered intellectually more rewarding) there seems to be a need to discuss sympatric, vs. allopatric speciation, and this is often done without the appropriate data. To schematise, the following questions have to be answered in the following sequence: 1) how many stocks are involved (corollary: how are they distinguished) ? 2) are they conspecific or not ? 3) for each of the recognised species, which is the closest related species or group of species (or sister-group) ?

The answer to question 1 provides data to satisfy the first part of the condition to recognise species (an irreductible cluster of organisms diagnosably distinct from other such clusters). The answer to question 2 has to deal with the second part of the definition (there is a parental pattern of ancestry and descent). To answer question 3 implies to answer corollary questions: 3.1) is each of the species endemic to the lake or does it occur outside ? 3.2) for each species, is the sister-group in or outside the lake ? And finally, facultative, 3.3) what is the speciation mechanism ?

Without answering questions 3.1 and 3.2, a discussion of 3.3 does not make sense as the needed information is missing. To answer these, one of course needs to have reliable data on the other, related species.

In the case of lake Thingvalla, I think that Sandlund et al. (1992) clearly answered question 1 (judging from figure 5, there is a potential for several useful morphological characters like respective position of fins, body shape, caudal peduncle shape, distance between dorsal and adipose fins, etc.; none of these characters is discussed; also standard length should be used for such an analysis instead of fork length, especially as fin lengths are potentially informative characters). They answered question 2 (but I disagree with their answer, see below) and they tried (see also Snorrason et al., 1994: 14) to discuss 3.3 without answering questions 3.1 and 3.2; thus, a conclusion is not possible.

Although admitting that the four stocks are conspecific, Sandlund et al. (1992: 347) considered that the two benthic ones (SB, LB) belong to two different breeding populations that "may be reproductively isolated through differences in spawning time and assortative mating behaviours" and that the two stocks of the "pelagic morphotype" (PL, PI) are "two trophically specialized morphs [which] may develop from each of the two parental types" (apparently similar to the case postulated by Skeslet [1973] for Jan Mayen Is. and Nordeng [1983] for river Salangen, Norway). As the stocks seem to have assortative mating (Sigurjónsdóttir & Gunnarson, 1989: 174) and as they seem to consistently differ in breeding colours, the SB and LB stocks should be treated as valid species under the PSC. Available data do not allow to reach a conclusion concerning the PL and PI stocks, and I tentatively treat them as conspecific (although the PL stock might be unique in having striking colour sexual dimorphism; Sandlund et al., 1992: 316).

Contrary to Sandlund et al. (1992), I conclude that their data demonstrate that three stocks are diagnosable and constitute separate lineages (are reproductively isolated) and I do not see reasons for not calling them species. Available data do not allow me to know whether or not they are restricted to lake Thingvalla and whether one of them could be exactly the same as the '*S. alpinus*' outside the lake. At this stage there is no advantage in arbitrarily equating one of the lacustrine species with '*S. alpinus*' from the rest of Iceland and I decided to recognise them as three species endemic to the lake. I could not find published data allowing to compare non-lacustrine Icelandic *Salvelinus* with other European stocks.

Sympatric stocks are also reported from lakes My [Myvatn] (Lamby, 1941: 772), but the available data no not allow a discussion.

There is a variety of works on Russian stocks of *Salvelinus*, with a variety of contradictory opinions (see, for example, Chereshnev, 1982; Savvaitova, 1983). As they concern mainly northern and eastern Asian stocks (and also because of my inability to read them in original, without translation bias), I have decided not to comment on them. As for other areas, I cannot follow Savvaitova's model because she considers sympatric non-interbreeding stocks as conspecific. I do not perceive it as a problem if a great number of species have to be recognised and called by their names. If this diversity exists, we want it to be displayed, not hidden.

Nomenclature. I consider here that the Alpine and Scandinavian groups of populations are distinct species, *S. salvelinus* and *S. alpinus* respectively. The deepwater stock of lake Konstanz is a distinct species, *S. profundus*; it should urgently be investigated if the deepwater stocks of other Alpine lakes are conspecific or not (see below discussion of *S. profundus*) as several are potentially under serious threat of extinction. High altitude forms are tentatively referred to *S. salvelinus*, although, if naturally occurring populations really exist, their status might have to be re-evaluated.

For Scandinavian stocks, awaiting more data allowing resolution of their phylogeny and taxonomy, a pragmatic way to handle their nomenclature is needed. It would not be logical to treat as conspecific sympatric stocks known to be reproductively isolated. Stocks with the 'normal' *S. alpinus* habitus are tentatively (and somewhat arbitrarily) considered as conspecific. In cases where sympatric stocks shows reproductive isolation and are diagnosable, they should be considered as species. The problem is that the 'morphological' data presented up to now are of very limited or no use to decide whether or not stocks are diagnosable and to link them with the available names. As a result, a single Scandinavian species (*S. alpinus*) appears in the list of valid species, but there is a potential that more species can be diagnosed and recognised.

Sixteen species had been recognised from the British Isles and one from the Faroes. Their status should be re-examined and if they really are independent and diagnosable lineages, they should be recognised as valid species (this applies to populations from Spitzbergen and Jan Mayen islands too). Available data (Regan, 1908a, 1909a, 1911b; Friend, 1959) are strongly indicative that lineages are present that deserve recognition as species under the PSC, but the same data do not allow a determination of the exact number of involved species. Also, more recent data indicate that here too, two species occur in sympatry in some lakes but it is not known if they are identical or not with stocks in other lakes. Under these conditions, considering that presently all are diagnosable and *seem* to constitute independent lineages, I am left with no choice but to accept them as valid species, pending confirmation (or rejection). Ferguson (1981) analysed tissue proteins of Irish charr and found a high degree of similarity (for comments on similar studies, see p. 19). Some authors refer to Friend (1959) for a review of British species. Although this publication includes some interesting data, it does not contain any concrete result or conclusion and was not intended as a revision. Friend was considering the British stocks as different subspecies under the BSC (see Introduction, p. 17). He points to the existence of a great number of still unreported, geographically isolated stocks which "can be identified, in most cases at a glance, because of the varied yet racially constant characters they show" (p. 128). It seems that the two criteria for identifying species (diagnosability and monophyly) are met. This was in 1959 and Friend's researches have not resulted in any other publication. (How many of these stocks are now lost, in part because of failure to recognise them as distinct or unwillingness to handle too many names ?)

For lake Thingvalla, names are available for two of the three species. The SB stock should be called *S. thingvallensis* and the PI and PL stocks *S. murta*. There is no available name for the LB stock and it was my intention to provide one. This has not been possible, as I have been unable to personally examine specimens at the time of completing this manuscript. Hopefully it can be done soon.

A potential nomenclatural problem results from Linnaeus's (1758) making four names simultaneously available (*S. salvelinus, S. alpinus, S. salmarinus, S. umbla*) which have been treated as synonyms by subsequent authors. The first reviser's action is decisive to determine respective priority among these four names. Table 3 shows the earliest decisions I could find for each pair of names.

The earliest synonymy apparently is by Paula Schrank (1798: 322) who considered *S. salvelinus, S. alpinus* and *S. salmarinus* as conspecific but he did not explicitly gave priority to one of the names. Fitzinger (1832: 338) treated *S. alpinus* as subspecies of *S. salvelinus*, thus explicitly giving priority to *S. salvelinus* over *S. alpinus*. Agassiz (1835a: 622) considered the four of them as synonyms and retained *S. umbla* as the valid name, thus giving priority to this name over the three others (Agassiz

Table 3. Respective priority between *Salmo alpinus* Linnaeus, 1758, *S. salvelinus* Linnaeus, 1758, *S. umbla* Linnaeus, 1758 and *S. salmarinus* Linnaeus, 1758 as determined by the first subsequent reviser's action for each pair of names.

and	*S. salvelinus*	*S. alpinus*	*S. umbla*
S. alpinus by	*S. salvelinus* Fitzinger, 1832		
S. umbla by	*S. umbla* Agassiz, 1835a	*S. umbla* Agassiz, 1835a	
S. salmarinus by	*S. salvelinus* Bloch, in Schneider, 1801: 401	*S. alpinus* present decision	*S. umbla* Agassiz, 1835a

has been followed, e.g., by Siebold, 1863a; Smitt, 1895: 842; Roule, 1925). According to Günther (1862a: 43), Jardine (1835b: 614), same volume, adopted Agassiz's views but retained *S. alpinus*; formally speaking this is not the case as Jardine indicated the author of *S. umbla* as Agassiz and did not indicate the author of *S. alpinus*. Therefore I consider that Agassiz (1835a) is the first reviser. Should one consider that Jardine (1835b) acted as first reviser, then it has been published in the same volume, at the same date as Agassiz's (1835a) action and the first reviser's action is decisive to decide which of these two first revisers has priority (ICZN art. 24). Agassiz's action being much more detailed and explicit, as first reviser I retain Agassiz's act as having priority over Jardine's. Day (1887: 231) states that Richardson (1835) considered *S. umbla*, *S. alpinus* and *S. salvelinus* as conspecific, but I could not find such a statement in Richardson (1835).

This means that if *S. umbla*, *S. salmarinus* and *S. salvelinus* are considered synonyms, the valid name of the species has to be *S. umbla*. If *S. alpinus* and *S. umbla* are considered as constituting a single species (as concluded, e.g., by Behnke, 1980), the valid name of the Arctic charr is *S. umbla*, and not *S. alpinus* (unless it can be demonstrated that before 1835 an author explicitly designated *S. alpinus* as having priority). Earlier authors have apparently not paid much attention to priority and the use of one name or another often seems to have depended mainly on local traditions. Scandinavian authors tended to prefer *S. alpinus* (maybe because it had been described from Scandinavian material), central European authors *S. salvelinus* (maybe because the name is derived from the German saibling) and south-western European authors *S. umbla* (maybe because the name is derived from the French omble).

14.5.1 *Salvelinus alpinus* (Linnaeus, 1758)

Salmo alpinus Linnaeus, 1758: 309 (based on Linnaeus [1746: 117, n. 310, Salmo dorso nigro ...; **1747: 257**, Roeding] and Artedi [1738: gen. 13 [52], syn. 25, spec. 52 [13], Salmo vix pedalis ...; based on "Salmo Lapponicus Alpinus Linnaei", probably described in Linnaeus, **1732**]; type locality: "in Laponniae, Angliae alpibus, solus"; type material: NT)

Salmo carbonarius Strøm, 1784: 122 (type locality: Modum [in Buskerud District, southwest of Oslo], Norway; type material: NT)

Salmo levis Mohr, 1786: 80 (type locality: Iceland; type material: NT ?; refers to Olafsen, 1732 [sic 1772]: 595)

Salmo Lepechini Gmelin, 1788: 1374 (available by indication to Lepechin, **1780: 229, pl. 14 fig. 2** [according to Gmelin; addendum p. 19, pl. 15 fig. 2 according to Berg, 1948: 275]; type locality: erroneously given as rivers of Olonets district by Lepechin, 1780, but should be lake Ladoga, according to Berg, 1948: 275; syntypes: LU)

Salmo laevis Walbaum, 1792: 60 (based on Hammer [1775: 85, number 381, Salmo laevis pinnis maximis, Iceland, itself based on Olafsen, 1772: 595], Olafsen [1772: 595, Reydus, Bleikia] and Mohr [1786: 80, *Salmo levis*]; type material: NT ?; either an unnecessary replacement name for, an unjustified emendation or a junior homonym of *Salmo levis* Mohr, 1786: 80 [ICZN art. 58(1)]); synonymy follows Faber, 1829: 168

Salmo palja Walbaum, 1792: 67 (based on Lepechin, **1780: 229** [according to Walbaum; addendum p. 19, pl. 15 fig. 2 according to Berg, 1948: 275] and *S. lepechini* Gmelin, 1788: 1374; type locality: erroneously given as rivers of Olonets district by Lepechin, 1780, but should be lake Ladoga, Russia, according to Berg, 1948: 275; syntypes: LU)

Salmo punctatus Cuvier, 1829: 304 (type locality: Lapland and British Isles, by present restriction [originally: "all around the Alps"]; available by description and indication to *S. alpinus* of Bloch, 1784: 158, pl. 104, itself based on a drawing of material from the [Swiss ?] Alps and earlier records, including original description by Linnaeus, 1758: 308; *S. punctatus* is here restricted to Linnaeus's (1758: 308) account of *S. alpinus* (see p. 131); type material: NT)

Salmo nivalis Faber, 1829: 170 (type locality: Greenland, Iceland, Faroe Islands, Norway; syntypes: LU)

Salmo ventricosus Nilsson, 1832: 7 (type locality: Sigdal, Norway; syntypes: LU)

Salmo rutilus Nilsson, 1832: 10 (type locality: "lakes in Hadeland territories", Norway; syntypes: LU)

Salmo Ascanii Valenciennes, in Cuvier & Valenciennes, 1848: 256 (type locality: lakes of Christiansadvis, Norway; based on the Röding, Roëding or Roetelet of Ascanius, 1775: 4, pl. 32; type material: NT)

Salmo salvelino-stagnalis Smitt, 1886: 111, 163 (type locality: Teriberka, mouth of river Murmansk, Kola Peninsula, Russia; syntypes: NRM 12050–12051 [2, #414–415])

Salmo alpino-stagnalis Smitt, 1886: 112, 163 (type locality: Godthaab and Godhavn, Greenland; syntypes: NRM [12, # 402–413])

Salmo hybridus Smitt, 1886: 112 (type locality: lake Yngern [59°45'N 14°15'E, near Persberg], Sweden; syntypes: NRM)

Salvelinus lepechini melanostomus Berg, 1932a: 116 (nomen nudum; locality: lake Segozero, White Sea drainage)

Salvelinus lepechini infraspecies *profundicola* Berg, 1932c: 174 (infrasubspecific, name not available; locality: lake Ladoga, Russia [Berg, 1948: 278])

Salvelinus lepechini melanostomus Berg, 1932c: 177 (type locality: Segozero, basin of river Vyg [a tributary of lake Onega], Russia [Berg, 1948: 281]; syntypes: ZISP ?)

Nomenclatural notes. Nyman et al. (1981: 133) discussed the type locality of *Salmo alpinus* on the assumption that Linnaeus (1758: 309) based it on Artedi (1738) and his own *Iter Lapponicum* (**1732**). Actually Linnaeus based his account on his *Fauna Svecica* (1746) and *Wästgöta-resa* (**1747**) and on Artedi (1738) [who himself refers to Linnaeus (**1732**), but there is no unambiguous statement of this]. A type locality restriction should be based on these accounts and is best linked to a neotype designation.

The author of *Salmo laevis* is sometime indicated as Olafsen (1772: 595). Olafsen's use of the name *S. laevis* is obviously not binominal, as "*Salmo laevis, pinnis maximis, corpore subtereti pallide fusco*". The first use making the name available is as *S. levis* by Mohr (1786). The spellings *laevis* and *levis* are homonyms (ICZN art. 58(1)).

If the Scandinavian charr is considered as conspecific with the Alpine one, the valid name is *S. umbla* (see above, p. 151).

14.5.2 *Salvelinus colii* (Günther, 1863)

Salmo colii Günther, 1863: 12, pl. 2 (type locality: Lough Eske, county of Donegal, Ireland / Lough Dan, Wicklow county, Ireland; syntypes: BMNH)

14.5.3 *Salvelinus faroensis* Joensen & Tåning, 1970

Salvelinus alpinus faroensis Joensen & Tåning, 1970: 68 (type locality: Leynavatn, Faroe Islands; holotype: ZMUC, missing according to Nielsen, 1974: 12)

Systematic notes. The status of this taxon is unclear because the diagnosis is vague and not very explicit. The characters distinguishing it from *S. gracillimus* from the 'nearby' Shetlands are not mentioned.

14.5.4 *Salvelinus fimbriatus* Regan, 1908

Salvelinus fimbriatus Regan, 1908a: 232, fig. 5 (type locality: Lough Coomasaharn in Kerry, Ireland; holotype: BMNH or NMI)

Salvelinus fontinalis (Mitchill, 1814) introduced

14.5.5 *Salvelinus grayi* (Günther, 1862)

Salmo grayi Günther, 1862a: 51, pl. 7 (type locality: Lough Melvin in Fermanagh, Ireland; syntypes: BMNH [3])

14.5.6 *Salvelinus gracillimus* Regan, 1909

Salvelinus gracillimus Regan, 1909a: 115, fig. 2a (type locality: Loch of Girlsta, Tingwall, Shetland islands, U.K.; syntypes: BMNH [4])

14.5.7 *Salvelinus inframundus* Regan, 1909

Salvelinus inframundus Regan, 1909a: 116 (type locality: lake Hellyal, Hoy Island, Orkney islands, U.K.; syntypes: BMNH [2])

Systematic notes. Extinct according to Regan (1909a: 116; 1911b: 101) and Joensen & Tåning (1970: 70); recent data would be desirable.

14.5.8 *Salvelinus killinensis* (Günther, 1865)

Salmo killinensis Günther, 1865a: 699, pl. 40 (type locality: Loch Killin, Inverness-shire, U.K.; syntypes: BMNH, ZMB 8330)

14.5.9 *Salvelinus lonsdalii* Regan, 1909

Salvelinus lonsdalii Regan, 1909a: 119, fig. 2b (type locality: Haweswater, Cumberland, U.K.; syntypes: BMNH [2])

14.5.10 *Salvelinus mallochi* Regan, 1909

Salvelinus mallochi Regan, 1909a: fig. 4 (type locality: Loch Scourie, Sutherlandshire, U.K.; syntypes: BMNH [4])

14.5.11 *Salvelinus maxillaris* Regan, 1909

Salvelinus maxillaris Regan, 1909a: 117, fig. 3 (type locality: Loch near Ben Hope, Sutherlandshire, U.K.; syntypes: BMNH [11])

14.5.12 *Salvelinus murta* (Saemundsson, 1909)

Salmo alpinus var. *murta* Saemundsson, 1909: 93 (type locality: lake Thingvalla, Iceland; syntypes: IMNH uncat.)

14.5.13 *Salvelinus obtusus* Regan, 1908

Salvelinus obtusus Regan, 1908a: 233 fig. 6 (type locality: Lough Luggala and Lough Dan in Wicklow, Killarney and Lough Acoose in Kerry, Ireland; syntypes: BMNH or NMI [17])

14.5.14 *Salvelinus perisii* (Günther, 1865)

Salmo cambricus Günther, 1862a: 49, pl. 6 (type locality: lakes of Llanberis, Carnarvonshire, North Wales, U.K. / lake Coss-y-gedawl, near Barmouth in Merionethshire, U.K.; syntypes: BMNH [ca. 24]; junior primary homonym of *S. cambricus* Donovan, 1806)

Salmo Perisii Günther, 1865b: 75 (replacement name for *Salmo cambricus* Günther, 1862)

14.5.15 *Salvelinus profundus* Schillinger, 1901

Salmo salvelinus var. *profundus* Schillinger, 1901: 149, fig. (type locality: lakes Konstanz and Ammersee, Germany restricted here to lake Konstanz; type material: NT)

? *Salvelinus salvelinus* var. *profundus* Fuhrmann, 1903: 332 (type locality: lake Neuchâtel, Switzerland; syntypes: MHNN 837 [2], MHNG 809.61 [3, 2 now lost]; junior secondary homonym of *Salmo salvelinus* var. *profundus* Schillinger, 1901)

Systematic notes. Although formally named in 1901, a detailed description of this species has never been published. It is definitely reported from lake Konstanz only. Deep water forms from other sub-Alpine lakes have occasionally been referred to it, but evidence that they are conspecific is missing. Descriptive data of other stocks are only available for lake Neuchâtel, Switzerland (Fuhrmann, 1903; Quartier, 1951), but without comparison with the material of lake Konstanz.

The identity of material presently referred to as deepwater charr in lake Konstanz is open to question. Behnke's (1972: 641) and Cavender's (1980: 298) examination of ancient material indicates that *S. profundus* differs from the 'normal' charr *S. umbla*. This is supported by data in Dörfel (1974). The normal charr used to be the dominant species, but since about 1980 the deep-water one became dominant (Hartmann, 1994). Hartmann also reports that today's deep water charr in lake Konstanz does not agree with descriptions of earlier workers; this is confirmed by my examination of material caught in 1995 (provided by J. Hartmann). It has not yet been possible to compare this material with ancient museum specimens of *S. profundus*, but preliminary observations suggest that the present deepwater charr is not *S. profundus* but possibly small individuals of *S. umbla*. If this is confirmed, it should be investigated if the real *S. profundus* possibly survives in deeper areas where commercial fishermen do not operate. It may already be too late and the species might be extinct.

The large charr of lake Konstanz reportedly is (was) not identical with the 'normal' charrs of other alpine lakes (Nümann, 1972: 835).

Pollution, eutrophication and decreased oxygen concentration in deep-water layers (Nümann, 1972: 842) may be responsible for the extinction of *S. profundus* which was apparently restricted to this habitat. Lake Konstanz has been regularly stocked with allochtonous material since 1978 (from lake Vierwaldstätter; Ruhlé, 1991) and it also cannot be ruled out that hybridisation might be partly responsible for this change.

Nomenclatural notes. Fuhrmann (1903: 332) described *Salvelinus salvelinus* var. *profundus* from lake Neuchâtel. The name is a junior secondary homonym of *Salmo salvelinus* var. *profundus* Schillinger, 1901. As there is no indication that Fuhrmann was aware of Schillinger's work and of the lake Konstanz species, it is not possible to consider that he was simply using the name created by Schillinger and I treat it as an independent (but unavailable) name.

14.5.16 *Salvelinus scharffi* Regan, 1908

Salvelinus scharffi Regan, 1908a: 228, fig. 2 (type locality: Lough Owel in Westmeath, Ireland; holotype: BMNH or NMI)

Systematic notes. Charrs have become extinct in Lough Owell (Quigley & Flannery, 1996: 31). It is not known whether this species possibly survives in other lakes.

14.5.17 *Salvelinus struanensis* (Maitland, 1881)

Salmo struanensis Maitland, 1881: 516 (type locality: Loch Rannoch, Scotland, U.K.; syntypes: LU)

Systematic notes. Walker et al. (1988) reports that two stocks are present in Loch Rannoch, with different morphology, habitat, spawning places and feeding habits, which would apparently justify them being recognised as two species under the PSC. One of them is *S. struanensis*. The identity of the second one can only be determined after careful comparisons with stocks from other lakes as it might be identical with one of them. On the other hand, it might represent an unnamed species.

Salvelinus struanensis in Regan (1911: 94, pl. 10 fig. 1) is apparently not Maitland's species but the unnamed benthic species of Walker et al.

14.5.18 *Salvelinus thingvallensis* (Saemundsson, 1909)

Salmo alpinus var. *Thingvallensis* Saemundsson, 1909: 93 (type locality; lake Thingvalla, Iceland; syntypes: IMNH uncat.)

Salmo alpinus forma *niger* Fridriksson, 1939: 24 (subspecific because treated as valid prior to 1985, e.g., Fowler, 1974: 70 (ICZN art. 45(g)(ii)(1)); type locality: lake Thingvalla, Iceland; syntypes: LU)

Systematic notes. According to S. Snorrason (pers. comm., 1995), the *S. a. niger* of Fridriksson (1939) can hardly be anything else than the SB stock of Sandlund et al. (1992); it cannot be excluded that some of Fridriksson's specimens belonged to the LB stock, but this cannot be demonstrated as none of his material is extant.

14.5.19 *Salvelinus trevelyani* Regan, 1908

Salvelinus trevelyani Regan, 1908a: 229, fig. 3 (type locality: Lough Finn in Donegal, Ireland; holotype: BMNH)

14.5.20 *Salvelinus umbla* (Linnaeus, 1758)

Salmo Salvelinus Linnaeus, 1758: 309 (based on Artedi [1738: gen. [spec.] 13, syn. 26, Salmo pedalis maxilla ...; based on Ray [**1710: 64**, Linz, Austria]]; type locality: "in Austria ad Lintz"; type material: NT)

Salmo Salmarinus Linnaeus, 1758: 310 (based on Artedi [1738: syn. 24, Salmo dorso fulvo ...; based on Salviano (1554–58: fol. 102, pl. 27, "Tridento ... alio fluuio apud Brissanam [Bressanone ?, Alto Adige, Italy] quadra ginta millia passum a Tridento")]; type locality: "Tridenti in fluviis frigidis saxosis"; type material: NT)

Salmo Umbla Linnaeus, 1758: 310 (based on Artedi [1738: gen. [spec.] 13, syn. 25, Salmo lineis lateralibus ...; based on Rondelet [1555: 160, lake Genève] and Gesner [no year, 1775: 190, 191, lakes Genève, Zürich, Luzern and Konstanz]; type locality: "in Helvetiae, Italiae lacubus"; type material: NT)

Salmo Salvelinus var. *Marsilii* Fitzinger, 1832: 338 (available by indication to Marsili [1726: 83, pl. 29 fig. 1, Umbla II, "Männ-Seer"]; type locality: "Männ-See" [Marsili], lake Mondsee, Austria; syntypes: NMW [not yet located; B. Herzig, pers. comm., 1995])

Salmo Salvelinus var *carneus* Fitzinger, 1832: 338 (nomen nudum; locality: lake Traunsee, Austria)

Salmo pallidus Nilsson, 1832: 9 (type locality: lake Vättern, Sweden; syntypes: LU)

Salmo monostichus Heckel, 1851a: 146 (type locality: lake Königssee, Germany; syntypes: NMW 65458 [1], 66063 [2]); predates Heckel, 1852a: 299

Salmo distichus Heckel, 1852a: 359, 361 (type locality: lakes of Salzkammergut, Austria; syntypes: NMW [not yet located; B. Herzig, pers. comm., 1995])

Salmo costatus Gronow, 1854: 152 (type locality: Switzerland; type material: NT)

Salmo Schrankii Heckel & Kner, 1858: 280 (listed in synonymy, name not available; author stated to be Fitzinger, but Heckel & Kner are actual authors)

Systematic notes. This species includes all the 'normal' stocks of the Alpine and sub-Alpine lakes, and, according to Behnke (1972, 1980), the stocks from lake Vättern, Sweden (for which the name *S. pallidus* would be available if further research proves it distinct) and lake Coomarsaharn, Ireland (here treated as *S. fimbriatus*).

14.5.21 *Salvelinus willoughbii* (Günther, 1862)

Salmo willoughbii Günther, 1862a: 46, pl. 5 (type locality: lake Windermere, Westmorland, U.K.; syntypes: BMNH [2])

Salvelinus willughbii forma *autumnalis* Frost, 1966: 260 (infrasubspecific, name not available; locality: lake Windermere, Cumbria, U.K.; autumn spawning form)

Salvelinus willughbii forma *vernalis* Frost, 1966: 260 (infrasubspecific, name not available; locality: lake Windermere, Cumbria, U.K.; spring spawning form)

Systematic notes. Frost (1966) documented the existence of a spring and an autumn spawning stocks in lake Windermere; they do not interbreed in nature (but can be crossed under laboratory conditions) and are apparently not distinguishable morphologically (but we are not given much information on characters other than gill-rakers). Child (1984: 249) obtained "evidence ... supporting the genetic isolation" of the two stocks.

Nomenclatural notes. The original spelling *willoughbii* has been emended to *willughbii* by Günther (1863: 11). As both spellings Willughby and Willoughby appeared on the title pages of his works, I consider that *willoughbii* (based on a latinised form of Willoughby) is a correct original spelling which should not be emended.

14.5.22 ? *Salvelinus youngeri* Friend, 1956

Salvelinus alpinus youngeri Friend, 1956: 220 (type locality: Loch Eck, Cowal, Argyllshire, Scotland, U.K.; syntypes: ? Zoology Dept., Edinburgh Univ. [upwards of 50])

Systematic notes. The data provided by Friend (1956) do not allow to identify this stock with any of the named ones and it is tentatively treated as a valid species.

14.5.23 *Salvelinus* sp. Lake Thingvalla LB stock

Systematic notes. This is the LB stock of Sandlund et al. (1992) which is considered here as a distinct species. No name is available for it.

14.6.1 *Thymallus thymallus* (Linnaeus, 1758)

Salmo Thymallus Linnaeus, 1758: 311 (based on Artedi [1738: gen. 10 [41], syn. 20, spec. 41 [10], Coregonus maxilla superiore ...], Linnaeus [1746: 119, n. 314, idem], and Gronovius [1756: 13, n. 165 (actually p. 12, n. 162), idem; river Rhine near Basel, Switzerland]; type locality: "in Europae fluviis maritimis"; syntype: BMNH 1853.11.12:159, Wheeler, 1958: 207)

Salmo thymus Bonnaterre, 1788: 167, pl. 53 fig. 202 (type locality: streams of England and Germany; type material: NT [apparently based on Willughby (1686: 187) and Salviano (1554–58: fol. 81, pl. 16, thymallo, Ticino, Athesi, Addua, Pado, Transalpinae Galliae)

Salmo striatus Reisinger, 1830: 44 (type locality: 'in rivis frigidis Liptoviae' [Liptau = Liptov], Hungary [now Slovakia]; type material: NT)

Thymallus vulgaris Nilsson, 1832: 13 (unnecessary replacement name for *Salmo thymallus* Linnaeus, 1758)

Thymallus vexillifer Perty, 1832: 718 (unnecessary replacement name for *Salmo thymallus* Linnaeus, 1758)

Thymallus decorus Koch, in Koch, Herrich-Schäffer & Forster, 1840: 42 (unnecessary replacement name for *Salmo thymallus* Linnaeus, 1758)

Thymallus gymnothorax Valenciennes, in Cuvier & Valenciennes, 1848: 445, pl. 625 (type locality: Berlin, Germany, and Russia; syntypes: MNHN)

Thymallus gymnogaster Valenciennes, in Cuvier & Valenciennes, 1848: 446, pl. 626 (type locality: river Neva, Russia; syntypes: MNHN [3])

Thymallus Æliani Valenciennes, in Cuvier & Valenciennes, 1848: 447 (type locality: lake Maggiore, Italy; syntypes: MNHN [3])

Thymallus umbrosa Gistel, in Gistel & Bromme, 1850: 344 (no locality data; type material: NT)

Salmo punctatus Gronow, 1854: 153 (type locality: Germany; type material: NT; preoccupied by *Salmo punctatus* Cuvier, 1829)

Thymallus thymallus kamensis Lukash, **1929: 7** (upper reaches of river Kama [a tributary of river Volga], Russia) from Berg, 1948: 432 and Svetovidov, 1936: 218

Thymallus thymallus morpha *lacustris* Balon, 1962: 152 (infrasubspecific, name not available; locality: reservoir on river Hnilec, Slovakia)

Gadidae

15.1.1 *Lota lota* (Linnaeus, 1758)

Gadus Lota Linnaeus, 1758: 255 (based on Linnaeus [1746: 109, n. 292, Gadus dipterygius ... aequalibus], Artedi [1738: gen. [spec.] 22, syn. 38, Gadus dorso ... ore cirrato, spec. 107, Silurus ciro in mento unico]; type locality: "in lacubus Europaeis"; syntypes: LSL 37, 38 [2], Wheeler, 1985: 37, UUMZ 178, Wheeler, 1991: 165)

Lota vulgaris Fitzinger, 1832: 331 (unnecessary replacement name for *Gadus lota* Linnaeus, 1758)

Lota fluviatilis Perty, 1832: 717 (unnecessary replacement name for *Gadus lota* Linnaeus, 1758)

Lota marmorata Koch, in Koch, Herrich-Schäffer & Forster, 1840: 42 (unnecessary replacement name for *Gadus lota* Linnaeus, 1758)

Lota communis Rapp, 1854: 172 (type locality: lake Konstanz, Germany-Switzerland-Austria; syntypes: LU; author indicated as Cuvier, but Rapp is actual author)

Lota Linnéi Malm, 1877: 491 (unnecessary replacement name for *Gadus lota* Linnaeus, 1758)

Lota vulgaris var. *obensis* Anikin, **1902: 108** (river Ob, Siberia) from Berg, 1949: 943

Lota lota kamensis Markun, **1936: 211** (river Kama near Okhansk, Russia) from Berg, 1949: 944

Lota lota leptura Hubbs & Schultz, 1941: 17 (type locality: Kotlik, one of the mouth of river Yukon on Norton Sound, Alaska; holotype: USNM 29916)

Lota lota infrasp. *onegensis* Melyantsev, **1948: 96** (infrasubspecific, name not available; locality: lake Onega, Russia) from Berg, 1949: 944

Lota lota asiatica Kirillov, 1972: 279 (type locality: Yakutia, Siberia; syntypes: LU)

Systematic notes. Kirillov (1972) distinguished two subspecies on the basis of pyloric caeca, but according to Holčík & Nagy (1987) the number of pyloric caeca shows clinal variation and increases with size.

Nomenclatural notes. The author of *Lota vulgaris* is often cited as Cuvier (1829: 215) but Cuvier only used a French name and no Latin name. The first use making the name available seems to be by Fitzinger (1832: 331).

Mugilidae

16.1.1 *Chelon labrosus* Risso, 1826

Mugil labrosus Risso, 1826: 389 (type locality: not stated, probably around Nice, France; syntypes: apparently lost)

Mugil chelo Cuvier, 1829: 232 (type locality: Brest, France; lectotype: MNHN 6400, designated by Blanc & Hureau, 1971: 686)

? *Mugil curtus* Yarrell, 1836: 210, fig. (type locality: between Brownsey Island and South Haven, at the mouth of Poole Harbour, England; holotype: LU)

Mugil corrugatus Lowe, **1838: 184** (type locality: Madeira; syntypes: LU) from Trewavas, in Hureau & Monod, 1973: 569

Mugil Buosega Nardo, 1847: 127 (cited in synonymy, name not available)

Mugil septentrionalis Günther, 1861b: 349, fig. (type locality: British coasts; syntypes: BMNH, Trewavas, in Hureau & Monod, 1973: 569)

16.2.1 *Liza aurata* (Risso, 1810)

Mugil Auratus Risso, 1810: 344 (type locality: Nice, France; syntypes: apparently lost)

Mugil cryptocheilos Valenciennes, in Cuvier & Valenciennes, 1836: 61 (type locality: river Nile [Egypt]; holotype: MNHN A.3665, Thomson, in Daget et al., 1986: 345)

Mugil breviceps Valenciennes, in Cuvier & Valenciennes, 1836: 106 (type locality: Gorée [near Dakar, Senegal]; holotype: MNHN A.4677, Thomson, in Daget et al., 1986: 345)

Mugil maderensis Lowe, **1839: 82, 83** (type locality: Lanzarote, Canary Islands; holotype: BMNH 1860.5.3:22) from Thomson, in Daget et al., 1986: 345 and Costa Pereira, in litt.

Mugil Lotreganus Nardo, 1847: 127 (cited in synonymy, name not available)

Mugil octo-radiatus Günther, 1861b: 347, fig. (type locality: England; holotype: BMNH)

16.2.2 *Liza ramada* (Risso, 1826)

Mugil ramada Risso, 1826: 390 (type locality: not stated, probably around Nice, France; syntypes: apparently lost)

Mugil capito Cuvier, 1829: 232 (type locality: La Rochelle, France; lectotype: MNHN A.3587, designated by Blanc & Hureau, 1971: 682)

? *Mugil britannicus* Hancock, **1830: 137** (type locality: London market, U.K.; type material: NT) from Trewavas, in Hureau & Monod, 1973: 570

Mugil Dubahra Valenciennes, in Cuvier & Valenciennes, 1836: 60 (type locality: river Nile [Egypt]; syntypes: MNHN A. 3730–3732 [5], Thomson, in Daget et al., 1986: 346)

Mugil Caustelus Nardo, 1847: 127 (cited in synonymy, name not available)

Mugil petherici Günther, 1861a: 441 (type locality: river Nile at Cairo, Egypt; holotype: BMNH 1861.9.9:5, Trewavas, in Hureau & Monod, 1973: 570)

Myxus maroccensis Mohr, 1927: 191, fig. 13 (type locality: Morocco; holotype: ZMH 75, Ladiges et al., 1958: 162)

16.2.3 *Liza saliens* (Risso, 1810)

Mugil Saliens Risso, 1810: 345 (type locality: Nice, France; syntypes: apparently lost)

Mugil Verselata Nardo, 1847: 127 (cited in synonymy, name not available)

Liza saliens furcata Popov, **1930: 72, 122** (Black Sea) from Trewavas, in Hureau & Monod, 1973: 573

16.3.1 *Mugil cephalus* Linnaeus, 1758

Mugil Cephalus Linnaeus, 1758: 316 (based on Artedi [1738: gen. 32 [71], syn. 52, spec. 71 [32], Mugil] and Hasselqvist [**1757**: 385, Mugil cephalus]; type locality: "in Oceano Europaeo, fluvios subiens"; potential syntypes: NRM LP 43 [1], 44 [1], 143 [2], Fernholm & Wheeler, 1983: 257)

Mugil Öur Forsskål, 1775: 74 (type locality: Red Sea; holotype: ZMUC 67, Klausewitz & Nielsen, 1965: 26, pl. 36 fig. 67)

? *Mugil Tang* Bloch, 1794: 171, pl. 395 (type locality: Acara [Accra], Ghana; syntypes: ZMB 1785 [1])

Mugil Provensalis Risso, 1810: 346 (type locality: river Var, near Nice, France; syntypes: apparently lost)

Mugil cephalotus Valenciennes, in Cuvier & Valenciennes, 1836: 110 (type locality: Pondichery, India; syntypes: MNHN 8102 [1], A.4645 [1], A.4698 [1], Thomson, in Daget et al., 1986: 348)

Mugil Vulpinus Nardo, 1847: 127 (cited in synonymy, name not available)

Mugil ashanteënsis Bleeker, 1863a: 91, pl. 19 fig. 2 (type locality: Ashanti, Guinea [now Ghana]; holotype: RMNH 1631)

Myxus caecutiens Günther, 1876: 397 (type locality: Rodriguez Island, Indian Ocean; syntypes: BMNH 1877.12.10:37–38 [2], Thomson, in Daget et al., 1986: 348)

Nomenclatural notes. Fernholm & Wheeler (1983: 257) comment that the potential type material of *Mugil cephalus* includes at least three species and that a lectotype designation is needed.

Atherinidae

17.1.1 *Atherina boyeri* Risso, 1810

Atherina Boyeri Risso, 1810: 338 (type locality: sea shore and lower course of rivers in Département du Var, France; syntypes: MNHN A.4342 [2], B.860 [1], Maugé, in Daget et al., 1986: 277)

Atherina presbyter var. *pontica* Eichwald, 1831: 72 (type locality: Odessa, Ukraine; syntypes: LU)

Atherina presbyter var. *caspia* Eichwald, 1831: 72 (type locality: "sinu Balchanensis" [Balkhan Bay, Caspian Sea; Berg, 1949: 1003]; syntypes: LU)

Atherina Risso Valenciennes, in Cuvier & Valenciennes, 1835: 435 (type locality: Nice, France; syntype: MNHN A.4350 [listed as holotype by Kiener & Spillmann, in Hureau & Monod, 1973: 576, but Valenciennes had at least one specimen and a skeleton])

Atherina sarda Valenciennes, in Cuvier & Valenciennes, 1835: 435 (type locality: salt marshes of Sardegna, Italy; holotype: MNHN A.4354, Kiener & Spillmann, in Hureau & Monod, 1973: 576)

Atherina Lacustris Bonaparte, 1836: [fasc. 17–18, p. 279], pl. 118 fig. 3 (type locality: lakes Albano, Castel Gandolfo and Nemi, Italy; syntypes: ANSP 9953–9974 [22], Böhlke, 1984: 23)

Atherina anterina Nardo, 1847: 127 (listed in synonymy, name not available)

? *Atherina hyalosoma* Cocco, 1885: 239 (type locality: Sea of Messina, Sicilia; syntypes: LU)

Atherina Riqueti Roule, 1902: 263, fig. 1 (type locality: Canal du Midi, France; syntypes: MNHN 1908.88–89, Kiener & Spillmann, in Hureau & Monod, 1973: 577)

Atherina mochon var. *aegyptia* Boulenger, 1907: 424, fig. 31 (type locality: Mediterranean coast of Egypt / lakes Temsah and Menzaleh, Egypt; syntypes: BMNH, MNHN 1907-238, Maugé, in Daget et al., 1986: 277)

? *Atherina Bonapartii* Boulenger, 1907: 426 (type locality: Gulf of Cagliari, Italy; syntypes: BMNH)

Systematic notes. The existence of different 'populations' of *A. boyeri* inhabiting different habitats is quite well documented (see, e.g., Kiener & Spillmann, 1969: 53) and various authors have studied this variability around the Mediterranean.

Kartas & Trabelsi (1990) analysed the variability of *A. boyeri* in Tunisia. They recognise marine, lacustrine and insular 'populations'. From their data (pp. 301–304), while the insular stock can be distinguished from the marine one, there do not seem to be striking differences between the insular and the mainland, lacustrine ones. The morphological distinctness (diagnosability) is complete between the marine and the lacustrine-insular populations and, unless it is demonstrated that there is complete intergradation between the stocks, it is more parsimonious to consider that we have to deal with two species with different habitat requirements than with a single polymorphic species developing different adaptations in different habitats under the supposed pressure of some hypothetical external factors. One is surprised to see that the difference in gill-raker counts (23–31, vs. 33–41) between the two stocks of *A. boyeri* coincides with the histograms of Kiener & Spillmann (1969: 46) for *A. boyeri* and *A. hepsetus*, but as the range of values for vertebrae and lateral line scales (among the most useful characters to distinguish the two species) for the two stocks agree with those of *A. boyeri* of Kiener & Spillmann, there is apparently no doubt about the identification as '*A. boyeri*'.

Marfin (1982) also confirmed the existence of two 'morphological types' in southern France: a marine and a lagoon stocks. Marfin reports the same type of differences, plus differences in teeth position, premaxillary shape and scale shape. The two stocks occur in different but overlapping habitats. Marfin considers that the two stocks have distinct spawning areas, do not form mixed schools while spawning (but no details are provided) and maintain their morphological characteristics. Thus, under the PSC, they are different species. Marfin (1982: 25) considered the fact that they co-occur in part of their range as indicative of the possibility of gene flow, but the stability of the diagnostic characters over 200 years (the age of the oldest museum samples) and the lack of intergrades seem to be evidence that there is no gene flow. I do not think that the size of the mouth and the number of gill-rakers are individual adaptations to different food types (a Lamarkian interpretation ?) but species characteristics. Marfin stated that when the whole range of variability within '*A. boyeri*' is considered it is not possible to distinguish several species (referring to Kiener & Spillmann, 1969). This makes little biological sense and it is obvious that in order to reach a conclusion on how many species are involved in, let us say, southern France, one should consider the local stocks only. The variability observed in, let us say, the eastern Mediterranean is uninformative and possibly irrelevant (but it might provide information on parallelism).

With the available data, it seems well documented that at least in some parts of the Mediterranean, there are two diagnosable lineages of '*A. boyeri*' which satisfy the definition of two species under the PSC, a marine (here *A. mochon*) and a lacustrine one (here *A. boyeri*, see Nomenclatural notes, below). Results of electrophoretic study by Focant et al. (1992) also show this dichotomy.

Trabelsi et al. (1994) report that within the marine '*A. boyeri*' from Tunisia and Corsica (here *A. mochon*) they also distinguish two groups differing, among other characters, in coloration, premaxillary shape and gill-raker counts. Although they claim that all belong to the marine 'population' (here *A. mochon*) (referring among others to Kartas & Trabelsi, 1990), their Y1 population seems to fall within the lacustrine 'populations' of these authors (here *A. boyeri*): they give mean values for total gill-raker counts of 29.55 and 28.57 for the Corsican, respectively Tunisian Y1 specimens (they do not indicate range, which would be a more interesting and biologically meaningful information), while Kartas & Trabelsi reported a range of 33–41 in the marine species (but 23–31 in the lacustrine species). The same remark applies for the counts of lower and upper gill-rakers, lateral row scales and vertebrae. Other characters were not examined by Kartas & Trabelsi (1990). Trabelsi et al. (1994) do not state how their Y1 stock differs from the lacustrine species (*A. boyeri*) and unless clarification about the noted apparent contradiction is provided, it does not seem necessary to comment further on marine populations.

Svetovidov (1964: 226–229) considers that the Black Sea stock (called *A. mochon pontica*) differs from a Mediterranean one (called *A. m. mochon*) in number of gill-rakers (26–31, vs. 22–26) and scale rows (44–51, vs. 45–46). It seems possible that his concept of *A. m. pontica* may have included both *A. boyeri* and *A. mochon* as recognised here, but this should be confirmed by direct examination of specimens. His concept of *A. m. mochon* includes most of the species listed above in the synonymy of *A. boyeri* and it is not clear to me whether he examined material from the Mediterranean. A comparison of the values he reports for the Black Sea stock with those reported by the above mentioned authors for the Mediterranean stock does not allow to distinguish the Black Sea stock from *A. boyeri*. Svetovidov (1964: 229) also recognises *A. bonapartei* as valid species, but I cannot discuss its status; it might be *A. mochon* as understood here.

Bamber & Henderson (1985) considered that *A. boyeri* and *A. presbyter* represent a single species, on the basis of material from the British Isles. They considered that the morphological differences reported by earlier authors was due to environmental factors (but it is not clear whether their material actually included both species). An electrophoretic study showed that they are distinct species (Creech, 1991). There is no data in Creech to determine whether his *A. boyeri* is the real *A. boyeri* or *A. mochon*.

Nomenclatural notes. I have examined the syntypes of *A. boyeri*. MNHN B.860 is a dry, mounted specimen ca. 74.0 mm SL, with 42 rows of scales; gill-rakers cannot be counted; MNHN 4342 includes 2 alcohol preserved specimens in poor state, one 70.6 mm SL with about 46 rows of scales and 24 distinct gill-rakers (some may be missing) and one 67.0 mm SL with 30 gill-rakers. They seem to agree with the lacustrine stock of Kartas & Trabelsi and I restrict the use of the name *A. boyeri* to this species. The holotype of *A. risso* (MNHN A.4350, 75.5 mm SL; 25 gill-rakers), the holotype of *A. sarda* (MNHN A.4354, 47.9 mm SL, ca. 25 gill-rakers) and one syntype of *A. riqueti* (MNHN 1908-88, 41.0 mm SL, 23 gill-rakers) also clearly belong to this species. The lectotype of *A. mochon* (MNHN A.4355, 57.9 mm SL, 32 gill-rakers) apparently represent the marine species and this is the earliest available name for it. As most of these specimens are in quite poor state and many had been damaged by earlier researchers, it might be desirable that these identifications be confirmed by a researcher more familiar with this family and in the context of a critical, taxonomic revision. As the marine species only sporadically and marginally occurs in freshwaters, I did not investigate further its identity and use here for this species the name *A. mochon* Cuvier, 1829 (p. 235; type locality: Iviça, Balearic islands; lectotype: MNHN A.4355, designated by Blanc & Hureau, 1971: 707). Some of the names listed in the above synonymy might actually apply to this species.

17.1.2 *Atherina hepsetus* Linnaeus, 1758

Atherina Hepsetus Linnaeus, 1758: 315 (based on Artedi [1738: syn. 117, Atherina], Gronovius [1754: 23, n. 66, Atherina] and Hasselqvist [**1757**: 382, Atherina Hepsetus]; type locality: "in Mari Mediterraneo"; syntypes: BMNH 1853.11.12:79 [1], NRM LP 65 [5], ? UUMZ 209 [1], Wheeler, 1958: 236, 1991: 168, Fernholm & Wheeler, 1983: 229)

Athaerina athaerina Nardo, 1827b: 33, 39 (available by indication to Rondelet [1554: 216, Athaerina] and "Ann. du Mus. V. 13 p. 288 var. 1 ?" [Delaroche, 1809: 357]; type locality: Marseilles, France [Rondelet] and Iviza, Balearic Island [Delaroche]; syntypes: ? MNHN)

Nomenclatural notes. Wheeler (1958: 236) and Fernholm & Wheeler (1983: 229) indicate that the type series of *Atherina hepsetus* includes two species and that a lectotype should be designated. Inclusion of this species as occurring in freshwaters follows Blanc et al. (1971), Maitland (1977: 204) and others.

17.1.3 *Atherina presbyter* Cuvier, 1829

Atherina presbyter Cuvier, 1829: 235 (type locality: La Rochelle, France; lectotype: MNHN 4377, designated by Blanc & Hureau, 1971: 710)

Systematic notes. See *A. boyeri*.

Odonthestes bonariensis (Valenciennes, 1835) introduced

Fundulidae

18.1.1 *Fundulus heteroclitus* (Linné, 1766) introduced

Valencia lozanoi Gomez, Peiro & Sanchez, 1984: 67, fig. 3 (type locality: Trebujena, Cádiz, Spain; holotype: Estación Ornitológica y Piscicola Experimental "Mata del Fang", Albufera de Valencia 840106)

Systematic notes. Synonymy follows Fernández-Delgado et al. (1986) and Bianco & Miller (1989).

While the identity of the introduced Spanish population seems beyond doubts, Delgado et al. (1991) noted differences between the karyotype of '*V. lozanoi*' and the one reported by Chen & Ruddle (**1970**) for *F. heteroclitus*. They concluded that either 1) *V. lozanoi* is a European *Fundulus* which had been misplaced in the genus *Valencia*, or 2) *V. lozanoi* is an introduced *Fundulus*, distinct from *F. heteroclitus*. The hypothesis of a European, native *Fundulus* seems unlikely, especially with the absence of supporting evidences. There are additional alternative hypotheses to explain the differences between the karyotypes described by Delgado et al. and Chen & Ruddle: 3) Chen & Ruddle's material might have been misidentified; 4) *F. heteroclitus* having an extensive distribution, geographical chromosome polymorphism may occur (or many species may presently be lumped under that name); 5) *V. lozanoi* is a native species belonging to a still unrecognised genus superficially similar to *Fundulus*; 6) differences in methodology and/or terminology. Hypothesis 5 seems unlikely. Hypothesis 4 seems the most likely and is actually confirmed by data in Bernardi et al. (1995) and Fernández-Pedrosa et al. (1996). The karyotype of *F. heteroclitus* illustrated by Fisher & Rachlin (1972) does not seem to differ from the one by Delgado et al. *Fundulus heteroclitus* has been revised by Relyea (1983).

One may only regret that so much attention is given to an introduced fish, and not to the native European species deserving urgent work.

Valenciidae

19.1.1 *Valencia hispanica* (Valenciennes, 1846)

Hydrargyra Hispanica Valenciennes, in Cuvier & Valenciennes, 1846: 214, pl. 531 fig. 1 (type locality: freshwaters of Catalogna, Spain; syntypes: MNHN)

19.1.2 *Valencia letourneuxi* (Sauvage, 1880)

Fundulus Letourneuxi Sauvage, 1880: 214 (type locality: sources near Cressida, Corfou [Kerkira island], Greece; syntypes: MNHN)

Systematic notes. See Villwock et al. (1982) and Bianco & Miller (1989) for discussion.

Poeciliidae

***Gambusia affinis* (Baird & Girard, 1853) introduced**
***Gambusia holbrooki* Girard, 1859 introduced**
***Poecilia reticulata* Peters, 1859 introduced**

Cyprinodontidae

20.1.1 *Aphanius fasciatus* (Valenciennes, 1821)

Lebias fasciata Valenciennes, in Humboldt & Valenciennes, 1821: 160, pl. 51 fig. 4 (type locality: not stated [Cagliari, Sardegna according to Valenciennes, in Cuvier & Valenciennes, 1846: 156]; syntypes: MNHN)

? *Ciprinoides* [sic] *Nanus* Nardo, 1824: 259 [23 of reprint] (nomen nudum; locality not stated [streams of Adriatic Sea basin, Italy])

? *Cyprinoides Nanofasciatus* Nardo, 1824: 259 [23 of reprint] (nomen nudum; locality not stated [streams of Adriatic Sea basin, Italy])

Aphanius Nanus Nardo, 1827a: 488 (type locality: Adriatic Sea; syntypes: then in Nardo's collection in Chioggia) or 1827b: 34, 40 (same data)

Lebias lineato-punctata Wagner, 1828: 1055, pl. 12 figs. 1–6 (type locality: fresh and marine waters around Cagliari, Sardegna; syntypes: probably ZSM, now lost)

Lebias Sarda Wagner, 1828: 1055, pl. 12 fig. 7 (type locality: marine waters around Cagliari, Sardegna; syntypes: probably ZSM, now lost)

Poecilia calaritana Cuvier, 1829: 280 (type locality: Sardegna; syntypes: MNHN 187 [3], Wildekamp et al., in Daget et al., 1986: 168)

Lebias flava Costa, 1838: fasc. 19: 35, pl. 17 fig. 1 (type locality: lake Varano, Italy; syntypes: LU)

Cyprinodon Hammonis Valenciennes, in Cuvier & Valenciennes, 1846: 169 (type locality: Oasis Jupiter Ammon and other parts of Egypt and Syria; syntypes: MNHN 23346 [8], A-3822 and A-3979 [4], A-3961 and A-3980 [9], A-3981 and A-3982 [14], Wildekamp et al., in Daget et al., 1986: 168, ZMB 3479 [3], Paepke & Seegers, 1986: 147)

Lebias nigropunctata Schinz, 1840: 334 (type locality: salty ponds of Sardegna; type material: NT ?)

Cyprinodon Cyanogaster Guichenot, 1859: 378 (type locality: Biskara, north-eastern Algeria; syntypes: MNHN 3218 [5], Wildekamp et al., in Daget et al., 1986: 168)

Cyprinodon doliatus Guichenot, 1859: 379 (type locality: Biskara, north-eastern Algeria; syntypes: MNHN 4392 [8], Wildekamp et al., in Daget et al., 1986: 168)

Micromugil timidus Gulia, 1861: 11 (type locality: Malta Island; type material: NT ?)

Micromugil macrogaster Gulia, 1861: 11 (type locality: Malta Island; type material: NT ?)

Cyprinodon Desioi Gianferrari, 1932: 214, fig. 1 (type locality: sulphurous sources in Ain el-Braghi near Agheila, northern Libya; syntypes: MSNM 4546)

Nomenclatural notes. The type species of the genus *Lebias* Goldfuss, 1820 (p.16) is *L. fasciata* Valenciennes, 1821 as designated by Lazara (1995: 502). Thus *Lebias* is a subjective senior synonym of *Aphanius* Nardo, 1827, has priority and is the valid name. *Lebias* has been sometime used for this genus between 1820 and 1907 and it is only since 1948 that *Aphanius* has been used (Lazara, 1995: 502). Lazara's type-species designation is irrevocable (except by petitioning the International Commission on Zoological Nomenclature), but it is arguable since he could as well have designated *L. rhomboidalis* Valenciennes, in Humboldt & Valenciennes, 1821 [p. 160, pl. 51 fig. 3; type locality not stated] as type species, making *Lebias* a junior synonym of *Cyprinodon* La Cepède, 1803: 486 and thus avoiding nomenclatural changes. Some name changes are unavoidable, but this one not only could easily have been avoided but should have been avoided as it concerns a large number of species, most of which are endangered or threatened and listed on a variety of national and international legislations. An application has been submitted to the International Commission on Zoological Nomenclature to rule out Lazara's type species designation for *Lebias* (Kottelat & Wheeler, in press a). The existing usage (*Aphanius*) is to be maintained until the Commission publishes its ruling (ICZN art. 80(a)).

The publication date of *Lebias fasciata* is somewhat confused. Valenciennes (in Cuvier & Valenciennes, 1846: 156) wrote about Humboldt & Valenciennes's paper as "our work of 1817". Valenciennes (in Humboldt & Valenciennes, 1821: 193) stated that his work on poeciliids (p. 159; *L. fasciata* is on p. 160) was already printed when he received Lesueur (1821). It seems that the work was printed in 1817 but not distributed before 1821. Fascicle 10 appeared in 1817, fascicle 12 in 1821 (Kottelat, 1988: 88) and fascicle 11 in 1821 (Lazara, 1993). Humboldt & Valenciennes appeared in part in fascicles 11 (pp. 145–176) and 12 (177–216). For nomenclatural purposes, the year of publication is the year the name is made available (that is the date on which the work has been distributed, and not the year in which it has been printed).

Aphanius nanus Nardo (1827b) has been declared a nomen oblitum by Tortonese (1970b); note that this explicitly applies to Nardo's 1827b paper, but not to the 1827a one.

Paepke & Seegers (1986: 147) list three ZMB specimens (ZMB 3479) as syntypes of *Cyprinodon hammonis* because they have the same collecting data as the material mentioned by Valenciennes and on the assumption that this material is a part of the type series which had been returned to Berlin. Although loans were not a common curatorial practice of the time, there is evidence that some happened between Berlin and Paris (H.-J. Paepke, in litt., 1995). Valenciennes visited Berlin at least twice before 1846 (1826 and 1829, H.-J. Paepke, in litt., 1995) and he might have based his account on both the specimens with him and those left in Berlin.

20.1.2 *Aphanius iberus* Valenciennes, 1846

Cyprinodon Iberus Valenciennes, in Cuvier & Valenciennes, 1846: 160, pl. 528 fig. 1 (type locality: Spain; syntypes: MNHN 185 [8], Tortonese, in Hureau & Monod, 1973: 271)

Gasterosteidae

21.1 *Gasterosteus*

Data on the distribution of the different forms of European three-spined sticklebacks are summarised by Münzing (1963) and Paepke (1982: 273–275, 317–320, 1983: 115–119). Briefly, pure low-plated ("gymnura") populations inhabit streams of the Mediterranean drainage, streams draining to the Atlantic coast south of the Channel and along the western slope of British Isles, and the Rhine basin, while pure completely plated ("trachura") populations inhabit the Atlantic coast of Scotland and Scandinavia, the south-eastern shore of the Baltic Sea and tributary streams, the shores of the Black Sea and tributary streams. In the intermediate area (Baltic Sea, drainage of the North Sea, basins of rivers Elbe and Oder), populations include a mixture of these two types plus an intermediate type ("semiarmata"). See Paepke (1982: 292) for a detailed study of the sticklebacks of the Elbe and Oder basins.

Münzing proposed a complicated hypothesis for the evolution of the various populations. It would probably be difficult to have most of the details of Münzing's hypothesis fitting to present zoogeographical philosophy and procedures, but the main lines are that at some time (during glaciations), two distinct stocks had a widely disjunct distribution: the low-plated ("gymnura") form in the Mediterranean and western Europe and the fully-plated ("trachura") form in northern and eastern Europe and the Black Sea. They came into contact (supposedly in interglacial but definitively in postglacial times) in the area of the North Sea and the Baltic Sea where they hybridised ("semiarmata"). The existence of landlocked populations in northern Scandinavia and Iceland was considered to result from dispersal (p. 331).

In other words, we have two independent and diagnosable lineages with a contact zone, and these two lineages are species under the PSC.

I found that many of the discussions on the systematics of *Gasterosteus* are strongly biased because most authors focused on a single character (plate development) and omit discussing any other. Data on some European populations as summarised by Miller & Hubbs (1969: 65) seem to indicate that several geographically isolated populations are morphologically distinct, without known intergrades, and would be recognisable as species under the PSC (Miller & Hubbs recognised them as subspecies under the BSC). The long-range northward dispersal of southern European low-plated individuals/stocks to colonise isolated water bodies in northern Europe (Iceland, northern Scandinavia) seems very unlikely, and these isolated northern stocks are hypothesised to result of onsite differentiation from the local fully plated stocks.

Accordingly, I recognise here two species in mainland Europe, the fully plated, eastern *G. aculeatus* and the low-plated, western *G. gymnurus* with a contact zone in the North Sea and Baltic Sea area (in the following synonymies, nominal species based on intermediate specimens are arbitrarily referred to *G. aculeatus* in the North Sea and Baltic Sea and to *G. gymnurus* in the Channel). Isolated populations with independent histories and morphologically diagnosable are treated as species. These include two partially plated species, in Iceland and Romania. The naked population from Roma, Italy, named *G. hologymnus* by Regan (1909b) is included in *G. gymnurus* because there is apparently a north-south clinal variation of the plate number in Italy (P. G. Bianco, pers. comm., 1995). The status of the low-plated populations from northern Scandinavia has not been investigated.

Outside Europe, noteworthy are *G. algeriensis* Sauvage (1874a: 17; type locality: Algeria;

holotype: MNHN 5123 [Monod, in Hureau & Monod, 1973: 281 list 4 syntypes, while Sauvage explicitly designated a holotype]), if not introduced (Bertin, 1925), the only African stickleback (possibly extinct; Münzing, 1963: 326), and stocks from Iznik Gölü, Turkey (Münzing, 1962) whose taxonomic status should be evaluated.

This discussion is only based on published data based on European stocks. Results of the numerous studies on genetics, ecology, etc. of North American and East Asian stocks are a priori not relevant for discussion on systematics of European ones, unless it is demonstrated that they are conspecific.

Haglund et al. (1992a) examined allozyme variation among 16 stocks of European, North American and Japanese sticklebacks referred to *G. aculeatus*. They included one stock from Italy, two from U.K. and one from Sweden. Their data show the Italian stock more closely related with one of the U.K. stocks and the Swedish stock more closely related with the other U.K. stock. The Italy-U.K. clade was more closely related to a New York stock than to the other European clade. A similar study involving more European stocks could be used as a test for the hypothesis that *G. aculeatus* and *G. gymnurus* are distinct species. The mitochondrial DNA study by Ortí et al. (1994) is inconclusive in the present context; it shows (p. 619) that sympatric and reproductively isolated stocks (= species) of *Gasterosteus* display "small or no genetic divergence" (thus that speciation [especially recent] is not necessarily linked with genetic divergence, see p. 19).

If one does not want to consider *G. aculeatus* and *G. gymnurus* as different species, one should at least refrain from using a terminology similar to formal nomenclature (leiurus, trachurus, etc.) for different forms or morphs; readers (and authors) without clear understanding of these concepts often confuse them with species and subspecies. Bakker & Sevenster (1988) reviewed the confusing history of the uses and misuses of names like trachurus, leiurus and semiarmatus for plate morphs, ecological forms, etc. and I agree with their conclusions, except that if latinised names are used for morphs (leiura, semiarmata, trachura), they should in no case be italicised in order to avoid confusion with species names. Actually, I find that the use of vernacular descriptors (e.g., armored, semi-armored, etc.) has the advantage of explicitly describing what the author means.

The following synonymies include only taxa based on European specimens.

21.1.1 *Gasterosteus aculeatus* Linnaeus, 1758

Gasterosteus aculeatus Linnaeus, 1758: 295 (based on Artedi [1738: gen. 52 [96], syn. 80, spec. 26 [52], Gasterosteus aculeis in dorso tribus] and Linnaeus [1746: 103, n. 276, idem]; type locality: "in Europa"; syntypes: LSL 29–31 [3], Wheeler, 1985: 43)

Gasterosteus teraculeatus La Cepède, 1801: 295 (unnecessary replacement name for *Gasterosteus aculeatus* Linnaeus, 1758)

Gasterosteus trachurus Cuvier, 1829 [March]:170 (type locality: France; also available by indication to Bloch [1783: pl. 53 fig 3; *Gasterosteus aculeatus*; locality not stated but likely to be around Berlin, Germany]; syntypes: MNHN, ZMB, ? NMW 6918 [4])

? *Gasterosteus spinulosus* Jenyns, 1835a (nomen nudum); Yarrell, 1835: 83, fig. (type locality: near Edinburgh, Scotland; syntypes: LU ?; authors stated to be Jenyns & Yarrell, but Yarrell is alone responsible for conditions making the name available, see below); Jenyns, 1835b: 350 (locality: Edinburgh, Scotland).

Gasterosteus ponticus Nordmann, 1840: 380 (type locality: Black Sea; syntypes [total 6]: MNHN 7098 [1], Monod, in Hureau & Monod, 1973: 281, ? NMW 77244 [4])

Gasterosteus biarmatus Nordmann, 1840: 381 (type locality: lagoons near Tarkanckut, Crimea; type material: NT ?)

Systematic notes. It remains to be demonstrated that the Black Sea stocks are conspecific with the northern European ones.

Nomenclatural notes. The restriction of the name *G. aculeatus* to the armored species is discussed by Miller & Hubbs (1969: 66). They pointed out correctly the composite nature of Linnaeus's *G. aculeatus* which apparently included material of three species (*G. aculeatus*, *G. gymnurus* and *G. hologymnus* [included in *G. gymnurus* here]) and that a definitive restriction of the name is only possible by the designation of a lectotype or a neotype. Linnaeus syntypes are still extant (Wheeler, 1985: 43).

Yarrell (1835–36) and Jenyns (1835a–b) indicate the authorship of *G. spinulosus* as Yarrell & Jenyns, but there is no joint paper by these authors. They published separately on this fish, but obviously shared information as they refer to each other, often with exact page numbers. Jenyns (1835a: 22) is the earliest use of the name (April

1835 according to Sherborn, 1922: lxxi) but it is a nomen nudum. The first use making the name available is apparently by Yarrell (1835–36: 83); this work has been issued in 19 parts between April 1835 and September 1836, and I assume that p. 83 appeared before the next use by Jenyns (1835b) in November 1835 (Sherborn, 1922: lxxi, cxxx). Jenyns (1835b: 350) refer to Yarrell & Jenyns, Edinburgh New Phil. J., April 1831, p. 386. This page refers to a paper by Stark (1831) which actually describe the same fish under the name *G. aculeatus*, but the paper has nothing to do with Jenyns or Yarrell.

The author of *Gasterosteus biarmatus* is often given as Krynicki or Krynicki in Nordmann (1840). Nordmann is actually responsible for the conditions which make the name available and is thus author of the name.

21.1.2 *Gasterosteus crenobiontus* Bacescu & Mayer, 1956

Gasterosteus aculeatus forma *crenobionta* Bacescu & Mayer, 1956: 24 (type locality: sources of Techirghiol, Romania; syntypes: MGAB 49912, Mihai-Bardan, 1984: 460)

Systematic notes. This species is extinct (Bănărescu, 1994: 8).

Nomenclatural notes. Mihai-Bardan (1984: 460) lists specimen MGAB 49912 as holotype of *Gasterosteus crenobiontus*. As Bacescu & Mayer (1956) did not designate a holotype, all their specimens are syntypes.

21.1.3 *Gasterosteus gymnurus* Cuvier, 1829

Gasterosteus gymnurus Cuvier, 1829 [March]: 170 (type locality: France; also available by indication to Willughby, 1686: 341; syntypes: MNHN ?)

Gasterosteus leiurus Cuvier, in Cuvier & Valenciennes, 1829b [November]: 481, 487, pl. 98 fig. 4 (type locality not clearly stated; on pp. 494-495, Cuvier lists a number of localities in Europe: coasts of Normandie, Caen, and Hable d'Ault near Le Tréport, France; Berlin, Germany; syntypes: MNHN 7088 [3], 7151 [7], Monod, in Hureau & Monod, 1973: 281)

Gasterosteus semiarmatus Cuvier, in Cuvier & Valenciennes, 1829b [November]: 493 (type locality: Le Havre and creek of Braie near Abbeville, France; syntypes: MNHN 2348 [1], 7078 [3], 2347 [1], Monod, in Hureau & Monod, 1973: 281)

Gasterosteus semiloricatus Cuvier, in Cuvier & Valenciennes, 1829b [November]: 494 (type locality: river Somme, France; syntypes: MNHN)

Gasterosteus argyropomus Cuvier, in Cuvier & Valenciennes, 1829b [November]: 498 (type locality: Toscana [Firenze, Monod, in Hureau & Monod, 1973: 281], Italy; syntypes: MNHN 677 [3], Monod, in Hureau & Monod, 1973: 281)

Gasterosteus brachycentrus Cuvier, in Cuvier & Valenciennes, 1829b [November]: 499, pl. 98 fig. 2 (type locality: Toscana [Firenze, Monod, in Hureau & Monod, 1973: 281], Italy; syntypes: MNHN 694 [3], 7097 [2], Monod, in Hureau & Monod, 1973: 281)

Gasterosteus tetracanthus Cuvier, in Cuvier & Valenciennes, 1829b [November]: 499 (type locality: Toscana [Firenze, Monod, in Hureau & Monod, 1973: 281], Italy; holotype: MNHN 1821, Monod, in Hureau & Monod, 1973: 281)

Gasterosteus quadrispinosa Crespon, 1844: 283 (type locality: stream Vistre and ditches around Nîmes, France; syntypes: LU)

Gasterosteus nemausensis Crespon, 1844: 283 (type locality: standing waters of plain around Nîmes, France; syntypes: LU)

Gasterosteus neustrianus Blanchard, 1866: 220, fig. 28 (type locality: brooks in Harfleur and Gournay, Seine-Inférieure, France; syntypes: MNHN 7114 [1, listed as holotype by Monod, in Hureau & Monod, 1973: 281])

Gasterosteus Bailloni Blanchard, 1866: 231, fig. 34 (type locality: Abbeville, France; syntypes: MNHN 7153 [12], Monod, in Hureau & Monod, 1973: 281)

Gasterosteus argentatissimus Blanchard, 1866: 232, fig. 35 (type locality: brooks near Avignon, France; syntypes: MNHN 6675 [6], 6678 [18], Monod, in Hureau & Monod, 1973: 281)

Gasterosteus elegans Blanchard, 1866: 234, fig. 37 (type locality: between Cadillac and Langon, Gironde, France; syntypes: MNHN 6673 [2], 7100 [1], Monod, in Hureau & Monod, 1973: 281)

Gastrosteus [sic] *hologymnus* Regan, 1909b: 436 (type locality: Roma, Italy; syntypes: BMNH [5])

Gasterosteus aculeatus var. *messinicus* Stephanidis, 1971a: 202, fig. 10 (infrasubspecific, name not available; locality river Pamissos near Messini, Greece)

Nomenclatural notes. The description of *G. gymnurus* has priority over *G. leiurus* because it was published in March (Boeseman, 1962: 79), vs. November (Eschmeyer, 1990).

21.1.4 *Gasterosteus islandicus* Sauvage, 1874

Gasterosteus islandicus Sauvage, 1874a: 20, pl. 1

fig. 8 (type locality: Iceland; holotype: MNHN 5594 [Monod, in Hureau & Monod, 1973: 281 list 3 syntypes, while Sauvage explicitly mentioned a holotype])

Systematic notes. See Penczak (1964).

21.2.1 *Pungitius hellenicus* Stephanidis, 1971

Pungitius hellenicus Stephanidis, 1971b: 228, figs. 7-8 (type locality: Spercheios valley, Greece; syntypes: lost ? [40])

21.2.2 *Pungitius laevis* (Cuvier, 1829)

Gasterosteus laevis Cuvier, 1829: 170 (type locality: France; syntypes: MNHN 7102 [5, Somme], 7103 [3, Bobigny, near Paris], Monod, in Hureau & Monod, 1973: 284)

Gasterosteus vulgaris Mauduyt, 1848: 19 (type locality: la Vergne near Poitiers, la Bergue near Gençay, les Aiffes near St-Maurice, la Séguinière near St-Julien-Lars, Vienne, France; syntypes: Musée de Poitiers ?)

Gasterosteus burgundianus Blanchard, 1866: 240 (type locality: Dijon, Côte d'Or, France; syntypes: MNHN 7103 [5], Monod, in Hureau & Monod, 1973: 284)

Gasterosteus lotharingus Blanchard, 1866: 244, fig. 42 (type locality: river Meuse and adjacent brooks near Saint Mihiel, France; syntypes: MNHN 7090 [2], Monod, in Hureau & Monod, 1973: 285)

Gasterosteus breviceps Blanchard, 1866: 245, fig. 43 (type locality: Caen, France; syntypes: MNHN 7110 [1, listed as holotype by Monod, in Hureau & Monod, 1973: 285])

? *Gasterosteus globiceps* Sauvage, 1874a: 35, pl. 1 fig. 17 (type locality: North America [erroneous according to Berg, 1932a: 169, Münzing, 1969: 217]; syntypes: MNHN 4081 [2], Monod, in Hureau & Monod, 1973: 284)

Pygosteus pungitius forma *hologymna* Bertin, 1925: 122 (infrasubspecific, name not available)

Systematic notes. Münzing (1969: 210) recognises two subspecies of *P. pungitius* in Europe. *Pungitius p. laevis* is distinguished from *P. p. pungitius* by the complete absence of lateral scutes (vs. presence of 3–18 scutes, generally 4–11). Although Münzing considers them as a cline, his data do not show a clear clinal variation (or if there is one, it is obscured by the way the data are presented), but a narrow fringe in northern France and Netherlands (and England according to his figure, but not his table 1) where some naked individual occur among populations usually with 3–8 plates. His figure 1 shows many more localities than cited in the text; these are probably from the literature. If a clear clinal variation were observable, I would conclude that a single species exists. But the published data seem to indicate more the existence of two species with a contact zone (see Warren 1992: 25–26 for brief discussion of contact or hybrid zones and further references) and so I recognise both *P. pungitius* and *P. laevis* as valid species. Münzing (1969: 226) considered that during the Pleistocene glaciations, *Pungitius* stocks survived in a western European, a Ponto-Caspian and an East Asian refugia. After the glaciations, *P. pungitius* would have recolonised eastern and northern Europe and *P. laevis* south-western Europe. This pattern is similar to the case discussed under *Gasterosteus aculeatus*. If this hypothesis is accepted, here too we have two independent and diagnosable lineages, which are species under the PSC.

It might be worth investigating if the *P. laevis*-like stocks from England and Ireland are conspecific with those from France. In this context, it should be pointed out that these stocks are united by a shared reductive character (the loss of scutes) which can hardly be used as a synapomorphy if not corroborated by additional characters. It does not seem that many other characters have been looked at.

'Clinal' variation of meristic characters are often interpreted as resulting from different temperatures. This hasty generalisation to all fishes of the results of some experiments with a few populations of a few species is not acceptable; see Gross (1979: 410) or Spillmann (1962: 450) for examples where this theory does not apply.

21.2.3 *Pungitius platygaster* (Kessler, 1859)

Gasterosteus platygaster Kessler, 1859b: 202 (type locality: harbour of Odessa and side arm of the Dnieper in Aleschki, Ukraine; syntypes: [21] lost, H.-J. Paepke, in litt., 1995)

Gasterosteus platygaster var. *Kessleri* Yakovlev, **1870: 110** (Astrakhan, Russia) from Berg, 1949: 969

Gasterosteus platygaster var. *niger* Yakovlev, **1870: 110** (Astrakhan, Russia) from Berg, 1949: 969

Gasterosteus platygaster var. *caucasicus* Kessler, 1877a: 3 (type locality: Transcaucasia [Berg, 1949: 969]; syntypes: LU [12])

Gasterosteus platygaster var. *danubica* Steindachner, 1899: 542 (type locality: Danube swamps near Negotin, Serbia and river Save [Sava] near Belgrad, Serbia; syntypes: NMW 6823 [6])

Pygosteus platygaster var. *nuda* Berg, 1905: 218 (type locality: lake Charkhal, river Ural basin; syntypes: ZISP 10613; author given as Nikolsky, but Berg is actual author)

Systematic notes. Münzing (1969: 222) recognises two subspecies, *P. p. platygaster* and *P. p. aralensis* (Kessler, 1877a: 4). The presentation of his data does not allow a clear interpretation of the characters and their variability in both subspecies, but it seems that *P. aralensis*, restricted to the Aral Sea basin, is a distinct species under the PSC.

21.2.4 *Pungitius pungitius* (Linnaeus, 1758)

Gasterosteus Pungitius Linnaeus, 1758: 296 (based on Artedi [1738: gen. 52 [97], syn. 80, spec. 97 [52], Gasterosteus aculeis in dorso decem] and Linnaeus [1746: 104, n. 277, idem]; type locality: "in Europa"; syntypes: LSL 34-35, Wheeler, 1985: 44)

Pygosteus pungitius forma *trachura* Bertin, 1925: 122 (infrasubspecific, name not available)

Pygosteus pungitius forma *semiarmata* Bertin, 1925: 122 (infrasubspecific, name not available)

Pygosteus pungitius forma *carinata* Bertin, 1925: 122 (infrasubspecific, name not available)

Systematic notes. See *Pungitius laevis* for comments. Similarly, it seems unlikely that the East Asian and nearctic populations are conspecific with the European ones, and they have been omitted from the above synonymy. Allozyme studies by Haglund et al. (1992b) confirms this hypothesis, but do not contribute to understanding relationships among European stocks as too few have been examined.

Syngnathidae

22.1.1 *Nerophis ophidion* (Linnaeus, 1758)

Syngnathus Ophidion Linnaeus, 1758: 337 (based on Artedi [1738: gen. 1, syn. 2, spec. 1, Syngnathus teres ...], Linnaeus [1746: 126, n. 334, idem] and Gronovius [1754: 1, n. 2, idem]; type locality: "in Europa"; syntype: BMNH 1853.11.12:185, Wheeler, 1958: 216)

Scyphius violaceus Risso, 1826: 187 (type locality: not stated, probably around Nice, France; type material: NT)

Scyphius littoralis Risso, 1826: 188 (type locality: not stated, probably around Nice, France; type material: NT)

Scyphicus teres Rathke, **1837: 319** (Sevastopol, Crimea, Ukraine) from Berg, 1949: 978

Nomenclatural notes. Wheeler (1958: 216) noted that Linnaeus's (1758) description of *Syngnathus ophidion* is based on different accounts which include two species. The only surviving syntype of this composite series is not conspecific with the species usually called *N. ophidion*.

22.2.1 *Syngnathus abaster* Risso, 1826

Syngnathus abaster Risso, 1826: 182 (type locality: not stated, probably around Nice, France; type material: NT)

Syngnathus ethon Risso, 1826: 182 (type locality: not stated, probably around Nice, France; type material: NT)

Syngnathus Agassiz Michahelles, 1829: 1013 (type locality: Triest, Italy; type material: NT ?)

Syngnathus nigrolineatus Eichwald, 1831: 61 (type locality: Black Sea near Odessa, Ukraine; syntypes: LU)

Syngnathus caspius Eichwald, 1831: 61 (type locality: "sinu balchanensi caspii maris"[Balkhan Bay, Caspian Sea; Berg, 1949: 985]; syntypes: LU)

Syngnathus bucculentus Rathke, **1837: 317** (Sevastopol, Feodosiya, Crimea) from Berg, 1949: 982

Syngnathus flavescens Kaup, 1856b: 35 (type locality: Tripoli, Libya; holotype: RMNH, lost according to Dawson, in Daget et al., 1986: 287)

Syngnathus cuvieri Kaup, 1856b: 38 (type locality: Catwyk, North Sea / Napoli, Italy; syntypes: RMNH [several], MNHN [1])

Syngnathus algeriensis Günther, 1870: 164 (type locality: freshwaters in Algiers [Alger], Algeria; syntypes: BMNH 1869.1.29:17 [5], Dawson, in Daget et al., 1986: 287)

Syngnathus Anguisigola Chiereghini, in Nardo, 1847: 113 (type locality: lagoon of Venezia, Italy; type material: LU)

Syngnathus microchirus Moreau, 1891: 188 (type locality: pool of Pinetto, near Bastia, Corsica; syntypes: LU [22], lost according to Dawson, in Daget et al., 1986: 287)

Syngnathus abaster ganzirriensis d'Ancona, 1934: 53 (type locality: Lago grande di Ganzirri, Messina, Sicilia; syntypes: LU)

Syngnathus nigrolineatus maeoticus Slastenenko, 1938a: 174 (nomen nudum), **1938b: 138** (Azov Sea, Black Sea, lakes of Danube delta in Romania) from Berg, 1949: 982

Syngnathus ethon aeolicus Caporiacco, 1948: 91 (type locality: Napoli, Messina, Palermo, southern Tyrrhenian Sea, Italy; syntypes: LU [11])

22.2.2 *Syngnathus acus* Linnaeus, 1758

Syngnathus Acus Linnaeus, 1758: 337 (based on Artedi [1738: gen. 1 [2], syn. 2, spec. 2 [1], Syngnathus corpore medio heptagona ...], Linnaeus [1746: 126, n. 335, idem] and Gronovius [1754: 1, n. 3, idem]; type locality: "in Europa"; type material: NT)

Syngnathus Rubescens Risso, 1810: 66 (type locality: sea shore in Nice, France; type material: NT)

Syngnathus Temminckii Kaup, 1856b: 36 (type locality: Cape [of Good Hope, South Africa]; syntypes: RMNH [2, lost, Dawson, in Daget et al., 1986: 287])

Syngnathus brachyrhynchus Kaup, 1856b: 42 (type locality: "Isle of Bourbon" [Réunion Island]; holotype: MNHN 6133, Dawson, in Daget et al., 1986: 287)

Syngnathus Delalandi Kaup, 1856b: 45 (type locality: Cape of Good Hope and Cape Seas, South Africa; syntype: MNHN 6139 [1], Dawson, in Daget et al., 1986: 287, ZMB [2])

Syngnathus alternans Günther, 1870: 162 (type locality: Seychelles islands; holotype: BMNH 1855.9.19:1395, Dawson, in Daget et al., 1986: 287)

Nomenclatural notes. Dawson (in Daget et al., 1986: 287) lists MNHN as holotype of *Syngnathus Delalandi* Kaup, 1856. As Kaup clearly stated that he had examined three specimens, they all are syntypes.

22.2.3 *Syngnathus taenionotus* Canestrini, 1871

Syngnathus taenionotus Canestrini, 1871: 143 (type locality: Laguna Veneta, Italy; syntypes: MSNG 14038 [3], Tortonese, 1963a: 312)

22.2.4 *Syngnathus typhle* Linnaeus, 1758

Syngnathus Typhle Linnaeus, 1758: 337 (based on Artedi [1738: gen. 1 [3], syn. 1, spec. 3 [1], Syngnathus corpore medio hexagono [heptagono in gen. 1] ...], Linnaeus [1746: 126, n. 336, idem] and Gronovius [1754: 2, n. 4, idem]; type locality: "in Europa"; potential syntype: LSL 49, Wheeler, 1985: 42)

Syngnathus Rondeletii Delaroche, 1809: 324, pl. 21 fig. 5 (type locality: Iviça [Ibiza], Spain; syntypes: MNHN)

Tiphle hexagonus Rafinesque Schmaltz, 1810a: 18 (unnecessary replacement name for *Syngnathus typhle* Linnaeus, 1758)

Syngnathus pelagicus Risso, 1810: 63 (type locality: Nice, France; type material: NT; junior homonym of *Syngnathus pelagicus* Osbeck, 1765)

Syngnathus Viridis Risso, 1810: 65 (type locality: "mer de S. Hospice" / Villefranche, France; type material: NT)

Syngnathus ponticus Pallas, 1814: 118 (type locality: Black Sea, Azov Sea; syntypes: LU)

Syngnathus argentatus Pallas, 1814: 120 (type locality: Black Sea; syntypes: LU)

Syngnathus pyrois Risso, 1826: 180 (replacement name for *Syngnathus pelagicus* Risso, 1810)

Syngnathus rotundatus Michahelles, 1829: 1014 (type locality: Triest, Italy; syntypes: LU)

Nomenclatural notes. The only extant potential syntype of *Syngnathus typhle* is actually a specimen of *S. acus* Linnaeus, 1758 (Wheeler, 1985: 42). Linnaeus also based his diagnosis on the accounts of Artedi (1738) and Gronovius (1754) who apparently refer to the species presently called *S. typhle*.

Cottidae

23.1.1 *Cottus ferrugineus* Heckel & Kner, 1858

Cottus ferrugineus Bonaparte, 1846: 62 (nomen nudum)

Cottus ferrugineus Heckel & Kner, 1858: 34, figs. 14-15 (type locality: lake Garda, Milano, Treviso, Italy, and Xegar, Dalmatia [Croatia]; syntypes: NMW 6036 [4], 6419 [5], 6562 [2], 6563 [3], 6673 [6], 78799 [4])

Systematic notes. Koli (1969: 385) treated *C. ferrugineus* as synonym of *C. gobio*. Bianco (1994: 472) lists Italian material as *C. gobio* without commenting on the nomenclature. With the present (lack of) data, the characters reported by Bacescu & Bacescu-Mester (1964: 444) justify treating *C. ferrugineus* as a distinct species until this is confirmed or refuted.

23.1.2 *Cottus gobio* Linnaeus, 1758

Cottus Gobio Linnaeus, 1758: 265 (based on Artedi [1738: gen. 48 [82], syn. 76, spec. 82 [48], Cottus alepidotus glaber .....], Linnaeus [1746: 104, n. 279, idem] and Gronovius [1756: 14, n. 166, Uranoscopus capite utrinque ...; "Mare septentrionale"]; type locality: "in Europae fluviis"; type material: NT)

Cottus microstomus Heckel, 1837: 147, pl. 8 figs. 3-4 (type locality: vicinity of Krakow, Poland; holotype: NMW [not yet located; B. Herzig, pers. comm., 1995])

Cottus affinis Heckel, 1837: 130 (available by indication to Ekström [1835: 167, *Cottus gobio* (1832: 308 in original)]; type locality: Mörkö Island [near Stockholm], Sweden; syntypes: LU)

Cottus gobio var. *macrostomus* Jeitteles, 1863: 14 (infrasubspecific, name not available; locality: Baden in der March [Morava], near Neustift, near Olmütz [Olomouc], Czech Republic; junior homonym of *Cottus poecilopus* var. *macrostomus* Jeitteles, 1862)

Cottus koshewnikowi Gratzianow, 1907a: 658 (type locality: river Goredwa [Goredva] (Oka system), river Kolomna, lake Selig and Malysch district, Wjatka [Vyatka], Russia; syntypes: ZMMSU)

? *Cottus gobio jaxartensis* Berg, 1916a: 437 (type locality: river Ugam, a tributary of river Chirchik, itself a tributary of the Syr-Darya, Uzbekistan; holotype: ZISP ?)

Cottus gobio milvensis Soldatov, **1924: 57** (river Pechora, near confluence with river Mylva, Russia) from Berg, 1949: 1147

Cottus gobio var. *roseus* Odenwall, 1927: 56 (type locality: Lappajärvi Sjö, Finland; syntypes: MZH, Koli, 1969: 384)

Cottus gobio natio *pellegrini* Vladykov, 1931: 353, fig. 28 (infrasubspecific, name not available; locality: "Russie sous-carpathique" [Carpathes range in Ukraine], Danube basin)

Cottus gobio pellegrini Bacescu & Bacescu-Mester, 1964: 442 (available by indication to Vladykov, 1931: 353; type locality: "Russie sous-carpathique" [Carpathes range in Ukraine], Danube basin; syntypes: LU)

Cottus gobio hispaniolensis Bacescu & Bacescu-Mester, 1964: 445 (type locality: river Garona at Viella, Eastern Pyreneans, Spain; syntypes: MGAB ?)

? *Cottus gobio haemusi* Marinov & Dikov, 1986: 19 (type locality: upper river Beli Vit above village Ribarica, Danube basin, Bulgaria; holotype: BFSU 6039-1)

Systematic notes. A revision of this 'species' is needed. Material from the whole range of the species should be critically compared. It seems very likely that several species have been confused under a single name. From a study of Scandinavian populations, Koli (1969: 353) concluded that there are two distinct groups resulting of "the post-glacial immigration of morphologically different strains from two different directions" with a zone of secondary intergradation (a case similar to the one reported above for *Gasterosteus*). Witkowski (1979, 1995) made the same observations with material from Poland. If this is confirmed by study of additional material from other areas, these two independent and diagnosable lineages may have to be treated as species under the PSC. Robins (1961: 310) considered *C. gobio* as a species-complex. The genetic data in Riffel & Schreiber (1995) also suggest that several species may be confused.

A suggested reading on characters useful for distinguishing some North American species of *Cottus* is Jenkins & Burkhead (1994: 625-674).

Cottus gobio haemusi Marinov & Dikov (1986) is said to differ from all other populations of *Cottus gobio* in having a smaller head and less anal rays. Data from all other populations have been compiled from the literature and it remains to be demonstrated that all authors used the same methods, especially for measuring head length. If the differences are confirmed, this stock may have to be treated as a valid species and should be described in detail.

23.1.3 *Cottus petiti* Bacescu & Bacescu-Mester, 1964

Cottus petiti Bacescu & Bacescu-Mester, 1964: 432, fig. 1, pl. 1 (type locality: sources of river Le Lez, France; holotype: MGAB 50)

Systematic notes. Koli (1969: 386) treated *C. petiti* as conspecific with *C. gobio* because the characters used to recognise them are within the range of variation of his *C. gobio*. His data are based mostly on Scandinavian specimens, and it seems dubious that the similarity in some characters (extent of prickling, complete lateral line) between *C. petiti* from southern France and some specimens from northernmost Finland should justify considering them conspecific. The comparison with material from adjacent waters would be more meaningful and the data presented by Bacescu & Bacescu-Mester (1964) presently justify recognising *C. petiti* as a distinct species. Persat et al. (1996: 325) report possible differences in reproduction biology of *C. petiti* and *C. gobio*.

To just rule out the existence of species on the ground that they "have been recorded ... by single authorities, but their occurrence has not been subsequently confirmed" or that "they have not been accepted" (Changeux & Pont, 1995: 137) is definitively not acceptable in the case of *C. petiti* because there is no demonstration that it is not valid and the species has simply been overlooked in the literature. That a species fails to attract attention or that a paper is overlooked does not imply that a species does not exist.

23.1.4 *Cottus poecilopus* Heckel, 1837

Cottus poecilopus Heckel, 1837: 145, pl. 8 figs. 1-2 (type locality: a hill stream [probably Červený; J. Holčík, pers. comm.] of the Carpathes [Vysoké Tatry], near Grossschlagendorf [Veľký Slavkov] near Käsmark [Kežmarok], Upper Hungary [now Slovakia], Vistula basin; syntypes: NMW 6424 [1], 6729 [3], 78816 [2])

Cottus poecilopus var. *macrostomus* Jeitteles, 1862: 292, pl. 2 fig. 2 (type locality: creeks near Koritnicza [Korytnica] in Liptau [Liptov], hill streams of Pohorella [Pohorelá] at the foot of Königsberg [Králova Hoľa], Hamor [Hámor] near Kaschau [Košice], Slovakia, Danube basin; syntypes: LU)

Cottus poecilopus var. *microstomus* Jeitteles, 1862: 292, pl. 2 fig. 3 (type locality: creek in Zips [area of Stará Ľubovňa on upper Poprad], Slovakia; syntypes: LU; junior homonym of *Cottus microstomus* Heckel, 1837)

Cottus gobio var. *microcephalus* Kessler, **1868: 44** (Onega district, Russia) from Berg, 1949: 1145

Systematic notes. *Cottus szanaga* Dybowski, 1869 (p. 949, pl. 14 fig. 1; type locality: river Onon and its tributaries, Amur basin, Siberia; syntypes: IZPAN ?, ZMB 7107, 84 mm SL, Paepke & Fricke, 1992: 284) treated as a synonym of *C. poecilopus* by Berg (1949: 1143) is a valid species (Holčík & Pivnička, 1969: 18). According to these authors (p. 23), *Cottus minutus volki* Taranec, 1933 (p. 84; type locality: rivers of eastern slope of Sikhote-alin' from river Suchan [Peter the Great Bay] to river Takema or Takkoma [45.5-46°N], Siberia; syntypes: LU) treated as a subspecies of *C. poecilopus* by Berg (1949) is also specifically distinct. Berg (1949: 1143) also lists *C. kuznetzovi* Berg, 1903 (p. 110; type locality: river Aunakit, river Lena basin [not Baikal, see Berg, 1949: 1143], Siberia, Russia; holotype: ZISP 12476) as a synonym of *C. poecilopus*; it most likely is not conspecific (J. Holčík, pers. comm.) and is not included in the above synonymy.

23.2.1 *Triglopsis quadricornis* (Linnaeus, 1758)

Cottus quadricornis Linnaeus, 1758: 264 (based on Linnaeus [1746: 104, n. 278, Cottus verrucis capitis ...; **1748: 47, pl. 4 fig. 3**, idem; **1754: 70, pl. 32 fig. 4**] and Artedi [1738: gen. 48 [84], syn. 84 [77] [spec. 48], Cottus scaber, tuberculis 4 ...]; type locality: "in M. Balthico"; syntypes: NRM 2491, 2492 [2], Fernholm & Wheeler, 1983: 235)

Cottus quadricornis var. *relicta* Lilljeborg, 1884: 146 (type locality: lake Vettern [Vättern], Sweden [restricted by Lönnberg, 1919: 164]; syntypes: LU)

Cottus latifrons Gatzianov, **1904: 195, pl. 11** (west coast of Kanin peninsula) from Berg, 1949: 1130

Myoxocephalus quadricornis morpha *lönnbergi* Berg, 1916a: 431, fig. 318 (infrasubspecific, name not available; localities: lake Ladoga, Russia and lake Mälaren, Sweden [restricted by Berg, in Lönnberg, 1932b: 5]) and 1916b: 1346, fig. 2 (same data)

Cottus quadricornis vaenernensis Lönnberg, 1919: 165 (type locality: lake Vänern, Sweden; syntypes: NRM 20336-20338 [6], 40338 [1])

Cottus quadricornis lönnbergi Lönnberg, 1919: 167 (type locality: lake Mälaren, Sweden; syntypes: NRM ?)

Cottus quadricornis frykenensis Lönnberg, 1932a: 14, fig. 5 (type locality: lake Fryken, Sweden;

syntypes: NRM 30315 [1], museum of Karlstad's school [1], UUZM [1])

Cottus quadricornis oernensis Lönnberg, 1932a: 16, figs. 6a-b (type locality: lake Örn, Sweden; syntypes [total 9]: NRM 20323-20325 [7])

Cottus quadricornis asundensis Lönnberg, 1932a: 17, figs. 7a-b (type locality: lake Åsunden, Sweden; syntypes: NRM 20329-20332 [12])

Myoxocephalus quadricornis onegensis Berg & Popov, 1932: 158 (type locality: lake Onega, Russia; syntypes: ZISP 3842 [1], 9026a [1])

Cottus quadricornis kallavesensis Lönnberg, 1932b: 7, fig. 1 (type locality: lake Kallavesi, Finland; syntypes: MZH [9])

Cottus quadricornis pygmaeus Lönnberg, 1932b: 9, fig. 2 (type locality: lake Puruvesi, Finland; syntypes: MZH)

Cottus quadricornis borkensis Lönnberg, 1939: 4 (type locality: lake Borken, parishes of Yxnerum and Björsäter, Osthrogothland Prov., Sweden; syntypes: NRM 20327 [2])

Cottus quadricornis vermelnensis Nybelin, 1940: 77, fig. 1 (type locality: lake Värmeln, Sweden; syntypes: LU)

Systematic notes. Generally called *Myoxocephalus quadricornis* or *Oncocottus quadricornis*. Generic placement follows Neyelov (1979: 115, 131) and Fedorov, in Whitehead et al. (1986: 1259).

Several landlocked stocks are known from relatively deep lakes and many have been recognised as subspecies. It seems that some of these stocks should be treated as valid species under the PSC (they are diagnosable and constitute independent lineages), but a detailed revision is needed in order to determine the extent of their variability and distribution.

Serranidae

24.1.1 *Dicentrarchus labrax* (Linnaeus, 1758)

Perca Labrax Linnaeus, 1758: 290 (based on J. F. Gronovius [1751: 39, pl. 4, Perca ...] and Artedi [1738: gen. [spec.] 41, syn. 69, Perca radiis pinnae ...]; type locality: "in Europa australiore"; type material: NT)

Sciaena diacantha Bloch, 1792: 58, pl. 302 (type locality: Mediterranean Sea; holotype: ZMB ?)

Centropomus mullus La Cepède, 1802: 251, 268, 271 (type locality: entering river Seine, France; type material: NT)

Perca elongata Geoffroy Saint-Hilaire, 1817: pl. 19 fig. 1 (type locality: Egypt; holotype: LU)

Centropomus lupus La Cepède, 1802: 267 (type locality: Adriatic Sea, Mediterranean Sea, European coasts of Atlantic Ocean, especially Golf of Gascogne, Channel and "Golfe Brittanique"; syntypes: LU)

Labrax Linnéi Malm, 1877: 379 (unnecessary replacement name for *Perca labrax* Linnaeus, 1758)

24.1.2 *Dicentrarchus punctatus* Bloch, 1792

Sciaena punctata Bloch, 1792: 64, pl. 305 (type locality: Mediterranean; holotype: ZMB, lost, H.-J. Paepke, in litt., 1995)

Labrax orientalis Günther, 1863b: 175 (type locality: Alexandria, Egypt; syntypes: BMNH [2])

Systematic notes. Inclusion of this species as occurring in freshwaters follow Blanc et al. (1971), Maitland (1977: 206) and others.

Centrarchidae

***Ambloplites rupestris* (Rafinesque, 1817) introduced**

***Lepomis auritus* (Linnaeus, 1758) introduced**

***Lepomis cyanellus* Rafinesque, 1819 introduced**

***Lepomis gibbosus* (Linnaeus, 1758) introduced**

***Micropterus dolomieu* La Cepède, 1802 introduced**

***Micropterus salmoides* (La Cepède, 1802) introduced**

Percidae

25.1.1 *Gymnocephalus baloni* Holčík & Hensel, 1974

Gymnocephalus baloni Holčík & Hensel, 1974: 472, fig. 1a (type locality: river Danube near Kližská Nemá, Slovakia; holotype: SNM 2261)

Systematic notes. Fricke (in Riehl & Meinel, 1994: 29) considers *G. baloni* as an 'ecological morph' of *G. cernuus*. As long as no data or evidence are provided, it is difficult to follow this view. The wording of the brief argument is somewhat ambiguous: "while there are pure *G. cernuus* populations, there is no pure *G. baloni* populations. All individuals of *G. baloni* also exhibit characters of *G. cernuus*; there is always an overlap of character". If the 'absence of pure *G. baloni* populations' mean that the range of *G. baloni* is included within the range of *G. cernuus*, then this is not evidence of conspecificity in itself; similar cases involving closely related species abound (e.g., *G. acerina* and *G. schraetser*). 'Ecological morphs' of a single species usually do not occur mixed but in distinct habitats. Although not impossible, it seems strange that the *G. baloni* 'morph' would exist only in part of the range of *G. cernua*. Holčík & Hensel's (1974) character analysis seems to indicate that some osteological character states are unique to *G. baloni* (e.g., shape of operculum and suboperculum); if the sentence on characters means that character states of *G. cernuus* are shared by *G. baloni*, this does not negate the existence of unique characters of *G. baloni*. Isozyme patterns further support the distinctness of *G. baloni* (Šlechtová & Šlechta, 1996).

25.1.2 *Gymnocephalus cernuus* (Linnaeus, 1758)

Perca Cernua Linnaeus, 1758: 294 (based on Linnaeus [1746: 107, n. 286, Perca ... radiis 27], Artedi [1738: gen. 40 [80], syn. 68, spec. 77 [40], Perca dorso monopterygio capite ...], Gronovius [1754: 41, n. 94, idem]; type locality: "in Europae lacubus"; syntypes: BMNH 1853.11.12:5 [1], 2 [1], Wheeler, 1958: 219, 1985: 51)

Holocentrus post La Cepède, 1802: 357 (unnecessary replacement name for *Perca cernua* Linnaeus, 1758)

Cernua fluviatilis Fleming, 1828: 212 (type locality: "rivers in England"; type material: NT ?)

Acerina vulgaris Cuvier, in Cuvier & Valenciennes, 1829a: 4, pl. 41 (unnecessary replacement name for *Perca cernua* Linnaeus, 1758: 294)

Acerina fischeri Eichwald, **1871: 16, pl. 2** (lakes of the Tomsk Province, Siberia) from Berg, 1949: 1046

Acerina Czekanowskii Dybowski, 1874: 383 (type locality: middle and lower course of river Angara, Siberia; syntypes: IZPAN ?)

Acerina cernua essipovi Burmakin, **1941: 156, fig. 2** (Gyda Bay basin [Arctic Ocean], river Yuribei, Siberia) from Berg, 1949: 1047

Acerina cernua natio *danubica* Vladykov, 1931: 345 (infrasubspecific, name not available; locality: river Danube)

25.1.3 *Gymnocephalus schraetser* (Linnaeus, 1758)

Perca Schraetser Linnaeus, 1758: 294 (based on Artedi [1738: gen. [spec.] 40, syn. 68, Perca dorso monopterygio lineis ...]; type locality: "in Europa australis"; type material: NT)

Schraitser ratisbonensium Schaeffer, 1761: 48, pl. 2 fig. 4 (locality: Ratisbonum [Regensburg], Germany; name not available because work not consistently binominal; ICZN art. 11(c))

Perca danubiensis Gronow, 1854: 112 (type locality: river Danube; holotype: BMNH 1853.11.12: 41 [1], Wheeler, 1958: 219)

Nomenclatural notes. "*Schraitser ratisbonensium* Schaeffer" (1761: 48) is sometimes listed as a synonym of *Gymnocephalus schraetser*. This name is actually not an available name as it was used by Schaeffer in a work not consistently binominal and was meaning "Schraitser of the inhabitants of Regensburg".

"*Holecentrus schraizer* La Cepède" is sometime listed as a synonym of *G. schraetser*. La Cepède (1802: 347) clearly referred to Linnaeus's species and used the same spelling, and thus did not create a new name.

25.2.1 *Perca fluviatilis* Linnaeus, 1758

Perca fluviatilis Linnaeus, 1758: 289 (based on Linnaeus [1746: 106, n. 285 (sic; 284)], Artedi [1738: gen. 39 [74], syn. 66, spec. 74 [39], Perca lineis utrinque ...] and Gronovius [1754: 42, n. 96, idem]; type locality: "in Europae lacubus imprimis"; syntypes: BMNH 1853.11.12: 3 [1], LSL 1 [1], Wheeler, 1958: 219, 1985: 52)

Perca vulgaris Schäfer, 1761: 1, pl. 1 (locality: Ratisbonum [Regensburg], Germany; not available because work not consistently binominal, ICZN art 11(c))

Perca vulgaris Paula Schrank, 1792: 99 (type locality: Regensburg, Germany [by indication to Schäfer, 1761: 1, pl.1; type material: ZMB ?)

Perca italica Cuvier, in Cuvier & Valenciennes, 1828b: 45 (type locality: Bologna, Italy; syntypes: MNHN)

Perca vulgaris Fitzinger, 1832: 331 (available by indication to Schäfer [1761: 1, *Perca vulgaris*] and Meidinger, 1785: pl. 5, *Perca fluviatilis*]; type locality: Regensburg, Germany [Schäfer], lakes and rivers of Austria [Meidinger], rivers Danube, Leytha and Schwarza, lake Traunsee, Austria; syntypes: NMW [not yet located; B. Herzig, pers. comm., 1995]; junior homonym of *Perca vulgaris* Paula Schrank, 1798)

Perca vulgaris var. *aurata* Fitzinger, 1832: 331 (nomen nudum; localities: rivers Danube, Leytha and Schwarza, lake Traunsee, Austria)

Perca fluviatilis var. *nigrescens* Heckel, 1837: 155 (nomen nudum; locality: river Marizza near Philippoli in Rumelia [southern Bulgaria])

Perca helvetica Gronow, 1854: 113 (type locality: Basel, Switzerland; holotype: BMNH 1853.11.12:2 [1], Wheeler, 1958: 219)

Perca fluviatilis var. *gibba* Smitt, 1892: figs. 3-4 (infrasubspecific, name not available [see p. 30])

Perca fluviatilis var. *maculata* Smitt, 1892: 30, fig. 5 (type locality: lake Tisaren, Nerike, Sweden; syntypes: ? NRM 35749; junior primary homonym of *Perca maculata* Bloch, 1792: 92, pl. 313; could possibly be treated as infrasubspecific, thus unavailable name)

Perca fluviatilis var. *aurea* Smitt, 1892: 30 (type locality: Eskilstuna, Sweden; holotype: ? NRM 35750; could possibly be treated as infrasubspecific, thus unavailable name)

Perca fluviatilis var. *macedonica* Karaman, 1924b: 79 (type locality: lake Dojran and river Vardar near Veles, FYROM; syntypes: LU)

Perca fluviatilis morpha *phragmiteti* Berg, 1933: 635 (infrasubspecific, name not available)

Perca fluviatilis infrasp. *gracilis* Pokrovsky, **1951** (infrasubspecific, name not available; junior homonym of *Perca gracilis* Cuvier, in Cuvier & Valenciennes, 1828b: 50) from Oliva et al., 1989: 222

Perca fluviatilis zaissanica Dianov, **1955** (locality: lake Zaissan, Kazakhstan) from Svetovidov & Dorofeyeva, 1963: 637

Perca fluviatilis intermedius Svetovidov & Dorofeyeva, 1963: 639 (type locality: river Kolyma, Siberia; holotype: ZISP 23998)

Nomenclatural notes. "*Bürstel bavarorum* Schaeffer" (1761: 1) is sometimes listed as a synonym of *Perca fluviatilis*. This name is actually not available as it was used by Schaeffer under the heading "*Perca vulgaris*" and it means simply "Bürstel of the Bavarians".

25.3.1 *Romanichthys valsanicola* Dumitrescu, Bănărescu & Stoica, 1957

Romanichthys valsanicola Dumitrescu, Bănărescu & Stoica, 1957: 230, figs. 1-4 (type locality: river Vilsan, a left side tributary of river Arges, near Gales village, Raion Curtea de Arges, Romania; holotype: MGAB 49900, Mihai-Bardan, 1984: 464)

25.4.1 *Sander lucioperca* (Linnaeus, 1758)

Perca Lucioperca Linnaeus, 1758: 289 (based on Linnaeus [1746: 106, n. 285, Perca ... radiis 23] and Artedi [1738: gen. 39 [76], syn. 62 [67], spec. 76 [39], Perca pallide maculosa ...]; type locality: "in Europae lacubus"; type material: NT)

Centropomus sandat La Cepède, 1802: 248, 255 (unnecessary replacement name for *Perca lucioperca* Linnaeus, 1758: 289)

Lucioperca sandra Cuvier, in Cuvier & Valenciennes, 1828b: 110, pl. 15 (unnecessary replacement name for *Perca lucioperca* Linnaeus, 1758: 289)

Lucioperca Linnéi Malm, 1877: 381 (unnecessary replacement name for *Perca lucioperca* Linnaeus, 1758)

Nomenclatural names. *Stizostedion* Rafinesque (**1820: 23**), *Lucioperca* Schinz (in Cuvier, 1822: 475), *Lucioperca* Fleming (**1822: 394**), *Lucioperca* Cuvier (in Cuvier & Valenciennes, 1828b: 110) and at least six other generic names (see Collette & Bănărescu, 1977: 1457) are junior synonyms of *Sander* Oken (1817: 1782); see also Gill (1903), and Eschmeyer (1990: 365).

25.4.2 *Sander volgensis* (Gmelin, 1788)

Perca Volgensis Gmelin, 1788: 1309 (available by indication to Pallas [1771: 461, *Perca asper*]; type locality: rivers Volga and Rhymnus [Ural], Russia; syntypes: ZISP ?)

Schilus Pallasii Krynicki, 1832: 443, pl. 25 (type locality: rivers Volga, Rhymnus [Ural], Dnieper and Donets, Ukraine; syntypes: ZISP ?)

25.5.1 *Zingel asper* (Linnaeus, 1758)

Perca Asper Linnaeus, 1758: 290 (based on Artedi [1738: gen. [spec.] 40, syn. 67, Perca lineis utrinque ...]; type locality: "in Europa australiore"; type material: NT)

Aspro Apron Siebold, 1863a: 55 (type locality: river Rhône, France; holotype: probably ZSM, now lost)

Aspro vulgaris Cuvier, in Cuvier & Valenciennes, 1828b: 188, pl. 26 (unnecessary replacement for *Perca asper* Linnaeus, 1758: 290)

25.5.2 *Zingel balcanicus* (Karaman, 1936)

Aspro streber balcanicus Karaman, 1936: 60 (type locality: river Vardar, FYROM; syntypes: LU)

Systematic notes. See discussion under *Zingel streber*.

25.5.3 *Zingel streber* (Siebold, 1863)

Asper verus Schaeffer, 1761: 69, pl. 3 fig. 4 (locality: Ratisbonum [Regensburg], Germany; name not available because work not consistently using binominal nomenclature; ICZN art. 11(c))

Aspro streber Siebold, 1863a: 54 (type locality: rivers Danube and Amper, Germany; syntypes: [14, probably ZSM, now lost])

Zingel streber nerensis Bănărescu & Nalbant, 1979: 353 (type locality: river Nera at Sasca Montana, Romania; holotype: ISBB 2534)

Systematic notes. Bănărescu & Nalbant (1979) recognise three subspecies within *Z. streber*. The mosaic distribution of the characters between the three subspecies (as well as *Z. asper* and *Z. zingel*) and the apparent absence of intergrades seems to indicate that at least two species are involved. The naked cheeks, the shape of the nostrils, the presence of two opercular spines and other characters listed by Bănărescu & Nalbant seem very diagnostic for the Vardar population and it is treated here as a distinct species, *Z. balcanicus*. It seems likely that *Z. s. nerensis* could be a valid species too, but I am unable to reach a conclusion from the published data.

Nomenclatural notes. "*Streber ratisbonensium* Schaeffer" (1761: 69) is sometimes listed as a synonym of *Zingel streber*. This name is actually not an available name as it was used by Schaeffer under the heading "*Asper verus*" and it means simply "Streber of the inhabitants of Regensburg".

25.5.4 *Zingel zingel* (Linné, 1766)

Perca zingel Linné, 1766: 482 (based on Gronovius [1763: 92, n. 303, Perca dorso dipterygio ...], Schaeffer [1761: 58, pl. 3 fig. 1, Zingel], and Kramer [1756: 386, Zingel]; type locality: river Danube at Regensburg [Schaeffer] and in Hungary [Kramer, Gronovius]; syntype: BMNH 1853.11.12:81 [1], Wheeler, 1958: 219)

Nomenclatural notes. "*Asperulus ratisbonensium* Schaeffer, 1761" and "*Zindel ratisbonensium* Schaeffer, 1761" are sometimes listed as synonyms of *Zingel zingel*. These names are actually not available; they were used by Schaeffer (1761: 58) as the heading "*Asperulus*" (an unavailable name, because not binominal), with the subheading "*Zindel ratisbonensium*", meaning "Zindel of the inhabitants of Regensburg".

Cichlidae

'*Cichlasoma*' *facetum* (Jenyns, 1842) introduced

Systematic notes. The identification of the cichlid introduced into Portuguese waters (Almaça, 1995: 22) has been confirmed by S. O. Kullander (in litt., 1995).

Blenniidae

The generic nomenclature of Bath (1977) is followed here. Bock & Zander (1986: 142) united the genera *Lipophrys* and *Salaria* and used *Lipophrys* Gill, 1896 as the valid name. *Salaria* Forsskål, **1775** being the oldest name is the one to be used. The argument of similarity of the generic names *Salaria* and *Salarias* Cuvier, 1816: 251 is irrelevant to the discussion (ICZN art. 56(b) is explicit). Similarly, the argument for rejecting *Ichthyocoris* Bonaparte, 1840: [fasc. 28, p. 182], another name older than *Lipophrys*, is not relevant.

The argument of Bock & Zander (1986: 142) for not recognising *Paralipophrys* and *Salaria* as distinct from *Lipophrys* ("which are to dissolve as these show no differences in ancient-relevant-characters") is a semantic mystery to me and at this point I cannot see reasons for not following Bath (1977).

26.1.1 *Salaria fluviatilis* (Asso, 1801)

Blennius fluviatilis Asso, 1801: 31, pl. 33 (type locality: river Ebro in Zaragoza, Spain; type material: NT ?)

Blennius Frater Bloch, in Schneider, 1801: 171 (type locality: "Ibero amne prope Caesar-Augustam" [Zaragoza, Spain]; based on Asso, 1784: 95, pl. 6 fig. 2; type material: NT)

Blennius fluviatilis Rafinesque Schmaltz, 1810a: 31 (type locality: Sicilia; type material: NT ?; junior homonym of *Blennius fluviatilis* Asso, 1801)

Blennius vulgaris Pollini, 1816: 20, pl. 1 fig. 1 (type locality: lake Garda, Italy; type material: NT)

Salarias varus Risso, 1826: 237 (type locality: river Var, France; type material: NT)

Blennius inaequalis Valenciennes, in Cuvier & Valenciennes, 1836: 230 (type locality: Cette [Sète], France; holotype: MNHN A.1789, Bath, 1977: 209)

Blennius cagnota Valenciennes, in Cuvier & Valenciennes, 1836: 249 (type locality: Toulon, France; lectotype: MNHN A.1667, present designation)

Blennius Lupulus Bonaparte, 1840: [fasc. 28, p. 185], pl. 106 fig. 5 (type locality: stream Fiora and others draining to the Mediterranean in Toscana and Romana, Italy; syntypes: LU)

Blennius Anticolus Bonaparte, 1840: [fasc. 28, p. 188], pl. 106 fig. 4 (type locality: lake Nemi and "ne'sudetti laghi suburbicarii" ["in these suburban lakes" = volcanic lakes surrounding Roma] [p. 280; see reference p. 188]; type material: NT)

Ichthyocoris pollinii Bonaparte, 1846: 68 (unnecessary replacement name for *Blennius vulgaris* Pollini, 1816)

Blennius Petteri Heckel & Kner, 1858: 44, 46 (nomen nudum; locality: creek near Salona [near Split], Croatia)

Blennius alpestris Blanchard, 1866: 261, fig. 49 (type locality: lake Bourget, France; syntypes: MNHN A.2368 [5], Bath, in Daget et al., 1986: 357)

Nomenclatural notes. Bath (in Daget et al., 1986: 356) indicates that Asso (1784: 95, pl. 6 fig. 2) is author of *Blennius fluviatilis*. The species is described on this page, but no binominal name is used. The first use of the name is by Asso (1801).

Bath (1977: 209) lists a specimen (MNHN A.1667) from Toulon as holotype of *Blennius cagnota*. Even if Valenciennes based his description on this specimen, as he referred additional specimens to the species and as none is explicitly designated as holotype or type, all are syntypes. I designate here specimen MNHN A.1667 as lectotype of *B. cagnota* Valenciennes, 1836.

Both *Blennius fluviatilis* Asso and *B. frater* Bloch have been published in 1801. Precise publication dates are not known and as first reviser, I retain *B. fluviatilis* Asso, 1801 as having priority.

See Costa Pereira (1995: 517) for a discussion of the status of *Blennius sujefianus* La Cepède, 1800 (p. 473; type locality: not stated; type material: NT) sometime tentatively listed as a synonym of *Salaria fluviatilis*.

Gobiidae

27.1.1 *Benthophiloides brauneri* Beling & Iljin, 1927

Benthophiloides brauneri Beling & Iljin, 1927: 309, figs. 1–2 (type locality: lower course of river Dnieper at Ossnowa [Osnova], Britany, Kachowka [Kakhovka], Berisslaw [Berislav] and Chersson [Kherson], southern river Bug at Novaya Odessa and its liman at Nikolaev, Ukraine; syntypes: LU [34])

27.2.1 *Benthophilus stellatus* (Sauvage, 1874)

Doliichthys stellatus Sauvage, 1874b: 336 (type locality: river Don at Woronesch [Voronezh], Russia; syntypes: MNHN 7341 [2], Bauchot et al., 1991: 21)

Benthophilus macrocephalus var. *maeotica* Kuznetsov, **1888: 207** (Azov Sea: Arabat Spit, mouths of river Don) from Berg, 1949: 1114

Benthophilus monstrosus Kuznetsov, **1888: 208** (Azov Sea: lower reach of Berdyansk liman) from Berg, 1949: 1114

Benthophilus macrocephalus var. *nudus* Berg, **1898: 34** (river Dniester at Benderi, Ukraine) from Berg, 1949: 1114

Benthophilus macrocephalus ponticus Berg, 1916a: 427 (type locality: north-western Black Sea [Berg, 1949: 1114]; syntypes: ZISP ?)

Systematic notes. The above synonymy includes only nominal species based on material from the Black Sea basin. Ragimov (1978) recognises two subspecies from the Caspian Sea, *B. s. casachicus* Ragimov (1978: 705) and *B. s. leobergi* Ragimov (1978: 707; see below). The available data do not indicate if the two Caspian 'subspecies' are sympatric or not. The two 'subspecies' are reportedly diagnosable and it does not seem that they are conspecific with *B. stellatus* which I tentatively consider as restricted to the Black Sea basin.

Nomenclatural notes. *Bentophilus stellatus leobergius* Iljin, 1949 is recognised as a valid subspecies by Ragimov (1978: 707), but the name is a nomen nudum in Iljin (1949: 28) as it is not accompanied by a description or diagnostic characters. As the taxon does not occur in the area covered by the present work, I did not search intensively for subsequent uses of this name, but the earliest subsequent use I found is in Ragimov's (1978) description of *B. s. casachicus* which lists diagnostic characters of *B. s. leobergius* and makes the name available. If it is confirmed that this is the earliest use of making the name available, 100 specimens from the Caspian Sea (no precise locality data published) are syntypes (in Laboratory of Regeneration of Fish Stocks, Caspian Biological Station, Zoological Institute, Azerbaidjan Academy of Sciences). The name *leobergius* is based on a personal name and should be emended into *leobergi* [ICZN art. 31(a)(i), (iii), 32(c)(i), (d)]. If valid, this taxon should be called *B. leobergi* Ragimov, 1978.

27.3.1 *Economidichthys pygmaeus* (Holly, 1929)

Gobius pygmaeus Holly, 1929: 487, figs. 1–2 (type locality: near Zoodochos [Piggi] near Kaligoni, a small village on island Lafkas, Greece; syntypes: NMW 33930 [12])

Gobius martensii var. *prevesicus* Stephanidis, 1939a: 35, pl. 8 fig. 5 (type locality: stream Louros and lake Trichonidos, Greece; syntypes: lost ? [86])

Systematic notes. Generic position follows Bianco et al. (1987) and Economidis & Miller (1990).

27.3.2 *Economidichthys trichonis* Economidis & Miller, 1990

Economidichthys trichonis Economidis & Miller, 1990: 141, figs. 7–9 (type locality: stream Mataranga, south-west lake Trichonis, Greece; holotype: BMNH 1989.3.15.1)

27.4.1 *Gobius cobitis* Pallas, 1814

Gobius cobitis Pallas, 1814: 160 (type locality: "Sinu Theodosiano Ponti" [Feodosiya, Crimea, Ukraine]; syntypes: LU)

Gobius guttatus Valenciennes, in Cuvier & Valenciennes, 1837: 24 (type locality: Sicilia, Italy; syntypes: MNHN A.1144 [1], A.1147 [1], A.1148 [2], Bauchot et al., 1991: 33)

Gobius limbatus Valenciennes, in Cuvier & Valenciennes, 1837: 26, pl. 345 (type locality: Nice, France; holotype: MNHN A.1191, Bauchot et al., 1991: 35)

Gobius algarbiensis Capello, 1880: 23 (available by indication to Capello, 1869: 224 [*Gobius* sp.]; type locality: seas of Lisboa, Setubal and Lagos, Portugal; syntypes: LU)

? *Gobius spilogonurus* Cocco, 1885: 88 (type locality: Sea of Messina, Sicilia; syntypes: LU)

Gobius exanthematosus var. *gibbosus* Ninni, 1938: 160, fig. 50, pl. 19 fig. a (type locality: Laguna di Venezia, Italy; syntypes: LU)

27.4.2 *Gobius niger* Linnaeus, 1758

Gobius niger Linnaeus, 1758: 262 (based on Artedi [1738: gen. [spec.] 28, syn. 46, Gobius ex nigricante ...], Linnaeus [**1754**, 74, idem] and Osbeck [**1757**: 131, Apocryptes cantonensis]; type locality: "in Europa, Asia"; syntypes: NRM 103–104 [2], Fernholm & Wheeler, 1983: 267)

Gobius Jozo Linnaeus, 1758: 263 (based on Artedi [1738: gen. [spec.] 29, syn. 47, Gobius pinna ventrali ...]; syntypes: ? NRM 9453 [1], ? 9454 [1], Fernholm & Wheeler, 1983: 268)

? *Gobius gorgione* Rafinesque Schmaltz, 1810a: 35 (type locality: harbour of Palermo, Sicilia; type material: NT ?)

? *Gobius viridis* Otto, 1821a: 1, 1821b:7 (type locality: Nice, France; type material: NT ?)

Gobius longiradiatus Risso, 1826: 286 (type locality: not stated, probably around Nice, France; type material: NT, Bauchot, 1991: 56)

Gobius Brittanicus Thompson, 1837: 61 (type locality: Galway Bay, western coast of Ireland / Corfou [Kerkira island], Greece; syntypes: BELUM ?)

Gobius fuliginosus M'Coy, 1841: 403 (type locality: Connamara, Ireland; holotype: NMI ?)

Gobius jozo var. *pontica* Kessler, 1859b: 255

(type locality: Odessa and the coast of Crimea, Ukraine; syntypes: ZISP ?)

Gobius jozo var. *albescens* Canestrini, 1861: 129 (infrasubspecific, name not available; locality: Gulf of Genova, Italy)

Gobius jozo var. *nigrescens* Canestrini, 1861: 129 (infrasubspecific, name not available; locality: Gulf of Genova, Italy)

Gobius punctulatus Cocco, 1885: 87 (type locality: Sea of Messina, Sicilia; syntypes: LU ?)

Gobius jozo var. *major* Kolombatovic, 1891: 6 (infrasubspecific, name not available; locality: Spalato [Split], Dalmatia)

Gobius jozo var. *minor* Kolombatovic, 1891: 6 (infrasubspecific, name not available; locality: Spalato [Split], Dalmatia)

Gobius niger forma *hispanicus* de Buen, 1928: 16, fig. 6 (type locality: Malaga, Spain; syntypes: LU)

Gobius niger forma *nigerrimus* de Buen, 1928: 18, fig. 7 (type locality: Bahia de Porto-Pi, Mallorca, Balearic islands, Spain; holotype: LU)

Nomenclatural notes. Fernholm & Wheeler (1983: 267) comment that the type series of *Gobius niger* includes several species, including one from China.

27.5.1 *Knipowitschia caucasica* (Berg, 1916)

Gobius lenkoranicus Kessler, 1877a: 34 (type locality: Lenkoran, Azerbaidjan, Caspian Sea basin; holotype: LU; name suppressed by the International Commission on Zoological Nomenclature, 1968b; see also Svetovidov, 1966)

Gobius caucasicus Kawrajsky, in Radde, 1899: 309 (nomen nudum; localities: Batumi / Temirgoe [station south of Sulak mouth; Berg, 1949: 1065], Georgia)

Pomatoschistus caucasicus Berg, 1916a: 409 (type locality: swamp near Batum and lake Inkit near Pitzunda, Georgia [Berg, 1949: 1065; Svetovidov, 1966: 55]; syntypes: ZISP)

Bubyr caucasicus kosswigii Sözer, 1941: 159, fig. (type locality: lake Manyas, Turkey; syntypes: LU [7])

Systematic notes. See Economidis & Miller (1990: 152) for redescription.

27.5.2 *Knipowitschia croatica* Mrakovcic, Kerovec, Misetic & Schneider, 1994

Knipowitschia punctatissima croatica Mrakovcic, Kerovec, Misetic & Schneider, 1994: 46 (type locality: freshwater spring in Polje Jezero, Dalmatia, Croatia, 43°10'N 17°25'E; lectotype: HZM 9 VRG, designated by Mrakovcic et al., 1996: 313)

Nomenclatural notes. Mrakovcic et al. (1994) used the name *K. p. croatica* in the printed abstract of a symposium with a short description, making the name available (ICZN art. 13(a)(i)). As no holotype was designated, all specimens on which their original communication was based are syntypes. The taxon has been described by Mrakovcic et al. (1996: 313).

27.5.3 *Knipowitschia goerneri* Ahnelt, 1991

Knipowitschia goerneri Ahnelt, 1991: 266, figs. 1–2 (type locality: freshwater springs south-west of Korissias lagoon, Corfou [Kerkira island], Greece; holotype: NMW 90127)

27.5.4 *Knipowitschia longecaudata* (Kessler, 1877)

Gobius longecaudatus Kessler, 1877a: 35, pl. 3 fig. 8 (type locality: Caspian Sea [Berg, 1949: 1066]; syntypes: LU)

Pomatoschistus knipowitschi Beling, 1927: 351 (nomen nudum; lower reaches of river Bug to Belousovka, liman above Nikolaev, Ukraine [from Berg, 1949: 1066])

Knipowitschia georghievi Pinchuk, 1978: 798 (type locality: lake Gebedjinsky, Bulgaria; holotype: ZISP 42337)

27.5.5 *Knipowitschia milleri* (Ahnelt & Bianco, 1990)

Orsinigobius milleri Ahnelt & Bianco, 1990: 2, figs. 1–2 (type locality: delta of river Acheron, Epirus, western Greece; holotype: NMW 86065)

27.5.6 *Knipowitschia panizzae* (Verga, 1841)

Gobius Panizzae Verga, 1841: 379 (type locality: lagoon of Comacchio, Italy; syntypes: NMW 29810 [5], from Miller, in Hureau & Monod, 1973: 497)

Systematic note. See Miller (1972: 157) for redescription and discussion.

27.5.7 *Knipowitschia punctatissima* (Canestrini, 1864)

Gobius punctatissimus Canestrini, 1864: 101 (type locality: Mantova, Modena and Castelfranco di Bologna, Italy; syntypes [total: at least 10]: MSNG 126547 [1], Tortonese, 1963b: 344])

Systematic notes. Redescribed by Gandolfi et al. (1985).

27.5.8 *Knipowitschia thessala* (Vinciguerra, 1921)

Gobius thessalus Vinciguerra, 1921: 323, pl. 4 fig. 1 (type locality: Kefalovriso spring on Mount Kissavo (earlier Ossa) near Chasabali village, Thessaly, Greece; syntypes: MSNG

12606 [9], Tortonese, 1963b: 344)

Systematic notes. See Economidis & Miller (1990: 152) for redescription.

27.6.1 *Mesogobius batrachocephalus* (Pallas, 1814)

Gobius batrachocephalus Pallas, 1814: 149 (type locality: Black Sea near Chersonesus [Kherson] and Balaklava, Crimea, Ukraine; syntypes: LU)

27.7.1 *Neogobius eurycephalus* (Kessler, 1874)

Gobius eurycephalus Kessler, **1874: 281** (type locality: Yenikale near Kerch, Crimea; lectotype: ZISP 2234, designated by Pinchuk, 1977: 518)

Neogobius eurycephalus odessicus Pinchuk, 1977: 519 (type locality: 'M[are] Nigrum' [Black Sea, near Odessa ?, Ukraine]; holotype: ZISP 2090)

Systematic notes. Included on the basis of Romanian records by Bănărescu (1994b: 6).

27.7.2 *Neogobius fluviatilis* (Pallas, 1814)

Gobius fluviatilis Pallas, 1814: 162 (type locality: near the mouths of the rivers entering the Black Sea, restricted by Berg, 1949: 1091; syntypes: LU)

? *Gobius sordidus* Bennett, 1835: 91 (type locality: Black Sea at Trebizond [Trabzon], Turkey; holotype: BMNH ?)

Gobius lacteus Nordmann, 1840: 430, pl. 10 fig. 3 (type locality: river Dniester and lagoon crossed by it near Ovidiopol and Akkerman, Ukraine; syntypes: MNHN A.1198 ? [3], Bauchot et al., 1991: 34, NMW 29505–506 ? [2])

Gobius stevenii Nordmann, 1840: 430, pl. 13 fig. 1 (type locality: near Kertch, Crimea; syntypes: LU [2])

Gobius fluviatilis var. *nigra* Kessler, 1859b: 247 (type locality: mouth of rivers Bug and Dniester, Ukraine; syntypes: ZISP ?; junior primary homonym of *Gobius niger* Linnaeus, 1758)

27.7.3 *Neogobius gymnotrachelus* (Kessler, 1857)

Gobius gymnotrachelus Kessler, 1857: 464 (type locality: river Dniester and its tributaries, especially river Slutsch, Ukraine; syntypes: ZISP ?)

Gobius macropus Filippi, 1863: 391 (type locality: lake Palestrom near Poti, Georgia; syntypes: MZUT 675 [2], Tortonese, 1940: 144)

Gobius Burmeisteri Kessler, 1877a: 26, pl. 1 fig. 5 (type locality: Poti, Georgia [Berg, 1949: 1098]; syntypes: LU)

Mesogobius gymnotrachelus otschakovinus Zubovich, **1925: 192** (Ochakov, Ukraine) from Berg, 1949: 1098

27.7.4 *Neogobius kessleri* (Günther, 1861)

Gobius platycephalus Kessler, 1857: 468 (type locality: river Dniester and tributaries, river Southern Bug upriver of Wossnesensk, Ukraine; lectotype: ZISP 2107 [? designated by Pinchuk, 1977: 520, comment not clear; junior primary homonym of *G. platycephalus* Richardson, 1846: 204 and *G. platycephalus* Peters, 1852: 681)

Gobius kessleri Günther, 1861: 553 (replacement name for *G. platycephalus* Kessler, 1857: 468)

Systematic notes. This species is known from the north-western Black Sea (Miller, in Whitehead et al., 1986: 1062). The subspecies from the Caspian Sea is treated here as a valid species *N. gorlap* Iljin, in Berg, 1949. This conclusion has also been reached by Vasiljeva & Vasiljev (1996).

Nomenclatural notes. *Neogobius iljini* Vasiljeva & Vasiljev, 1996 (p. 264, fig. 1; type locality: Mangyshlak region, Caspian Sea; holotype: ZMMSU P-19726) has been proposed for the *N. gorlap* of Berg (1949) and subsequent authors because they feeled that *N. gorlap* was 'nonvalid unpublished' (p. 262). According to them, the name was used by Iljin in a manuscript which has never been published and is now lost (p. 261). Berg (1949) obviously had access to the manuscript and included some of Iljin's data; his use of the name makes the name available, with Iljin in Berg as author. Vasiljeva & Vasiljev list several subsequent authors who used the name (as a subspecies of *N. kessleri*) and mentionned morphological, osteological and karyological differences between *N. gorlap* and *N. kessleri*; if *N. gorlap* had not been available from Berg (1949) each of these papers using the name *N. gorlap* with descriptive material would be enough to make *N. gorlap* an available name. *Neogobius iljini* is thus a junior synonym of *N. gorlap*.

27.7.5 *Neogobius melanostomus* (Pallas, 1814)

Gobius melanostomus Pallas, 1814: 151 (type locality: "Chersonesus, Portu Symbolorum" [Sevastopol, Crimea / Balaklava, Ukraine; Berg, 1949: 1083]; syntypes: LU)

Gobius Cephalarges Pallas, 1814: 155 (type locality: Theodosianus [Feodosiya], Crimea, Ukraine; holotype: LU; see Pinchuk, 1976: 550 for discussion of unpublished figure)

Gobius Chilo Pallas, 1814: 156 (type locality:

Theodosianus [Feodosiya], Crimea, Ukraine; holotype: LU)

Gobius Melanio Pallas, 1814: 157 (type locality: Black Sea; syntypes: LU [or holotype ? see Berg, 1949: 1083])

Gobius virescens Pallas, 1814: 158 (type locality: Theodosianus [Feodosiya], Crimea, Ukraine; syntypes: LU)

Gobius exanthematosus Pallas, 1814: 160 (type locality: shores of Crimea, Ukraine; syntypes: LU)

Gobius affinis Eichwald, 1831: 75 (type locality: "in caspii maris sinu balchanensi" [Balkhan Bay, Caspian Sea; Berg, 1949: 1085]; syntypes: LU)

Gobius sulcatus Eichwald, 1831: 75 (type locality: "in caspii maris sinu balchanensi" [Balkhan Bay, Caspian Sea; Berg, 1949: 1085]; syntypes: LU)

Gobius lugens Nordmann, 1840: 414, pl. 9 fig. 1 (type locality: river Codor [Corax] near Drandarium, Abkhazia; syntypes: LU)

Gobius Grossholzii Steindachner, 1894: 447, pl. 2 fig. 1 (type locality: lake Küjük Cekmedze near Constantinopel [Istanbul], Turkey; syntypes: NMW 34032–062, 49912 [36])

27.7.6 *Neogobius syrman* (Nordmann, 1840)

Gobius Syrman Nordmann, 1840: 419, pl. 12 fig. 1 (type locality: near Odessa and lagoon communicating with river Dniester, Ukraine; lectotype: the specimen illustrated by Nordmann, designated by Pinchuk, 1976: 546 [possibly among the following syntypes: MNHN A.1126 ? [1], Bauchot et al., 1991: 40, NMW 30099 ? [1]])

Gobius Trautvetteri Kessler, 1859b: 244 (type locality: limans of river Bug in Nikolaev and limans of river Dniester, Ukraine; syntypes: ZISP ?, NMW 30125 [1], 30127 [1])

Gobius hybridus Iljin, 1956: 190 (type locality: Kertch, Crimea, Ukraine; holotype: ZISP 55a)

27.8.1 *Padogobius bonelli* (Bonaparte, 1846)

Gobius fluviatilis Nardo, 1824: 229, 230 [7, 8 of reprint] (type locality: not stated [streams draining to the Adriatic Sea, possibly near Pavia, Italy; syntypes: LU; junior primary homonym of *Gobius fluviatilis* Pallas, 1814: 162)

Gobius fluviatilis Valenciennes, in Cuvier & Valenciennes, 1837: 52 (type locality: streams of "Sardegna" [probably Piemonte, then included in Kingdom of Sardegna; Tortonese, 1975: 312], lake Aviglia [Avigliana, Torino] and lake Maggiore, Italy; syntypes: MNHN 2729 [2], A.1335 [2], A.1336 [3], A.1337 [1], A.1338 [1], A.1368 [4], Bauchot et al., 1991: 32; junior primary homonym of *G. fluviatilis* Pallas, 1814: 162 and *Gobius fluviatilis* Nardo, 1824: 229)

Gobius bonelli Bonaparte, 1846: 95 (replacement name for *G. fluviatilis* Bonelli [in Cuvier & Valenciennes, 1837])

Gobius martensii Günther, 1861: 15 (type locality: river Ticino, Italy; syntypes: BMNH [2])

Systematic notes. See Gandolfi & Tongiorgi (1974: 97) for a redescription of this species.

Nomenclatural notes. Gandolfi & Tongiorgi (1973: 262; 1974: 97) considered that *Gobius bonelli* had to be rejected as a nomen oblitum according to ICZN because it had not been used in the previous 60 years. Actually there is (was) no such obligation: this merely was an option given by the 1964 Code. Anyway, this was only possible between 6 November 1961 and 1 January 1973 (see ICZN art. 79(c)(iii), Glossary 'nomen oblitum'). As Gandolfi & Tongiorgi's papers appeared in 1973 and 1974, the rejection of *G. bonelli* was no longer possible; thus it is the oldest available and valid name for the present species.

Bonaparte (1846: 95) proposed *G. bonelli* as a replacement name for '*G. fluviatilis* Bonelli' [in p. 64, he listed it as *G. fluviatilis* Bonelli, but in his addenda, p. 95, he added *G. fluviatilis* Pallas, 1814, stating that it is not Bonelli's species which he recognises under the name *G. bonelli*]. The species has regularly been referred to as '*Gobius fluviatilis* Bonelli, in Cuvier & Valenciennes, 1846'. Valenciennes (in Cuvier & Valenciennes, 1837: 52) considered Bonelli as author of the name; he probably had received the specimens from Bonelli under that unpublished name; it was a common practice of that time to use unpublished names and to attribute the authorship to the person who created it, even if unpublished. Under present rules of nomenclature (ICZN art. 50(a)), Valenciennes is the only author of the name.

Tortonese (1940: 144) considered three specimens (MZUT 848) as probably part of the type series and he attributed the authorship of the species to Bonelli. As the species has been described by Valenciennes and as there is no evidence that Valenciennes had examined the specimens in MZUT, these specimens cannot be part of the type series.

27.8.2 *Padogobius nigricans* (Canestrini, 1867)

Gobius fluviatilis nigricans Canestrini, 1867: 11 (type locality: river Arno, Italy; syntypes: LU [4])

Gobius avernensis Canestrini, 1868: 169 (type locality: river Arno, Italy; syntypes: LU [at least 4])

Systematic notes. See Gandolfi & Tongiorgi

(1974: 105) and Pirisinu & Natali (1980) for redescriptions of this species.

27.9.1 *Pomatoschistus bathi* Miller, 1982

Pomatoschistus bathi Miller, 1982: 6, figs. 1–2 (type locality: Erdek, Bandirma, Sea of Marmara, Turkey; holotype: SMF 16431)

27.9.2 *Pomatoschistus canestrinii* (Ninni, 1883)

Gobius Canestrinii Ninni, 1883: 276, pl. 15 figs. 1–5 (type locality: Estuario di Venezia, Italy and river Jadro, Salona [near Split], Dalmatia [Croatia]; syntypes: NMW 28817–818 [2], 29943–945 [3])

Gobius jadrensis Giglioli, in Ninni, 1883: 276 (nomen nudum)

Systematic notes. See Gandolfi et al. (1982) for a redescription of the species.

27.9.3 *Pomatoschistus marmoratus* (Risso, 1810)

Atherina marmorata Risso, 1810: 339 (type locality: Nice, France; type material: NT, Bauchot et al., 1991: 51)

Gobius reticulatus Valenciennes, in Cuvier & Valenciennes, 1837: 50 (type locality: Sicilia, Italy and Nice, France; syntypes: MNHN A.1247 [1], 205 [1], Bauchot et al. 1991: 39; junior homonym of *G. reticulatus* Eichwald, 1831: 77)

Gobius leopardinus Nordmann, 1840: 436, pl. 13 fig. 4 (type locality: near Sevastopol, Crimea, Ukraine; holotype: MNHN A.1402 [1], Bauchot et al., 1991: 35)

Gobius rhodopterus Günther, 1861: 16 (replacement name for *Gobius reticulatus* Valenciennes, in Cuvier & Valenciennes, 1837)

Gobius ferrugineus Kolombatovic, 1891: 18 (type locality: Spalato [Split], Dalmatia, Croatia; syntypes: NMW 29363 [12], 37509–519 [11], 77868 [15])

Syrrhothonus Charrieri Chabanaud, 1933: 1249 (type locality: Tanger, Morocco; holotype: LU, Bauchot et al., 1991: 61)

Nomenclatural notes. The specimens listed as the holotype and paratype of *Gobius reticulatus* by Bauchot et al. (1991: 39) are actually syntypes. The specimen they list (1991: 35) as potential syntype of *G. leopardinus* is actually the potential holotype as Nordmann (1840: 436) explicitly stated that he had a single specimen [but the locality data differ slightly: Tauria, vs. Sevastopol; Tauria is a former name for Crimea].

27.9.4 *Pomatoschistus microps* (Krøyer, 1838)

Gobius microps Krøyer, 1838: 416 (type locality: Hirtsholmene, northern Kattegat, Denmark; holotype: ZMUC 72, Nielsen, 1974: 79)

Gobius pusillus Lowe, **1874: 32** (type locality: [King's] Lynn, Norfolk, England; syntypes: LU; junior homonym of *G. pusillus* Canestrini, 1861) from Miller, in Hureau & Monod, 1973: 509

Gobius minutus var. *minor* Heincke, 1880: 317 (type locality: river Schlei, bay of Kiel, Korsör, and Dassow, Germany; syntypes: LU)

Gobius laticeps Moreau, 1881: vol. 2, 215, figs. 103–104 (type locality: St. Valéry-en-Craux, Manche, France; holotype: MNHN 1898–395, Bauchot et al., 1991: 35)

Gobius Parnelli Day, 1881: 167, pl. 52 fig. 5 (type locality: Weston-super-Mare, Somerset, England; syntypes: BMNH ?)

Gobius microps var. *puckensis* Lawacz, 1965: 141, fig. 7 (infrasubspecific [ICZN art. 45 (g) (i)], name not available; locality: Baltic Sea, Puck Bay near Gdansk, Poland)

27.9.5 *Pomatoschistus minutus* (Pallas, 1770)

Gobius minutus Pallas, 1770: 4 (available by indication to Gronovius, 1763: 81, n. 276; type locality: "maris Belgici" [seas of Belgium]; syntypes: LU)

Gobius gracilis Jenyns, 1835a: 25 (nomen nudum); Yarrell, 1835: vol. 1: 260 (type locality: Colchester [Essex, U.K.]; syntypes: LU); Jenyns, 1835b: 387 (locality: Colchester [Essex, U.K.])

Gobius unipunctatus Parnell, 1838b: 243, pl. 29 (type locality: Firth of Forth in the neighbourhood of South Queensferry / Solway Frith / Exmouth on coast of Devon, U.K., syntypes: LU); also 1839a: 138, pl. 5

Gobius Ekströmi Günther, 1861: 57 (type locality: river Gotha [Göta älv], Sweden; holotype: BMNH)

Gobius elongatus Canestrini, 1861: 150, pl. 8 fig. 5 (type locality: Golf of Genova, Italy; syntype [total 4]: MSNG 12646 [1], Tortonese, 1963: 343)

Gobius gracilis Cabrera, in Steindachner, 1868: 401 (nomen nudum; junior homonym of *G. gracilis* Jenyns, 1835b)

Gobius cobitiformis Kessler, **1874b: 211** (type locality: Sevastopol, Crimea, Ukraine; syntypes: ZISP ?) from Miller, in Hureau & Monod, 1973: 506

Gobius Taalmankipii Hubrecht, 1878: 17 (type locality: North Sea; syntypes: LU [5])

Gobius minutus var. *major* Heincke, 1880: 313 (type locality: Bay of Kiel, Germany; syntypes: LU)

Gobius minutus var. *Guitelli* Le Danois, 1913: 88, figs. 147–148 (type locality: brackish waters in estuary of river Penzé [Roscoff], France; syntypes: LU)

Nomenclatural notes. See Nomenclatural notes under *Gasterosteus aculeatus* for publication dates of *Gobius gracilis* in Jenyns (1835a–b) and Yarrell (1835–36). Jenyns (1835b) refers to Yarrell (1835–36) with exact page numbers, so I conclude that Yarrell appeared first.

27.9.6 *Pomatoschistus tortonesei* Miller, 1968

Pomatoschistus tortonesei Miller, 1968: 221, fig. 1, pl. 1 (type locality: brackish water, Marsala, Sicilia, Italy; holotype: MSNG 41682)

27.10.1 *Proterorhinus marmoratus* (Pallas, 1814)

Gobius marmoratus Pallas, 1814: 161 (type locality: portum Ctenuntem, seu Sevastopolitanum Tauriae [Sevastopol], Crimea, Ukraine; syntypes: LU)

Gobius quadricapillus Pallas, 1814: 159 (type locality: sinu Theodosiano et littore Chersonesi [Feodosiya and Kherson], Crimea, Ukraine; syntypes: LU)

Gobius semilunaris Heckel, 1837: 152, pl. 8 figs. 5–6 (type locality: river Marizza [Maritsa] near Philippopoli in Rumelia [southern Bulgaria]; holotype: NMW 58144)

Gobius macropterus Nordmann, 1840: 434, pl. 13 fig. 2 (type locality: southern Crimea, Ukraine; syntypes: LU)

Gobius nasalis Filippi, 1863: 390 (type locality: Caspian Sea near Baku; syntypes: MZUT 672 [7], Tortonese, 1940: 144, MSNG 12655, 36228 [5], Tortonese, 1963b: 344, NMW 33894–896 [3])

Gobius rubromaculatus Kriesch, 1873: 371, pl. 6 (type locality: Altofner Therme, draining to river Danube [near Budapest], Hungary; syntypes: LU)

Gobius blennioides Kessler, 1877a: 12, pl. 1 fig. 4 (type locality: Baku Bay, Caspian Sea [Berg, 1949: 1100]; syntypes: LU)

Gobius marmoratus var. *nasalis pontica* Smitt, 1899: 544 (infrasubspecific, name not available; locality: Black Sea)

27.11.1 *Zosterisessor ophiocephalus* (Pallas, 1814)

Gobius ophiocephalus Pallas, 1814: 153 (type locality: coasts of Crimea, Ukraine; syntypes: LU)

? *Gobius viridis* Otto, 1821a: 1, 1821b: 7 (type locality: Nice, France; type material: NT ?)

? *Gobius filamentosus* Risso, 1826: 284 (type locality: not stated, probably around Nice, France; type material: NT)

Gobius reticulatus Eichwald, 1831: 77 (type locality: Black Sea near Odessa, Ukraine; syntypes: LU)

Gobius lota Valenciennes, in Cuvier & Valenciennes, 1837: 27 (type locality: Bologna and Sicilia, Italy / Martigues, France; syntypes: MNHN A.1040 [1], A.1039 [3], A.1171 [2], Bauchot et al., 1991: 35)

Gobius gous Chiereghini, in Nardo, 1847: 119 (type locality: lagoon of Venezia, Italy; syntypes: LU)

Gobius venetiarum Nardo, 1847: 120 (listed in synonymy, name not available)

Gobius venetiarum Nardo, 1860: 79 (nomen nudum; locality: Venezia, Italy)

Gobius ophiocephalus var. *citrina* Ninni, 1938: 154 (type locality: Sea of Marmara; syntypes: LU)

Citharidae

28.1.1 *Citharus linguatula* (Linnaeus, 1758)

Pleuronectes linguatula Linnaeus, 1758: 270 (based on Artedi [1738, gen. [spec.] 17, syn. 31, Pleuronectes oculis a dextra ...] and Gronovius [1754: 15, n. 41, idem]; type locality: "in M. Europaeo"; type material: NT)

Pleuronectes macrolepidotus Bloch, 1787: 34, pl. 190 (type locality: Brasilian Sea; syntype: ZMB 7491 [1])

Pleuronectes citharus Spinola, 1807: 374 (type locality: Gulf of Genova, Italy; syntypes: LU)

Pleuronectes patarachia Nardo, 1847: 121 (listed in synonymy, name not available)

Systematic notes. Included on the basis of Ivanovic's (1973: 124) record from lake Skadar (FYROM and Albania). Additional records are needed to confirm the regular occurrence of this species in freshwaters.

Pleuronectidae

29.1.1 *Platichthys flesus* (Linnaeus, 1758)

Pleuronectes Flesus Linnaeus, 1758: 270 (based on Linnaeus [1746: 112, n. 300, Pleuronectes ... lateralis aspera], Artedi [1738: gen. [spec.] 17, syn. 33, Pleuronectes oculis a dextris ..., spec. [gen.] 59, Pleuronectes linea lateralis aspera ...], Gronovius [1754: 15, n. 40, idem] and Linnaeus [**1751: 326**, idem]; type locality: "in M. Europaeo"; potential syntypes: BMNH 1853.11.12:132–134 [3], NRM 20 [1], ? UUMZ 191 [1], Wheeler, 1958: 244, 1991: 189, Fernholm & Wheeler, 1983: 272)

Pleuronectes Passer Linnaeus, 1758: 271 (based on Artedi [1738: gen. [spec.] 18, syn. 32, Pleuronectes ... laterali aculeata]; type locality: "in Oceano Europaeo"; type material: NT)

Pleuronectes flesoides Pontoppidan, 1765: 188, pl. 15 (type locality: Denmark; type material: NT ?)

Pleuronectes Roseus Shaw, 1803: vol. 4 (2): 302, pl. 43 (type locality: river Thames, U.K.; holotype: "Leverian Museum")

Pleuronectes luscus Pallas, 1814: 427 (type locality: Theodosia [Feodosiya], Crimea; syntypes: LU)

Platessa carnaria Brown, **1830: 99, pl. 2** (type locality: Prestonpans, Scotland, U.K.) from Costa Pereira, pers. comm.

Platessa glabra Rathke, **1837: 352** (Kerch, Crimea) from Berg, 1949: 1190

Platichthys flesus var. *marmorata* Nordmann, **1840: 534, pl. 28 fig. 1** (type locality not stated [Black Sea]) from Costa Pereira, pers. comm.

Pleuronectes italicus Günther, 1862b: 452 (type locality: Dalmatia [Croatia]; holotype: BMNH 1842.6.7:3, Nielsen, in Hureau & Monod, 1973: 626)

Flesus vulgaris Moreau, 1881: vol. 3: 299 (unnecessary replacement name for *Pleuronectes flesus* Linnaeus, 1758)

Pleuronectes flesus var. *trachurus* Duncker, 1892: 280, 291 (type locality: Baltic Sea at mouth of river Trave, Germany; syntypes: ? ZMH)

Pleuronectes flesus var. *leiurus* Duncker, 1892: 281, 291 (type locality: river Elbe in Hamburg, Germany; syntypes: ? ZMH)

Pleuronectes Bogdanovii Sandeberg, 1878: 236, figs. 1–2 (type locality: White Sea; syntypes: LU)

Pleuronectes flesus race *septentrionalis* Suvorov, **1925: 280** (infrasubspecific, name not available; Kola Bay, Russia) from Berg, 1949: 1189

Pleuronectes flesus race *baltica* Suvorov, **1925: 280** (infrasubspecific, name not available; Baltic Sea) from Berg, 1949: 1186

Pleuronectes flesus caninensis Suvorov, **1929: 111** (type locality: rivers falling into Chosha Bay, Arctic Ocean, Russia) from Berg, 1949: 1189

Pleuronectes flesus septentrionalis Berg, 1949: 1189, fig. 941 (type locality: Murman and as far eastward as the Pechora Bay, enters rivers, e.g., river Tuloma in Murman, Russia; syntypes: ZISP)

29.2.1 *Pleuronectes glacialis* Pallas, 1776

Pleuronectes glacialis Pallas, 1776: 706 (type locality: Arctic Ocean [p. 32: Kara Bay, Berg, 1949: 1181]; syntypes: LU)

Pleuronectes cicatricosus Pallas, 1814: 424 (type locality: mari inter Camtschatcam et Americam [Bering Sea]; syntypes: LU)

Platessa dwinensis Lilljeborg, 1850: 5 (type locality: river Dwina near its estuary in Archangel, Russia; syntypes: LU); also in 1851: 306, pl. 20

Pleuronectes glacialis caninensis Suvorov, **1929: 119** (Chosha Bay, Arctic Ocean) from Berg, 1949: 1181

Liopsetta glacialis knipowitschi Esipov, **1939: 171, fig. 2** (Gulf of Ob at Cape Drovyanyi, Siberia, Arctic Ocean) from Berg, 1949: 1181

Systematic notes. Formerly placed in genus *Liopsetta*. Generic position follows Sakamoto (1985: 209).

29.2.2 *Pleuronectes platessa* Linnaeus, 1758

Pleuronectes platessa Linnaeus, 1758: 269 (based on Linnaeus [1746: 113, n. 301, Pleuronectes oculis dextris ...], Artedi [1738, gen. [spec.] 17, syn. 31, Pleuronectes oculis dextris & tuberculis ...], Linnaeus, **1747: 179**, Pleuronectes oculis dextris ...; **1751: 326**, Pleuronectes Slatrvar] and Gronovius [1754: 14, n. 36, Pleuronectes oculis dextris & tuberculis ...]; type locality: "in M. Europaeo"; syntypes: BMNH 1853.11.12:130–131 [2], Wheeler, 1958: 243)

Platessa vulgaris Cloquet, 1826: 403 (unnecessary replacement name for *Pleuronectes platessa* Linnaeus, 1758)

Pleuronectes borealis Faber, 1828: 244 (type locality: Iceland, North and West Jutland and Kattegat not south of the island Anholt, Denmark; type material: NT ?)

Platessa latus Cuvier, 1829: 339 (type locality:

"sur nos côtes"[France]; syntypes: ? MNHN)

Pleuronectes platessa variet. *baltica* Nilsson, 1855: 616 (type locality: Sund, Baltic Sea [Berg, 1949: 1179]; syntypes: LU)

Systematic notes. Formerly placed in genus *Liopsetta*. Generic position follows Sakamoto (1985: 209).

Hybrids and incertae sedis

The following nominal species have later been considered to be hybrids. The list does not include names made of the combination of two generic and two specific names (e.g., *Squalio-alburnus cephalolucidus*). Names explicitly proposed for hybrids are not available (ICZN art. 1(b)(3)); names proposed for fishes which have later been considered as hybrids are available but cannot be used (ICZN arts. 17(1), 23(h)); names proposed for fish considered as hybrids by an earlier author but considered a distinct species by the author proposing the name are available (e.g., *Chondrostoma lemmingi steindachneri* Berg, 1932) even if these fishes are later considered again as hybrids.

30.1.1 Acipenseridae

Acipenser brandtii Günther, 1870: 336 (type locality: Black and Caspian Seas; syntypes: material described and illustrated by Brandt & Ratzeburg, 1833: 350, pl. 1a fig. 2; hybrid *Huso huso* × *Acipenser nudiventris*, Berg, 1911: 169)

Acipenser Helenae Duméril, 1870: 258 (type locality: Russia; syntypes: MNHN [2]; ? hybrid *Acipenser ruthenus* × *Acipenser gueldenstaedti*, Berg, 1911: 239)

Acipenser primigenius Chalikov, **1944: 47** (northern Caspian Sea; hybrid *A. ruthenus* × *A. gueldenstaedti*, Berg, 1949: 77)

30.1.2 Cyprinidae

Abramis cenomanensis Selys-Longchamps, 1870: 113 (listed in synonymy and proposed for an hybrid, name not available; locality: river Sarthe, France; hybrid *Blicca bjoerkna* × *Scardinius erythrophalmus*; author listed as Anjubault, but Selys-Longchamps is actual author)

Abramis dobuloides Günther, 1857: 51, pl. 2 (type locality: river Neckar / stream Blaulach, Tübingen, Germany; syntypes: LU; hybrid *Leuciscus dobula* × *Alburnus alburnus*, Günther, 1868: 223)

Abramis Heckelii Selys-Longchamps, 1842: 217, pl. 8 (type locality: vicinity of Bruxelles and river Meuse, Belgium / Abbeville, Somme, France; syntypes: ISNB 110 [1], NMW 55253 ? [3]; hybrid *Abramis brama* × *Rutilus rutilus*, Günther, 1868: 214)

Abramis Leuckartii Heckel, 1836: 229, pl. 20 fig. 5 (type locality: river Danube near Fischament, downriver of Wien, Austria; syntypes: NMW 55331 [1]; hybrid *Rutilus rutilus* × *Abramis brama*, Günther, 1868: 214, Berg, 1949: 531)

Abramis rhinosimus Linstow, 1878: 248 (proposed for an hybrid, name not available; hybrid *Rutilus rutilus* × *Vimba melanops*, Linstow, 1878: 248)

Alburnus Leydigi Knauthe, 1893a: 416, 1893b: 488 (proposed for an hybrid, name not available; locality: Schlaupitz, Kr. Reichenbach u. d. Eule, Schlesien [now Poland]; hybrid *Leucaspius delineatus* × *Alburnus alburnus*, Berg, 1912: 333)

Alburnus rosenhaueri Jäckel, 1866: 20 (proposed for an hybrid, name not available; locality: river Altmühl at Herrieden, Bayern, Germany; hybrid *Scardinius erythrophthalmus* × *Blicca bjoerkna*, Berg, 1912: 285)

Alburnus tauricus Kessler, 1859a: 534 (type locality: market in Simpheropol, Crimea, Ukraine, said to be from river Solghir; syntypes: ZISP ? [2]; hybrid *Leuciscus cephalus* × *Chalcalburnus chalcoides*, Berg 1949: 557)

Aspius margaritaceus Siebold, 1863a: 168 (proposed for an hybrid, name not available; hybrid *Scardinius erythrophthalmus* × *Alburnus alburnus*, ? Benecke, 1884: 229)

Bliccopsis alburniformis Siebold, 1863a: 168 (proposed for an hybrid, name not available; locality: Koenigsberg [now Kaliningrad, Russia]; hybrid *Blicca bjoerkna* × *Alburnus alburnus* Selys-Longchamps, 1887: 1078)

Bliccopsis erythrophthalmoides Jäckel, 1864: 49 (proposed for an hybrid, name not available; localities: rivers Altmühl and Wieseth, Bayern, Germany; hybrid *Scardinius erythrophthalmus* × *Blicca bjoerkna*)

Brama isognathus Bleeker, 1862: 235 (type locality: river Rhine in Leiden, Netherlands; holotype: RMNH ?; hybrid *Scardinius erythrophthalmus* × *Blicca bjoerkna*, Berg, 1912: 285)

Chondrostoma lemmingi steindachneri Berg, 1932a: 144 (available by indication to Steindachner [1866c: 21, pl. 4 fig. 2, "bastard von *Ch. polylepis* und *Leuciscus (Leucos) arcasii*"]; type locality: river Tera, Spain; syntypes: NMW 52569 [5]; hybrid *Chondrostoma polylepis* × *Rutilus arcasii*, Elvira, 1987: 138)

Chondrostoma Reiseri Steindachner, 1893: 239 (type locality: Busko Blato near Zupanjac, south of Livno, Bosnia; holotype: NMW 55524; hybrid *Chondrostoma phoxinus* × *Phoxinellus alepidotus*, Elvira, 1987: 138)

Carpio Sieboldii Jäckel, 1864: 21 (proposed for an hybrid, name not available; hybrid *Cyprinus carpio* × *Carassius carassius*)

Cyprinus abramo-rutilus Holandre, 1837a: 3 (type locality: river Moselle downriver of Malroy, France; syntypes: LU; hybrid *Abramis blicca* × *Rutilus rutilus*, Günther, 1868: 215)

Cyprinus Buggenhagii Bloch, 1784: 137, pl. 95 (type locality: river Pene and related lakes in Swedish Pommern [now Mecklenburg-Vorpommern, Germany]; holotype: ZMB 4106; hybrid *Abramis brama* × *Rutilus rutilus*, Günther, 1868: 214)

Cyprinus Carpio var. *latus* Fitzinger, 1832: 334 (indication to Marsilii [1726: 61, pl. 21, Cyprinus III; "circa Albim, circa Danubium"]; proposed for an hybrid, name not available; junior primary homonym of *Cyprinus latus* Gmelin, 1788)

Cyprinus dolabrata Holandre, 1837a: 3 (type locality: river Moselle, France; syntypes: LU; hybrid *Leuciscus dobula* × *Alburnus alburnus*, Günther, 1868: 223)

Cyprinus Kollarii Heckel, 1836: 223, pl. 19 fig. 2 (type locality: lake Neusiedlersee, Austria; syntypes: NMW 56166 [1], 56169 [1], 56171 [1], 56172 [1]; hybrid *Cyprinus carpio* × *Carassius carassius*, Günther, 1868: 31)

Cyprinus striatus Holandre, 1837a: 2 (type locality: ditches of the city of Metz, river Moselle, ponds of Belletanche, France; syntypes: LU [2]; hybrid *Cyprinus carpio* x *Carassius carassius*, Günther, 1868: 31)

Leuciscus affinis Valenciennes, in Cuvier & Valenciennes, 1844: 150 (type locality: Gand, Belgium; holotype: MNHN 3354, Almaça, 1969: 1119; hybrid *Rutilus rutilus* × *Scardinius erythrophthalmus*, Günther, 1868: 214, Almaça 1969, Fang, 1942a: 169)

Leuciscus alburnolucidus Linstow, 1878: 247 (proposed for an hybrid, name not available; locality: Hameln ?, Germany; hybrid *Rutilus rutilus* × *Alburnus alburnus*)

Leuciscus carii Knauthe, 1893a: 418 (proposed for an hybrid, name not available; hybrid *Leucaspius delineatus* × *Rutilus rutilus*)

Leuciscus dvinensis Plater, **1861** (proposed for an hybrid, name not available [ICZN art. 1(b)(3)]; river Düna, Latvia; parent species not stated) from Dybowski, 1862: 95

Leuciscus Lapacinus Steffani, Serra, Loffredo & Fossa, 1987: 15, pl. 1 (type locality: Lago di S. Croce, Alpago, Italy; holotype: Istituto di Zoologia, Universita, Cagliari; hybrid *Alburnus alburnus* × *Leuciscus cephalus*, Bianco, 1988a: 152)

Scardinopsis alburniformis Benecke, 1884: 228 (proposed for an hybrid, name not available; locality: Deutsch-Eylau [now Ilawa, Poland]; hybrid *Scardinius erythrophthalmus* × *Blicca bjoerkna*, Berg, 1912: 285)

Scardinopsis amphigenus Selys-Longchamps, 1870: 112 (proposed for an hybrid, name not available; locality: Belgium [Longchamps-sur-Geer; Selys-Longchamps, 1887: 1078]; hybrid *Rutilus rutilus* × *Scardinius erythrophthalmus*)

Scardiniopsis anceps Jäckel, 1864: 64 (proposed for an hybrid, name not available; localities: river Altmühl, Bayern, Germany; hybrid *Rutilus rutilus* × *Scardinius erythrophthalmus*)

Squalius Anjubaulti Selys-Longchamps, 1870: 113 (proposed for an hybrid, name not available; locality: river Loire bassin [river Sarthe near Le Mans; Selys-Longchamps, 1887: 1081], France; hybrid *Leuciscus leuciscus* × *Alburnus alburnus*)

30.1.3 Incertae sedis

The following names are either not identifiable with any known species (usually because their 'description' is very laconic, inaccurate or simply missing) or are not available because they are based on theoretical concept (that is hypothetical taxa)

Cobitis pannonica Heckel, 1848: 194 (nomen nudum; locality: lake Neusiedler, Hungary [and Austria])

Cyprinus asper Schmidt, 1795: 67 (nomen nudum; locality: river Moldau [Vltava], Czech Republic)

Cyprinus ellicola Hermann, 1804: 318 (type locality: not stated [Strasbourg, France ?]; holotype: LU)

Knipowitschia mrakovcici Mrakovcic, Misetic & Povz, 1995: 185 (nomen nudum; locality: river Krka, Croatia)

Leuciscus scaverde Bonaparte, 1845: 10 (nomen nudum)

Phoxinellus italicus Bonaparte, 1845: 6 (type locality: southern Italy; syntypes: LU)

Salmo trutta mediterranea Balon, 1968: 12; Karakousis & Triantaphyllidis, 1989: 302 (based on an hypothetical concept, name not available, ICZN art. 1(b)(1))

Epilogue

An unanswered question is very often a question which has not been asked properly.

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INDEX

Subspecies and infrasubspecific names are listed under generic name in alphabetical sequence and with omission of species and other intercalate names or words (e.g. *Acipenser güldenstaedti* var. *golis* is listed as *Acipenser golis*). Accidental misspelling of generic names are corrected (e.g. *Acipenser* for *Acipense*); misspellings of species names are not corrected. Unless involved in nomenclatural discussions, introduced taxa are not indexed.