

This article was downloaded by: [North Carolina State University]
On: 09 October 2012, At: 14:01
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number:
1072954 Registered office: Mortimer House, 37-41 Mortimer Street,
London W1T 3JH, UK



Journal of Natural History Series 8

Publication details, including instructions
for authors and subscription information:
<http://www.tandfonline.com/loi/tnah14>

XL.—The classification of existing Felidæ

R.I. Pocock F.R.S.

Version of record first published: 15 Sep
2009.

To cite this article: R.I. Pocock F.R.S. (1917): XL.—The classification of
existing Felidæ, *Journal of Natural History Series 8*, 20:119, 329-350

To link to this article: <http://dx.doi.org/10.1080/00222931709487018>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.tandfonline.com/page/terms-and-conditions>

This article may be used for research, teaching, and private study
purposes. Any substantial or systematic reproduction, redistribution,
reselling, loan, sub-licensing, systematic supply, or distribution in any
form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make
any representation that the contents will be complete or accurate
or up to date. The accuracy of any instructions, formulae, and drug
doses should be independently verified with primary sources. The
publisher shall not be liable for any loss, actions, claims, proceedings,
demand, or costs or damages whatsoever or howsoever caused

arising directly or indirectly in connection with or arising out of the use of this material.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[EIGHTH SERIES.]

No. 119. NOVEMBER 1917.

XL.—*The Classification of existing Felidæ.*
By R. I. Pocock, F.R.S.

Introduction.

The number of names quoted below in the lists of suggested synonymy attests the prevalence amongst zoologists, during the last half century or thereabouts, of the conviction that the genus *Felis* of Linnæus was capable of division into several genera. Severtzow and Gray were the most prolific proposers of titles of this rank. Severtzow, however—perhaps wisely,—made no attempt to define his genera; and the characters embodied in the definitions given by Gray seemed scarcely important enough to justify his efforts. Gray began his schismatic work in 1821 and finished it in 1869, overlapping Severtzow, who published in 1858; but since Gray was ignorant of Severtzow's paper, or possibly purposely passed it by because of the omission of diagnoses, the inevitable result was chaotic confusion in the generic nomenclature thus independently suggested.

Other authors have given generic titles to isolated species without attempting a comprehensive revision of the whole group. The only genus dismembered from *Felis* which has met with unanimous acceptance is *Acinonyx* or *Cynailurus*, of which *jubatus* is the type; but the frequency with which a certain measure of recognition has been specially accorded to *Lynx* luminously reflects the general character of the systematic efforts of authors, because of all the groups of species into which the cats can be divided *Lynx* is itself most nearly related to *Felis*, as exemplified by its typical form.

Practically the only modern classifications employing a selection of the generic terms previously published by Gray, Severtzow, and others are those proposed by Matschie (SB. Ges. nat. Fr. Berlin, 1895, pp. 198-199) and Trouessart (Cat. Mamm., Suppl. pp. 265-278, 1904).

Matschie grouped the species as follows :—

Genus *Uncia concolor, tigris, leo*.

- „ *Leopardus pardus* (including *uncia*), *onca*.
- „ *Galeopardus viverrina, marmorata, serval, pardalis*.
- „ *Felis microtis, scripta, shawiana, bengalensis, rubiginosa, ornata, nigripes, tigrina, macrura* [wiedii], *geoffroyi, guigna*.
- „ *Catus catus, manul, caudata, planiceps, chaus, maniculata* [ocrea], *pajeros, colocolo*, etc.
- „ *Lynx lynx, caracal*, etc.
- „ *Neofelis nebulosa*.
- „ [Self-coloured Cats] *temmincki, aurata, yaguarondi*.

Trouessart followed Matschie in some respects, but used in several cases different names :—

Genus *Felis*.

Subgen. *Uncia leo, tigris, concolor*.

- „ *Leopardus pardus, uncia, onca*.
- „ *Zibethailurus viverrina, marmorata, nebulosa, serval, pardalis*.
- „ *Oncoides microtis, shawiana, scripta, bengalensis, rubiginosa, ornata, wiedii, tigrina, geoffroyi, guigna*.
- „ *Felis catus, manul, planiceps, libyca* [ocrea], *nigripes, pajeros, colocolo*.
- „ *Catopuma temmincki, badia, aurata, yaguarondi*.

Genus *Lynx* with subgen. *Lynx, Cervaria, Caracal*.

I have elsewhere* criticised, both from the systematic and nominal standpoints, Matschie's genera *Uncia* and *Leopardus*. Neither in these cases nor in the case of the rest of the genera are any reasons vouchsafed for the specific groupings or for the names employed; and since such widely different forms as *planiceps*, *manul*, and *colocolo* are placed in the same genus and such closely related forms as *ornata* and *ocrea* in different genera†, further discussion of the

* Ann. & Mag. Nat. Hist. (8) xviii. p. 316 (1916).

† The same applies to Grévy's classification (Nov. Acta. Kais. Acad. Leop. lxiii. no. 1, pp. 76-77, 1894). Although this author adopted what he called subgenera, it does not appear to me that the names are worth quoting in synonymy when such subgeneric terms as "*Unicolores*," "*Cati*," and "*Pardina der alten Welt*," are enlisted with *Servalina*, *Tigrina*, and others. The names, at any rate, are in all cases antedated.

question would be profitless. So also with Trouessart's classification. The truth is that neither of these authors had sufficient acquaintance with the forms dealt with to allocate them otherwise than by conjecture. Moreover, their choice of generic and subgeneric terms was by no means in accordance with the rules of nomenclature.

In a series of five papers* on the existing Felidæ, I have recently discussed various characters, both cranial and external, which—for the most part, at all events—have not been employed hitherto in the discrimination of species and genera. Particular attention was drawn to the structure of the hyoid apparatus, of the tympanic bulla, of the feet and the rhinarium, and it was shown (1) that *F. leo*, *tigris*, *onca*, *pardus*, and *uncia*, which differ from the rest of the family in having the suspensorium of the hyoid imperfectly ossified, constitute a little group of Felidæ containing two genera, *Panthera* and *Uncia*; (2) that *Acinonyx* may be distinguished by the complete absence of cutaneous sheaths guarding the claws; and (3) that in the remaining species, all provisionally referred to *Felis*, there is very considerable variation in the structure of the feet, the size and shape of the rhinarium, and the structure of the auditory bullæ. These characters and others have been used in the following attempt to classify the existing species of Felidæ; but my main purpose in publishing what follows has been to show the true relationship of the species to one another, so far as it can be determined, and to dispose of such prevalent but fictitious groupings as those which imply that the lion (*leo*) and the puma (*concolor*) are closely allied and that the lynx (*lynx*) differs more from the domestic cat (*catus*) than the latter differs from the tiger (*tigris*) †.

The consideration of generic names, although of subordinate importance, has been inevitable. Probably no two authors will be quite in accord on the delimitation of the genera. In the present state of our knowledge and with the rapidly shifting conception of the value of the terms "genera" and "species," it would be idle to claim finality on this subject, and I do not pretend in all cases to have been consistent in the admission of species to generic rank. In some cases I may have gone too far, as in the severance of *Zibethailurus* from *Prionailurus*; in others not far enough,

* Ann. & Mag. Nat. Hist. (8) xviii. pp. 222-229, 1916 (Aug.); pp. 306-316 (Sept.); pp. 326-334 (Oct.); pp. 419-429 (Nov.), and xix. pp. 113-136, 1917 (Jan.).

† Perhaps the most important point connected with correctness of view on these and similar matters is that erroneous affiliation of species may be hopelessly misleading to students of geographical distribution.

as in the retention of *nigripes* and *chaus* in *Felis*, of *caracal* in *Lynx*, and of *rubiginosa* in *Prionailurus*. But such questions, in reality of no great moment, can easily be adjusted later, if modification is considered desirable.

Even if time and space had permitted, it would have been beyond my present purpose to attempt complete descriptions of the skulls of the genera admitted. Only the points that appeared to me useful in determining the genera have been referred to. Some of them may probably break down when further material is examined. Others, on the contrary, may be discovered or used; and since we are still in ignorance of the external characters of several of the genera, and since the study of the so-called tiger-cats of the tropics is hedged with difficulties, the classification, although I believe it to be in the main correct, is still in many respects tentative.

In the choice of names I have been guided strictly by priority, so far as it could be ascertained; and in the case of the names proposed by Severtzow line-priority has been taken as the determining factor in the selection.

The Subfamilies of Felidæ.

Reverting to the papers I have recently published on the external and cranial characters of cats, I propose to emphasize the characters distinctive of *Panthera* and *Uncia* and of *Acinonyx* as compared with the rest of the genera of Felidæ, by dividing this family into three subfamilies as follows:—

1. FELINÆ.—Suspensorium of the hyoid normally ossified, holding the larynx close up to the base of the skull and restricting its movement. Tips of the digits of both fore and hind feet furnished at least with a single cutaneous lobe protecting the retracted claw on the inner side of digits 2 and 3 and on the outer side of digits 4 and 5.

Containing the genera characterised in this paper.

2. ACINONYCHINÆ.—Resembling the Felinæ in the structure of the hyoid, but differing from them and from the Pantherinæ in the total suppression of the cutaneous lobes guarding the claws.

Genus *Acinonyx* (*Cynailurus*) for *jubatus*.

3. PANTHERINÆ.—Suspensorium of the hyoid imperfectly ossified, its inferior portion consisting of a larger or shorter elastic tendon conferring great mobility upon

the larynx, which is not held close up to the base of the skull. Feet like those of the Felinæ.

Genus *Panthera* for *leo*, *tigris*, *pardus*, *onca*.

„ *Uncia* for *uncia*.

The Genera of the Subfamily Fclinæ.

Genus FELIS, Linn.

Felis, Linn., 1758; type *catus*, Linn. (domestic cat).

Catus, Fitz., 1855, p. 265; type *catus*, Linn.

Catolynx, Severtzow, 1858, p. 385; type *catus*, Linn.

Otailurus, Severtzow, 1858, p. 388; type *megalotis*, Müll. (domestic cat from Timor).

Chaus, Gray, 1843, pp. 44-45; type *chaus*, Guld. (= *lybicus*, Gray).

Distr. Central and Southern Europe; South Asia to Burma; Africa apart from the western forested area.

Very small to medium-sized cats with long (*ocreata*) or moderately long (*chaus*) tails, usually short broad heads, reduced rhinarium, large, pointed, sometimes pencilled ears, never showing the white spot, vertically contracted ocular pupil and narrow paws with comparatively poorly developed claw-sheaths and moderately extensive emarginate webs.

Miller's full description* of the skull of *F. silvestris* and his comparison of the skull of *F. ocreata* (*sarda*) with it embody most of the characters of the typical species of this genus and make a repetition of the facts unnecessary.

The species may be referred to three categories:—

(1) Medium-sized cats from Europe, S.W. Asia, and Africa, e. g. *F. silvestris*, *ocreata*, *ornata*, and *caudata*, which are grouped closely round the typical form of the genus, *F. catus*, and the other domesticated breed, *F. torquata* †.

(2) Larger species ranging from Burma, through India, parts of Central Asia to South Africa, e. g. *F. chaus* (subspecies *furax* etc.) and *F. shawiana*, with the skull longer, narrower, less arched, and the zygomatica less salient than in the typical forms. These constitute the genus *Chaus* of Gray, defined by the comparative shortness of the tail.

(3) The very small South-African species *F. nigripes*, which in many of its cranial characters is like a dwarfed form

* Cat. Mamm. Centr. Europe, pp. 458-468 (1912).

† Miller admits three species of European cats, namely, *F. silvestris*, *F. sarda*, and *F. agrius*. *F. sarda*, however, appears to me to be at most a subspecies of *F. ocreata*, and there is no evidence that *F. agrius*, from Crete, was based upon anything but feral examples of the striped domestic cat (see P. Z. S. 1907, pp. 143-168).

of *F. ocreata* with certain peculiarities added. For instance, the suborbital portion of the malar arch is very deep, with its upper margin thin and the anteorbital thickening almost obliterated; the postorbital processes incline backwards, have a sinuous curvature, and an upturned anterior edge; the bullæ and auditory meatus are relatively enormous, and the inner lobe on the upper carnassial is greatly reduced (see Pocock, P. Z. S. 1907, pp. 669-674).

Genus *LYNX*, Kerr.

Lynx, Kerr, 1792, p. 41; type *lynx*, Linn.

Lynceus, Gray, 1821, p. 302 (preocc.); type *lynx*.

Lyncus, Gray, 1825, p. 339; type *lynx*.

Lynchus, Jardine, 1834, p. 274; type *lynx*.

Pardina, Kaup, 1829, p. 53; type *pardellus*, Miller.

Cervaria, Gray, 1867, p. 276 (preocc.); type *pardellus*, Miller.

Eucervaria, Palmer, 1903; type *pardellus*, Miller.

Caracal, Gray, 1843, p. 46; type *caracal*, Guld. (= *melanotis*, Gray).

Urolynchus, Severtzow, 1858, p. 388; type *caracal*, Guld.

Distr. Boreal and temperate latitudes of northern hemispheres as far south as the Mediterranean and Western Himalayas and Mexico (true lynxes); South-western Asia and the whole of Africa (caracals).

Medium-sized, short or comparatively short-tailed cats with large triangular tufted ears, short, broad heads, circular ocular pupils and large paws with well-developed claw-sheaths, comparatively short, emarginate webs.

Miller's description of the skulls of European lynxes and his detailed comparison between them and the skull of *F. silvestris* make a repetition of the facts unnecessary. He separates the genus *Lynx* from *Felis*, laying particular stress upon the doubtful characters afforded by the absence in *Lynx* of the small upper premolars. That the two genera are closely related is obvious from Miller's description, and this conclusion is confirmed by the similarity in the size and shape of the partition of the bullæ. The principal characters differentiating *Lynx* are supplied by the slender and gradually attenuated nasal branch of the premaxillæ, the thinner, less depressed, and sharper postorbital processes, the shallower notching of the suborbital edge of the palate, the proximity to the canine and more forward setting of the first large upper premolar.

The species fall into three groups* :—

(1) The typical lynxes (*Lynx* s. s.) comprising *L. lynx*, *pardellus*, *isabellinus*, and *canadensis*, and probably other species or subspecies.

(2) The lynxes of temperate America, *L. ruffus*, *fasciatus*, etc., which Allen and Bangs (see Proc. Biol. Soc. Wash. xi. pp. 48-49, 1897) have shown to differ in certain characters from the typical lynxes—namely, the narrower nose, longer junction between maxillæ and nasals, narrower presphenoid, less rounded mesopterygoid fossa, closer proximity between condyloid foramen and foramen lacerum posterius, longer tail, etc. Bangs proposed to distinguish these as a subgenus entitled *Cervaria* (*Eucervaria*), but this name belongs, as Miller has shown, to the Spanish lynx (*L. pardellus*), which does not exhibit the characters of the temperate American forms.

(3) The caracals (*L. caracal*) of Africa and India were distinguished generically by Gray on the strength of the longer tail and the alleged equality in length of the limbs. The latter feature is fictitious, caracals, like the true lynxes, being higher on the hind than on the fore limbs.

The skull resembles that of the lynxes in general characters, but is usually narrower in the cranial and facial portions, so that the zygomata appear more expanded. The nasals are usually less attenuated posteriorly, the preorbital foramen is longer, and the small upper premolar is often retained for a longer period. More important is the development of the external pterygoid crest, which recalls that of *Felis* and is practically suppressed in the true lynxes.

Genus TRICHÆLURUS, Satunin.

Otolobus, Severtz. 1858, p. 386 (preocc.); type *manul*, Pall.

Trichælurus, Satunin, pp. 495 (1905); type *manul*, Pall.

Distr. Central Asia as far south as the western Himalayas. One species known.

A small long-tailed cat with a broad head and short, rounded, widely separated ears, and a circular ocular pupil.

Skull, generally speaking, of the *Felis* and *Lynx* type, but broader and shorter, with the face steeply sloped from a point near the middle of the orbit; the orbits set higher, with a more forward aspect, their lower edge compressed,

* Not including the little-known *L. sardiniae*, Mola (Boll. Soc. Zool. Ital. Rome, (2) ix. p. 48, 1908), which has the tail relatively as long as in *L. caracal*.

without thickening, but a deep bridge above the preorbital foramen, and the malar continued as a thin strip up to the frontal in front of the lacrymal foramen; nasal branch of premaxilla not broad, evenly attenuated; anterior nares set low down, the upper edge hardly above the inferior edge of the orbit; palate wider than long, without conspicuous notch on the suborbital edge; basisphenoid markedly concave longitudinally; bulla advancing slightly in front of the glenoid ridge, its outer chamber as large as the inner, the partition extending to the occipito-sphenoidal suture; small upper first premolar and inner cusp of carnassial suppressed*.

Trichælurus is in some particulars intermediate between *Felis* and *Lynx*, the circular pupil, narrower premaxillæ, shallow notching of suborbital edge of palate, and suppression of small upper premolar being lyncine characters. The genus, however, may be easily distinguished by the sum of a number of structural peculiarities.

Genus PUMA, Jardine.

Puma, Jardine, 1834, p. 266; Severtzow, 1858, p. 123; type *concolor*, Linn.†.

Distr. From the United States to Patagonia.

Many species or subspecies, according to the fancy of authors.

Large, long-tailed cats with comparatively small, rounded, black ears without a white patch; the pattern‡, suppressed in the adult, consists in the cubs of solid dark spots and blotches of irregular shape, often arranged on each side in about four ill-defined rows and one along the spine; and on the head and nape there are often four longitudinal stripes and one running backwards from the eye beneath the ear, as in typical *Felidæ*. The rhinarium is naked above and moderately prominent. Except that the feet are broader, they do not differ greatly in form from those of *Felis* in the development of the webs and claw-sheaths.

The skull is short and broad, with complete sagittal crest, moderately deep and rounded postorbital constriction, quite short, widely separated postorbital processes, and salient

* For further particulars about this cat see Pocock, P. Z. S. 1907, pp. 299-306.

† Although Jardine included *F. yaguarondi*, *pajeros*, and others with *concolor* under *Puma*, *concolor* is indicated as the type-species by its ownership of the trivial name "puma," quite apart from the restricted association of the two names by Severtzow.

‡ See Ann. & Mag. Nat. Hist. (7) xx. pp. 442-445 (1907).

zygomata ; the muzzle is high and short, the anterior nares large, the nasal bones rather abruptly expanded distally, with longish narrow narial processes, and narrowed, sometimes strongly compressed, posterior portion ; the nasal branch of the premaxilla is narrow and the maxilla is tolerably evenly curved above ; the suborbital portion of the malar arch is thick, but the preorbital thickening is not well marked ; the palate is wide, and its orbital foramen is very large and comparatively close to the foramen of the optic nerve ; the mesopterygoid fossa is wide, short, parallel-sided, with rounded anterior rim, and the edges of the palate in front of it are widely divergent ; the spiniform process of the pterygoid descends somewhat abruptly, and the external pterygoid crest forms merely a short posterior projection or ridge ; the bullæ have a low internal partition, and a transverse line drawn from the stylomastoid divides the bulla into a larger anterior and a smaller posterior portion ; the occiput is wide across the mastoids, emarginate just above the level of the condyles and expanded above. The short upper post-canine space occupied by a well-grown first premolar.

Neither the pattern of the cub nor the structure of the skull indicates, in my opinion, close affiliation between *Puma* and any genus of the Felidæ. In general appearance the skull is, perhaps, most like that of *Lynx caracal* ; but there are many differences, notably the small size of the outer chamber and the lowness of the partition of the bulla in *Puma*, a particular in which *Puma* resembles the other American genera with exception of *Dendrailurus* ; but, apart from this, the skull exhibits none of the characteristics of other American cats.

Genus LEPTAILURUS, Severtz.

Leptailurus, Severtzow, 1858, p. 389 ; type *seval*, Schreb.

Galeopardus, Heuglin, 1866, p. 557 ; type *seval*.

Seval, Gray, 1867, p. 272 ; type *seval*.

One species only, with several local races*.

Distr. Africa, mainly south of the Sahara.

Medium-sized, long-legged, rather short-tailed cats, with narrow heads, very large rhinarium, large, rounded, unpencilled ears, closely juxtaposed on the summit of the head

* Two species have been admitted, namely, *seval* and *sevalina*. These, however, are now known to be merely varieties, the species being dimorphic in pattern (P. Z. S. 1915, i. p. 154), the two types of pattern symbolized by the names being found in the same litter.

and retaining the white spot, round ocular pupils and paws approximately as in *Felis*, but with the inner lobe of the sheath of the third digit of the fore foot much larger.

The skull differs from that of *Felis* in several points:—The submalar portion of the maxilla is much lower, the anterior end of the malar bone is greatly expanded and deflexed above the preorbital foramen, and the posterior half of the zygomatic arch is deeper as compared with the anterior portion; the postorbital process of the frontal rises farther forwards on the frontal bone; the nasal branch of the premaxilla is thinner, and the nasals themselves have no forward projection at the tip; the outer chamber and partition of the bulla are smaller, the posterior end of the partition being low and not confluent with the stylomastoid ridge, and, although the mesopterygoid fossa is broad in front and parallel-sided, the external pterygoid crest forms a longish ridge rising far in front of the root of the hamular, and the suborbital edge of the palate is less deeply notched.

In the characters supplied by the bulla, the lowness of the maxilla below the malar, the anterior expansion of the malar, the persistence of a well-developed first upper premolar, as well as in other characters of minor importance, the skull differs from that of *Lynx*.

Genus PRIONAILURUS, Severtz.

Prionailurus, Severtzow, 1858, p. 387; type *pardochrous*, Gray (= *ben-galensis*, Kerr).

Distr. Ceylon and India eastward to Borneo and the Philippines and northwards into China and Amurland.

Small cats with the structure of the rhinarium and feet unrecorded, but differing from *Felis* in having rounded white-spotted ears.

The skull recalls that of *Felis* at first sight, but differs therefrom in the sum of a number of characters. It is narrower as compared with its length and is less dome-shaped in profile view, the face being less steeply sloped from the interorbital region. The frontal postorbital processes are narrower, especially when seen from behind. The nasals are depressed, not everted apically, and the ascending or nasal branch of the premaxilla is more evenly attenuated. The inferior edge of the orbit is less salient, and the posterior half of the zygoma is less arcuate in profile view. The mesopterygoid fossa is narrower, especially anteriorly, with its front border more rounded, and the external pterygoid

crest is better developed, making an elongated pterygoid fossa. The bulla has a low partition.

The two best-known species of the genus are the Indian cats known as *bengalensis** and *rubiginosus*, which are very distinct, *rubiginosus* being characterized by exceedingly thin nasals, nearly vertical nares and premaxillæ, and superiorly expanded maxillæ, the temporal ridges remain separated, forming a wide lyrriform area, the postorbital processes fuse earlier, and the first upper premolar is much more frequently absent than in *bengalensis*. In the structure of the muzzle and the arrested muscular development of the cranium *rubiginosus* recalls some of the small South-American cats, *pardinoides* and ? *guigna*, but differs therefrom in certain characters enumerated below (p. 347).

Other known forms that certainly, or probably, fall under *Prionailurus* have been named *javensis*, *sumatranus*, *herschelii*, *chinensis*, *microtis*, and *scripta*.

Genus PARDOFELIS, Severtz.

Pardofelis, Severtzow, 1858, p. 387; type *marmorata*, Martin.

Catolynx, Gray, 1867, p. 267; type *marmorata* (nec *Catolynx*, Severtzow).

Two species, *P. marmorata* and *P. badia*.

Distr. East Indies from the Himalayas to Borneo.

Small long-tailed, short-headed cats with rounded ears, distinguishable from *Prionailurus* and related Oriental genera by having the skull higher and more rounded, with the mesopterygoid fossa lanceolate in front and provided with thickened margins or a better developed external crest.

The two species *marmorata* and *badia* referred to this genus have not, I believe, been previously affiliated. Despite the difference between them in the matter of coloration, their kinship is indicated by cranial characters. The structure of the feet and the form of the rhinarium are unknown to me. Of the two, *P. badia* seems to be most nearly related to *Prionailurus*.

* Based upon a specimen that swam on board a ship in Calcutta. The name has been fixed by tradition to the species that bears it; and since the description, so far as it goes, fits the species and most certainly does not apply to any domesticated cat of the *Felis catus* or *torquatus* types, I see no reason for discarding the term.

Genus *PROFELIS*, Severtz.

Profelis, Severtzow, 1858, p. 386; type *aurata* *, Temm. (= *celidogaster*).

Chrysailurus, Severtzow, 1858, p. 389; type *aurata* (= *neglecta*, Gray).

Catopuma, Severtzow, 1858, p. 387; type *temmincki*, Vig. & Horsf. (= *moormensis*, Hodg.).

Pyrofelis, Gray, 1874, p. 354; type *temmincki*.

Two well-marked species, *P. aurata* and *P. temmincki*, the latter at least probably containing subspecies (*dominicanorum*).

Distr. Himalayas and China to Indo-Malaysia (*temmincki*); West-African forest-region (*aurata*).

Medium-sized cats with rounded unspotted ears and moderately long tails, but with other external characters unknown.

Skull much larger than that of *Prionailurus* and differing therefrom in several characters. The nasals are a little broader, the postorbital processes shorter and never confluent; the crest on the malar is close to its inferior edge; the external pterygoid crest extends forwards considerably in front of the hamular, and the occipital area is much broader especially over the summit and across the mastoid processes, its width across the latter exceeding the width of the cranium across the parietals. In its broad nasals and occipital area *Profelis* is very like *Pardofelis*, but differs in the shape of the mesopterygoid fossa, of the external pterygoid crest, the width of the valley between the bulla and the glenoid crest, the shorter postorbital processes, and more sloping chin. From the skull of *Zibethailurus* that of *Profelis* differs in general form and aspect as well as in the shape and width of the occipital area, the position of the malar crest, narrower coronoid processes, etc. With *Ictailurus* and *Neofelis* no special comparison is necessary.

In connection with the mandible it may be noticed that the condyle is high above the angular process, the first premolar is small and considerably lower than the carnassial, and the alveolus of the canine is elevated. From this it results that there is a high postcanine space, the first little premolar of the maxilla, when retained, being widely separated from the first premolar of the mandible.

The species of this genus fall into two groups widely separated geographically, both being dimorphic in colour:—

(1) The West-African species *P. aurata*, assigned to *Profelis* and *Chrysailurus* by Severtzow, and ranging from Sierra

* For specific synonymy of this species see P. Z. S. 1907, p. 656.

Leone to the Ituri forest, a species which appears to be more nearly related to *Prionailurus* than the Asiatic representative of the genus, *P. temmincki*. The first upper premolar is markedly larger, when retained, than in *P. temmincki*; the external pterygoid crest is less well developed, especially posteriorly, where it exhibits a distinct notch before its spiniform termination; the occipital area is not so wide and shows a shallow emargination on each side, and the ridge below the masseteric fossa of the mandible is not so large.

(2) The Asiatic species, assigned to *Catopuma* by Severtzow and to *Pyrofelis* by Gray, has the first upper premolar minute, when retained, the postorbital processes are longer, the external pterygoid crest very well developed, especially posteriorly, where it ends in a spine but exhibits no notch; the occipital area is very wide and has no distinct lateral emargination, and the crest below the masseteric fossa is more salient.

Genus ZIBETHAILURUS, Severtz.

Zibethailurus, Severtzow, 1858, p. 387; type *viverrina*, Benn.
Viverriceps, Gray, 1867, p. 268; type *viverrina*.

Distr. India and Ceylon to Southern China, Formosa, and Tenasserim.

Medium-sized cats with small, rounded, white-spotted ears, moderately large rhinarium, and feet provided with small claw-sheaths and webs of moderate depth.

The skull may be described as a modification of the *Prionailurus*-type, many, but not all, of the differences being attributable to its accommodation to great development of the masticatory muscles. The sagittal crest is completed by the coalescence of the temporal ridges at a much earlier age, and the postorbital constriction forms in adult and subadult specimens a long emargination of the frontal on each side, instead of an angular notch immediately behind the process as in *Prionailurus*. Similarly, the lateral edges of the occipital area are more deeply emarginate and the coronoid of the mandible is broader at the summit.

The ascending branch of the premaxilla is broader than in *Prionailurus*. The inferior edge of the orbit is thicker and the anteorbital excrescences very conspicuous, and the cheek between the alveolar border and the orbit is relatively lower. The suborbital edge of the palate is less conspicuously notched. The external pterygoid crest is represented by a small triangular ridge above the hamular, being

noticeably shorter and less well developed than in *Prionailurus*.

Genus ICTAILURUS, Severtz.

"Ailurin," Gervais, 1855, p. 86; for *planiceps*, Vig. & Horsf.*.

Ictailurus, Severtzow, 1858, p. 387; type *planiceps*.

Ailurogale, Fitzinger, 1869, p. 249; type *planiceps*.

Elurina, Gill, 1871, p. 60; type *planiceps*.

Plethailurus, Cope, 1882, p. 475; type *planiceps*.

Only one species hitherto admitted.

Distr. Malay Peninsula to Borneo.

The skull in its elongated shape, the structure of the bullæ, exceedingly compressed nasals, and deep postorbital constriction recalls in a measure that of *Zibethailurus*, but may be distinguished by several peculiarities both dental and cranial†. (1) The posterior border of the complete postorbital bar is scarcely convex owing to the great width of the base of the malar portion. (2) The nasal branch of the premaxilla is slender and tolerably evenly attenuated. (3) The mesopterygoid fossa is very narrow, about twice as long as wide or even more. (4) The muzzle is broad and the palate nearly parallel-sided, the distance between the two anterior premolars being about equal to the distance between the inner cusps of the upper carnassials, and the suborbital edge of the palate has a conspicuous and narrow notch. (5) The occipital area is narrow, with a shallow lateral emargination, and the summit much more pointed than in *Zibethailurus*.

In the mandible the coronoid is low, with a wide summit set well in advance of the backwardly projecting condyle and angular. The anterior end of each ramus, carrying the canine and incisor teeth, is strongly elevated, and there is a large postcanine gap when the jaws are closed.

In the teeth the first upper premolar is unusually large

* Although Gervais was the first author to give nominal distinction to this genus, the name he proposed is inadmissible, as a comparison between it and such terms as "Chacal" and "Renard" of the same work will show. By Gray *planiceps* was associated with *viverrina* under his genus *Viverriceps*.

† Whether the resemblances between these two cats are due to close affinity or are merely adaptive it seems to me to be impossible to say. If the former, the two supply an interesting exception to the general rule in the Felidæ that the smaller species of a genus have skulls of a more juvenile type than the larger, owing to the lesser development of constrictions and ridges associated with powerful masticatory muscles. *I. planiceps*, although considerably smaller than *Z. viverrina*, has, nevertheless, a skull indicating relatively greater masticatory power.

and two-rooted, with a conical pointed crown, carrying a small anterior cusp. The first premolar of the lower jaw has an almost steeple-shaped crown higher than its basal length and than the apex of the succeeding tooth, and blocking the space between the first and second upper premolars; and the lower canines, when the jaw is closed, project considerably above the lower edge of the anterior nares, their tips being approximately on a level with the summit of the coronoid process.

The external characters of this species are known to me only from skins, and I am unable to give any particulars regarding the feet, rhinarium, and other points.

Genus NEOFELIS, Gray.

Neofelis, Gray, 1867, p. 265; type *nebulosa* (= *macrocelis*).

One species hitherto admitted with several subspecies, possibly deserving higher rank.

Distr. Eastern Himalayas to Borneo.

Large cats with head, body, and tail long and the legs short; with ears rounded and rhinarium and feet scarcely differing from those of *Panthera*.

Skull recalling in general features that of a small example of *Panthera pardus*, especially in the shortness and wide separation of the frontal and malar postorbital processes, the inferiorly attenuated maxilla, the straightness of its nasal edge, the width and exposure of the nasals from the lateral aspect, the inclination of the nares, relative proportions of the mandibular teeth, etc., but differing in the greater posterior width of the nasals, the thicker, more salient inferior edge of the orbit, carrying a distinct preorbital thickening, the evenly ovate antero-lateral border of the mesopterygoid fossa and the special modifications of the jaws, the mandible being greatly elevated anteriorly, with the symphysial region nearly vertical, flat in its upper two-thirds and abruptly curved backwards below, the incisive border being raised high above the external edge of the alveolus of the lower canine—as a result of which modifications the upper jaw is thrust up so that when the mouth is closed the alveolar lines of the maxillary and mandibular cheek-teeth are widely divergent in front, leaving a deep and long space behind the canines, with concomitant reduction or suppression of the first upper premolar and enormous elongation of the upper canine.

The occipital area is remarkably triangular and pointed

above, and the partition of the bulla is low, as in other forest-species.

This genus cannot be confused with any of the smaller Oriental, African, or American genera of Felidæ. Perhaps *Pardofelis* is its nearest ally. By Severtzow it was associated with *Uncia*, by Trouessart it was placed with *serval*, *pardalis*, and others in *Zibethailurus*. From *Panthera pardus*, with which it has been compared above, it differs in the hyoid bone etc.

Genus LEOPARDUS, Gray.

Leopardus, Gray, 1842, p. 260; type *griseus*, Gray (=? *pardalis*, Liun.) *.

Oncoides, Severtzow, 1858, p. 386; type *pardalis*.

Pardalis, Gray, 1867, p. 270; type *pardalis*.

Distr. From the Sonoran district of North America southwards throughout the forested districts of South America.

An uncertain number of species or subspecies referable to two groups typified respectively by *pardalis* and *wiedii* (*macrura*).

Moderately large or medium-sized cats, with the ears small, rounded, and white-spotted; the rhinarium prominent and naked above, and with widely separated nostrils; feet fully webbed and with well-developed claw-sheaths concealing the tips of the retracted claws; hair on the neck upright or reversed in direction of growth in the adult.

Skull variable in size and shape, and in the typical form of *Leopardus* most like that of *Profelis* of all the genera of the Old World, but differing in the sum of a number of characters. The nasals, though broad in front, are narrower posteriorly and fit like a wedge between the maxillæ, which are differently shaped above from those of *Profelis*, being broader and more truncated at the summit, the suture between them and the nasal processes of the frontal inclining more obliquely inwards and forwards from the dorsal aspect

* Gray originally included four species in this genus, namely, *griseus*, *pictus*, *elliotti*, and *horsfieldi*, but subsequently assigned *griseus* and *pictus* to *Pardalis*, *elliotti* to *Viverriceps*, ignored *horsfieldi*, and applied *Leopardus* to *pardus* and *onca*. Since *Leopardus* must unfortunately stand for one of the four species first included under it, I selected *griseus*, perhaps a subspecies of *pardalis*, as the type (Ann. & Mag. Nat. Hist. (8) xviii. p. 316, 1906).

than in *Profelis*, and the facial portion of the frontal anterior to the root of the postorbital process is larger and the lacrymal extends higher above the malar arch within the orbit. The skulls are variable in these respects, but, on the whole, the arrangement of the bones above described gives a different aspect to the skulls of *Leopardus* as compared with *Profelis*. The mesopterygoid fossa is more pointed as a rule in front, and has more sinuous margins owing to the curvature of the pterygoid bones. The bullæ are differently shaped from those of all the Old-World tiger-cats in that the portion behind a line drawn from the stylomastoid foramen at right angles to the occipital axis is larger than the portion in front of it.

In the mandible the condyle is not so high above the angular process as in *Profelis*, the first premolar is higher as compared with the carnassial than in that genus, and when the jaw is closed reaches up to the comparatively large first premolar of the maxilla, so that, as in *Leptailurus*, the post-canine space is quite small—a feature not observable in the Asiatic tiger-cats.

In addition to the true ocelots, often called jaguars*, I refer to this genus *L. wiedii* (*macroura*), commonly cited as *tigrina*†, which may be described as a small, long-tailed, smooth-skulled representative of the ocelots. The skull is like that of a young ocelot in most respects, showing at most a shallow postorbital constriction, with the temporal crests forming a lyriiform area generally wide but varying in width with age and possibly locally. The skulls differ, however, from those of ocelots in having a tolerably regularly rounded low occipital area; even when the occipital crest is well developed its edges have no definite lateral emargination; and the inferior edge of the orbit is thin, with the preorbital thickening hardly developed. In this last-mentioned particular, as well as superficially and in size, the skulls recall those of *Pardofelis*, but the maxillæ are wider above, the nasals narrower posteriorly, the malar arch is shallower from above downwards, the postorbital processes, although as long as in *Pardofelis*, are thinner, the back of the cranium is longer, and the occipital plane more vertical, the posterior part of the bulla is larger, the sides of the mesopterygoid fossa thinner, and the chin much more sloped.

* Schreber's figure of *Felis onca*, Linn., represents an ocelot (*Leopardus pardalis*), and not the species which is trivially known as the jaguar (*Panthera onca*).

† For the position of this species see below under *Herpailurus*.

As stated above, the skulls of typical *Leopardus* (ocelots) are very variable, and some of them show a decided approximation to those of *L. wiedii*.

Genus *HERPAILURUS*, Severtz.

Herpailurus, Severtzow, 1858, p. 385; type *yaguarondi*, Desm.

Oncifelis, Severtzow, 1851, p. 386; type *geoffroyi*, Gerv.

Noctifelis, Severtzow, 1853, p. 386; type *guigna*, Mol.

Pardalina, Gray, 1867, p. 266; type *geoffroyi* (= *himalayana*, Warw.).

Margay, Gray, 1867, p. 271; type *tigrina*, Schreb.*.

Distr. From Texas in the Sonoran area of North America as far south as the Argentine and Chili in South America.

Quite an uncertain number of species and subspecies referable to two well-marked types represented by *Herpailurus yaguarondi* and *Oncifelis geoffroyi*.

At least differing in external characters from *Leopardus* by the comparatively poor development of the webs and claw-sheath on the feet.

Skull variable, but presenting the following combination of characters :—The cranial portion is long and the facial short, and the dorsal contour is never strongly convex longitudinally, the temporal crests are almost always separated, forming either a narrow or a wide lyriiform area, rarely a complete sagittal ridge. The muzzle is compressed above, and the narrowest part of the interorbital region is situated forwards just behind the naso-maxillary line, and this line continued passes through the anterior half of the orbit, not approximately through its centre; the maxilla is very broad above, with horizontal or nearly horizontal upper edge, prominent rounded antero-superior angle, and vertical, or nearly vertical, anterior border. These features give a peculiar "facies" to the skull traceable in all species. In addition, the first upper premolar is minute or absent; the mesopterygoid fossa is slightly or considerably narrowed in front, with rounded angles and a small median notch in its anterior border; the inner chamber of the bulla is never much inflated anteriorly and does not project far beyond the partition, which is low or very low; the occipital crest is not appreciably concave above the condyles and is considerably broader at that point than the condylar width.

* For the determination and allocation of this species, previously regarded as identical with *Leopardus wiedii*, see Thomas (Ann. & Mag. Nat. Hist. (7) xii. pp. 234-239, 1903) and Pocock (Ann. & Mag. Nat. Hist. (8) xix. p. 43, 1917). In the latter paper the other American species of Felidae were grouped on the lines amplified in the present communication.

H. yaguarondi and *H. geoffroyi* are widely divergent species in cranial characters, the former departing the most, the latter the least, from the typical feline type. In *H. yaguarondi* the anterior nares are subvertical; the post-orbital processes of the frontal are short and depressed, but the malar process is longish; the zygomata are weakly arched, with the suborbital portion less salient above the carnassial and the squamosal root very long from before backwards, with its posterior border strongly inclined forwards and outwards; the valley between the bulla and the glenoid ridge is wider; the occipital area is narrow across the mastoids, and the crest is less strongly inclined backwards and inwards; the temporal crests always form a wide lyriform area.

On account of the differences in the skulls the two species might be regarded as generically or subgenerically distinct, but the difficulties of definition would in that case be great on account of *H. pardinoides* and its allies occupying in many cranial respects an intermediate position between the two, as Thomas pointed out in 1903.

The names *yaguarondi* and *eyra* were given, I believe, to colour-phases of one and the same species, the former being blackish with speckled hair, the latter red. Neither form shows pattern in the adult. If newly born kittens show pattern at all, which by the analogy of *Lynx caracal* is uncertain, it may be predicted that it will be like that of *H. pardinoides*, *guigna*, or *geoffroyi*. It may be added that the skull of *H. yaguarondi* differs widely from that of *Puma concolor* and completely negatives the claim of relationship that has been made between the two species on account of the absence of pattern in the adults.

Some of the smaller spotted species of the *pardinoides* and *tigrina* types of this genus, with the skull smooth and rounded, recall on superficial inspection the smaller species of *Prionailurus* like *bengalensis*, more particularly in the large size of the orbit, the shortness of the muzzle, expanded maxilla, and the vertical truncature of the anterior nares. The two, however, differ as follows:—

The *P. bengalensis*-type.

Postorbital processes long, often confluent.

Preorbital constriction narrowest midway along orbit, usually well behind maxilla and nasals.

Masseteric ridge advancing to middle of malar.

The *H. pardinoides*-type.

Postorbital processes short and subspiniform.

Preorbital constriction narrowest in front of centre of orbit and close behind maxilla and nasals.

Masseteric ridge near lower edge of malar.

The *P. bengalensis*-type.

Mesopterygoid fossa parallel-sided, with transverse anterior edge.

Base of cranium short; bulla more inflated in front; occiput narrower above, with its lateral margins sloping inwards.

The *H. pardinoides*-type.

Mesopterygoid fossa narrow and rounded in front.

Base of cranium long; bulla narrower in front; occiput more widely rounded above, its lateral margins more upright.

GENUS DENDRAILURUS, Severtz.

Dendrailurus, Severtzow, 1858, p. 385; type *colocolo*, H. Smith (= *strigilata*, Wagn.).

Lynchailurus, Severtzow, 1858, p. 385; type *pajeros*, Desm.

Pajeros, Gray, 1867, p. 260; type *pajeros* (= *pampanus*, Gray).

Distr. S. America : Guiana, Chili ; Uruguay to Patagonia.

Two species, if distinct, namely *colocolo* and *pajeros*.

Skull with the same general features as *Herpailurus*, but with widely different bullæ, which are not only more inflated and globular, extending posteriorly as far as the inferior edge of the foramen magnum and anteriorly almost as far as the ridge of the condyloid surface of the mandible, but differ in addition in the relatively enormous size of the outer or auditory chamber, which recalls that of *T. manul*. The groove of the partition runs over the summit of the bulla from the stylomastoid to a point just in front of the basi-occipital suture. The partition itself is nearly vertical with a convex inner wall. The external or auditory chamber is as wide in front as the posterior chamber is behind and projects forwards far in advance of the very narrow anterior end of the posterior chamber.

The following analytical key to the genera of Felinæ epitomises their main characters ; but, although an attempt has been made to juxtapose related forms, this method has been purposely abandoned in some cases in the interests of expediency in construction. For instance, *Ictailurus* and *Dendrailurus* have been widely separated from their allies, *Ictailurus* being, in my opinion, most nearly akin to *Zibethailurus* and *Dendrailurus* to *Herpailurus*, the only cranial similarity which brings *Dendrailurus* and *Trichailurus* together in the table having been independently acquired :—

Very long upper canines and immense postcanine space; chin long and vertical; nasals broad throughout; their maxillo-premaxillary suture almost straight; postorbital processes very short; occiput angular above. *Neofelis*.
Without that combination of characters. *a.*

- a.* First upper *pm* long, conical, two-rooted; first lower *pm* higher than second; postorbital bar complete, with slightly rounded posterior margin; condyle and angular set well behind broad rounded coronoid; tip of lower canine projecting high above lower edge of nares *Ictailurus.*
Without that combination of characters *b.*
- b.* Rhinarium very large; ears nearly meeting on summit of head. Malar greatly expanded in front, where it is clamped externally to preorbital foramen; cheek low; narrow postcanine space .. *Leptailurus.*
Without that combination of characters *c.*
- c.* Outer chamber of bulla very large, extending in front of narrowed apex of inner chamber; groove of partition passing from stylomastoid foramen to basioccipital suture *d.*
Outer chamber of bulla smaller or very small, not extending anteriorly in front of wider end of inner chamber, groove of partition passing to anterior edge of bulla *e.*
- d.* Face strongly sloped; upper rim of anterior nares nearly level with compressed lower rim of orbit; forehead and frontal postorbital processes very wide *Trichailurus.*
Face not strongly sloped; upper rim of nares much higher than thickened lower rim of orbit; forehead narrow, postorbital processes slender *Dendrailurus.*
- e.* Outer chamber of bulla comparatively large; partition rising some distance from crest of tympanic annulus *f.*
Outer chamber of bulla small or very small; partition rising close to crest of tympanic annulus *g.*
- f.* Nasal branch of *pmx* broad above behind nasal, then abruptly pointed; suborbital margins of palate deeply notched; upper *pm'* normally present *Felis.*
Nasal branch of *pmx* gradually attenuated above; suborbital margins of palate not deeply notched; upper *pm'* absent or early deciduous *Lynx.*
- g.* Skull short, rounded, zygomata wide, maxilla receding, not expanded above; palatine foramen in orbit very large, the distance between it and the orbital foramen only a little greater than the width of the wide, short mesopterygoid fossa and than the anterior nares; palate broad, sides of its posterior elongation widely divergent; post-orbital processes short, blunt; occiput wide across mastoids *Puma.*
Without that combination of characters *h.*
- h.* Mesopterygoid fossa lanceolate in front, with very thick lateral edges or large external crest; skull short, broad and high *Pardofelis.*
Without that combination of characters *i.*
- i.* External pterygoid crest reduced to a small triangular lamina; preorbital thickening of malar

- very large; masseteric crest on malar remote from its lower edge; skull powerful, with strong constrictions and upper half of occiput narrow but rounded above; coronoid wide and rounded at summit. *Zibethailurus.*
- Without that combination of characters *j.*
- j.* Masseteric crest on malar remote from its inferior edge; narrowest point of preorbital constriction nearly over the centre of the orbit; postorbital processes long, often confluent, occipital area narrow, its width across the mastoids less than the width of the cranium, its sides hardly emarginate, its summit rather narrowly rounded, and its width halfway above the condyles, about equal to the transcondylar width; portion of bulla behind the stylomastoid smaller than that in front of it, *Prionailurus.*
- Without that combination of characters *k.*
- k.* Skull powerfully developed with wide occiput, narrowest point of preorbital constriction nearly above centre of orbital space, maxilla not expanded above and inclined back well beyond lacrymal foramen; area of bulla behind stylomastoid foramen much smaller than that in front of it; mandible with first premolar much lower than carnassial, condyle high above angular and well-developed submasseteric ridge *Profelis.*
- Without that combination of characters *l.*
- l.* Feet fully webbed with well-developed claw-sheaths, hair on neck reversed in direction of growth *Leopardus.*
- Feet with only moderately developed webs and claw-sheaths, hair on neck not reversed *Herpailurus.*

Titles of principal Works quoted in the Synonymy.

- COPE, Proc. Amer. Phil. Soc. xx. 1882.
 FITZINGER, Wiss. Nat. Säug. i. 1855.
 " SB. Akad. Wiss. Wien, lx. 1869.
 GERVAISE, Hist. Nat. Mamm. ii. 1855.
 GILL, Arrangement Fam. Mamm. 1871.
 GRAY, London Med. Repos. xv. 1821.
 " Thomson's Ann. Phil. xxvi. 1825.
 " Ann. & Mag. Nat. Hist. x. 1842.
 " List Spec. Mamm. Brit. Mus. 1843.
 " Proc. Zool. Soc. London, 1867.
 " Cat. Carn. etc. Mamm. Brit. Mus. 1869.
 HEUGLIN, SB. Akad. Wiss. Wien, liv. 1866.
 JARDINE, Nat. Libr. Mamm. ii. Felinæ, 1834.
 KAUP, Entw. Gesch. Nat. Syst. Eur. Thierw. 1829.
 KERR, An. King. i. Mamm. Syst. Cat. 1792.
 SATUNIN, Ann. Mus. St. Petersb. ix. 1905.
 SEVERTZOW, Rev. Mag. Zool. (2) x. 1858.