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Wm. F. Vismes de Kane M.A.^a

^a Drumreask House, Monaghan

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3·84 millim. Halteres are not present, and the wings do not contain the pockets to receive the hooked ends. Antennæ apparently of nine joints, all bearing hairs; the last ending in three capitate hairs. Legs long and hairy. Claw large. The two pairs of digitules hair-like, with buttoned ends; not much longer than claw.

Hab. Campinas, State of S. Paulo, on an unidentified forest tree. The female scales are found on the twigs and branches, and the male scales on the upperside of the leaves. The insects and leaves become covered with a black fungus. A species of *Camponotus* also accompanies this insect.

Campinas, State of S. Paulo, Brazil,
July 22, 1901.

XLIX.—*Mysis relicta*, Lovén, in Ireland.

By WM. F. DE VISMES KANE, M.A.

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Mysis relicta, Lovén, which inhabits fresh water, differs but slightly from *M. oculata*, Fabr., an arctic marine species, except in its smaller size. According to Drs. Samter and Weltner, the latter has been taken in the sea off Grinnel-land, Greenland, Sabine Island, Iceland, Jan Meyen, Spitzbergen,

Barent's Sea, Novaia Zemlya, Kara Sea, Finmarken, Klostereld Fiord (*Norman*), North Sea, Labrador, and the Atlantic coasts of North America, at depths varying from $2\frac{1}{2}$ to $23\frac{1}{2}$ fathoms, but is absent from the Danish waters and the Ost See. Czerniavski also mentions its having been dredged in the White Sea on a muddy bottom at a depth of $6\frac{1}{2}$ fathoms. *Mysis relicta*, the freshwater species, the subject of this paper, has a very remarkable distribution. It would seem that its first discoverer was William Thompson, of Belfast, who in his 'Natural History of Ireland,' published 1856, mentions that on July 12th, 1851, he examined the contents of the stomach of a Pollan (*Coregonus pollan*, Thompson) taken in Lough Neagh, Ireland, which "proved to be wholly of the genus *Mysis* (not less than 100), except a *Limneus pereger*." Unfortunately he did not enquire further into the species, and made no further reference to it. Just ten years later, in 1861, Professor Lovén published a paper on the Crustacea of Lakes Vettern and Venern, in Sweden, and announced the discovery of the following, namely: *Mysis relicta*, *Idothea entomon*, Liun., *Pontoporeia offinis*, Lindström, *Gammarus loricatus*, Sabine, and *Gammarus cancelloides*, Gerstfeldt; all of which were closely allied to, if not identical with, marine forms. In 1867 G. O. Sars announced its discovery in Lake Mjösen, in Norway also, and eight other Swedish lakes in addition to Lakes Vettern and Venern. Subsequently various lakes in Russia and Finland were added to the list of European habitats. Sars also records its having been taken in the brackish water of the northern part of the Gulf of Bothnia, but not south of Quarken. In North America, Drs. Hoy, Stimpson, and Smith found it in Lakes Michigan and Superior, between which and the sea there is no evidence of any connexion in recent geological times. Lake Ontario, however (from which *M. relicta* appears now absent), evidently formed once a part of the St. Lawrence Valley, and marine shells of the Quaternary deposit have been found there as far up as Kingston; so that it has been suggested that the river flowing out of Lake Superior might have anciently afforded an access for marine species thence.

So far as to the published distribution of the species up to the present date. I have now to place on record further information as to its occurrence in Ireland, which marks at present the most southern range of its extension. In the autumn of 1898 the Rev. Canon Norman showed me a single specimen procured from Lough Neagh, which stands recorded in his monograph on British Mysidæ. The history of the discovery is as follows. Not having been aware of Thomp-

son's reference to a freshwater *Mysis* in Lough Neagh, in 1883 Dr. Norman spent some weeks in the investigation of the Crustacean fauna of several Scottish Lakes, in hopes of finding some of the marine forms taken by Lovén in Lakes Vettern and Venern. Loch Lomond and Loch Ness were first chosen for examination, as being the most likely waters for their occurrence; but though several days were spent, neither dredge nor tow-net yielded the desired results. Loch Leven, Loch Katrine, and many others were also explored on that occasion. He then thought of the great lake in the north of Ireland, and interested the late Rev. J. Gordon Holmes, of Antrim, in the research. Boats and men were then employed under the latter's superintendence in Lough Neagh for a week at the beginning of September 1885, and a series of dredgings were carried out extending over the N.E. quarter of the lake as far south as Ram's Island. The deepest sounding from which mud was collected was 55 feet, about 4 miles off shore. Large quantities of material were then forwarded to Canon Norman, and among masses of various species of Crustacea the specimen of *Mysis relicta* above referred to was detected. I am of opinion that the marine dredge used was unsuited for the capture of *Mysis*, as undoubtedly it is as plentiful in the northern half of Lough Neagh as in the southern, it having been taken there latterly by Dr. Scharff and Mr. Welch, of Belfast; and for the same reason I am not inclined to accept the negative evidence presented by Dr. Norman's examination of the Scottish lakes, in spite of his well-known experience and skill, as conclusively final. Lough Neagh is not only the largest lake in Ireland, but far the largest of any in the British Islands. It is almost rectangular in shape, and averages in length about 16 miles from north to south and in breadth about 10 miles from east to west. Summer level 48 feet above the sea at low water. For its extent it is extremely shallow, the greater area averaging about 40 feet, but it deepens about the N.W. corner towards Toome, where there is a hole with soundings of 96 feet near Pullan Bay. This contrasts remarkably with the depths of 480 to 600 feet to be found in the Scottish lakes. In 1898 Canon Norman urged me to make further researches in Lough Neagh, and accordingly the following July I spent four days at Lurgan, and dredged various parts of the southern half as well as the stormy weather would permit. I had come to the conclusion that a special apparatus would be desirable, and accordingly designed one provided with runners, to prevent it sinking in the muddy ooze which forms a great portion of the floor of freshwater lakes. On the 25th July therefore I crossed from

Kinnigo Gut to Ardboe Point (about 12 miles) on the western shore. With about 1 mile of offing in 40 to 50 feet of water and a muddy bottom I made a haul, and took several *Mysis relicta* and numerous Entomostraca, the new dredge working admirably. Again, when about halfway home, another haul in 35 feet and similar bottom resulted in a further capture of *Mysis*. On the following day I sailed north and dredged in 39 feet soundings about 1 mile west of a line drawn between Ram's Island and Langford Point, and drifted east, the bottom being muddy, and took a great quantity of *Mysis* and a few Entomostraca &c. Another haul was then made in 45 feet and similar ground, with Langford Point abeam about 2 miles off. An immense number of *Mysis* were captured. Another haul in shallower water nearer land and similar bottom was equally successful. Off Tolans Point, on a sandy bottom and shallower water, *Argulus foliaceus* and various Entomostraca were taken, but no *Mysis*. The third day's explorations were chiefly directed to research for Entomostraca along the south shore of the lake as far as the Upper Bann River. Here, with 2 miles of an offing in 20 feet of water, the bottom proved hard and sandy, and two trials for *Mysis* proved fruitless. The fourth day was devoted exclusively to Entomostraca, and no dredging was done. I may here state that the plankton did not offer any evidence of Scandinavian origin, such as I subsequently detected in the Lough Erne Entomostracous fauna. Consequent upon my success in Lough Neagh, I determined to follow up the quest of *Mysis relicta* in Lough Erne, and accordingly on the 30th November following I dredged in the head waters of the upper lake between Belleisle and Knockninny. This part is uniformly shallow, and the bottom wherever tested (except quite along the shore) of a soft ooze. Here also I succeeded in getting numerous examples of this *Mysis* in depths varying from 10 to 20 feet, the females generally being provided with ovigerous sacs, as I had hoped at that season, and were of a greater average size than those captured in July in Lough Neagh. But in addition to this I had the satisfaction of meeting with two species of Entomostraca which have not so far been recorded from British waters, and which constitute further links in the chain of evidence connecting the freshwater fauna of Ireland with that of Scandinavia, namely *Bythotrephes Cederstromii*, Schoedler, var. *Cederstromii* (species stricta), and *Bosmina mixta*, Lillj., var. *humilis*. My friend Canon Norman kindly identified them, and I give the names which correspond to the forms delineated in Prof. Lilljeborg's new

work 'Cladocera Suecica' (cf. p. 226 and plates), who also has been kind enough to examine specimens for me.

Further investigation in the year 1900 showed that in Lower Lough Erne also *Mysis relicta* exists in great numbers, every haul of the dredge producing a plentiful supply both in the shallower waters near the shore and in soundings from 100 to 180 feet in the middle of the broadest part of the lake, here about 5 miles across. Gatherings made about the 1st of June revealed the fact that the greater part of those taken were young individuals of about 9 millim. in length, mixed with a small proportion of adult specimens of full size, namely about 22 millim., which is the same as that of the females with ovigerous sacs taken in the Upper Lake in November; and therefore this may be taken as the average extreme length attained by adults in Lough Erne. An examination of these revealed very slight variation from the continental forms figured by Sars. To indicate the importance of a careful comparison of Irish with continental examples it is necessary to recapitulate the points of divergence between *Mysis relicta* and *Mysis oculata*. The theory put forward by Lovén and generally adopted in reference to the five freshwater Crustacea above referred to, which are only distinguished from their marine congeners by very trivial distinctions, is that the large lakes in which they are found were in late geological times beneath the sea-level, but by the elevation of the sea-bottom were converted into basins whose large extent ensured a very slow alteration of their contents by a very gradual reduction of their salinity. Those Crustacea which have survived proved able to accustom themselves to the gradual disappearance of the saline constituents of their habitat. And in process of time they appear to have developed the slight alterations which now distinguish them from the marine type, partly influenced perhaps by the altered medium and possibly in some respects by isolation. The chief differentiating characters between *Mysis relicta* and the larger *Mysis oculata* as given by Czerniavski and others may be stated as follows:—The flat appendix or scale of the second pair of antennæ in *M. relicta* exceeds by only one third the peduncle of the first pair, being proportionally shorter and broader than that of *M. oculata*. The armature of the mandibles is more complicated. The segments of the first pair of maxillipeds are shorter. The tarsi of the thoracic feet comprise only from six to eight segments, not nine as in the adult *M. oculata* (according to Kröyer). The third and fourth pair of the pleopods of the male, though agreeing in

general structure with those of the adult male of *M. oculata*, correspond more closely with those of its immature form. But the most salient differential character is that of the incision or indent at the distal extremity of the telson, the contour of which Sars points out as also indicative of a slightly arrested development in *M. relictæ*, since it accords closely with the shape of the younger specimens of the marine species. This character, though persistent in the freshwater species wherever taken (since Kessler's illustration from Lake Onega specimens appears only to be diagrammatic), presents some shades of variation. Czerniavski describes the Russian form thus, which accords well with Sars's plates of Scandinavian specimens:—"Telsonte utrinque spinis modo 17-19 armato, incisura postica duplo brevior et lata, marginibus modo leviter convexis." But he mentions that it varies somewhat, and gives two varieties—forma *major*, Sars, from Lake Ladoga, and forma *orientalis*, from Lakes Onega, Putko, and Keno. The latter is considerably the largest race of *M. relictæ* known, being from 18.3 to 21 millim. in body length and 22.5 to 25 millim. over all, measured from the end of the telson and uropods to the extremity of the second antennal laminae. Among other differential characters he points out that in var. *major* the telson is armed with twenty spines and its feet are slender &c., with the extremity of the tarsus much shorter proportionally than that of var. *orientalis*, whose feet are proportionally more robust. Drs. Samter and Weltner, in a recently published paper, describe another form of *M. relictæ* taken by them in the Madü Lake, Pomerania, which is only from 11 to 14 millim. in length as compared with those of Lovén and Sars, i. e. 20 and 18 millim. respectively. This form, though small, is stated to be in some respects nearer to *M. oculata* than the typical *M. relictæ* of Lovén, as regards the cephalothorax and eye, and in the male the secondary antennæ and the third and fourth pair of pleopods.

Irish specimens present, so far as I am able to judge, no differential characters from the type of any great importance. Adult examples from Lough Erne, taken on the 30th November, measured $16\frac{1}{2}$ millim. in body length and 22 millim. over all from the extremity of the antennal scale to the end of the telson and uropods*. The telson of all the specimens examined was armed with twenty-two spines counting the terminal ones, thus differing from those of Czerniavski, and

* These were preserved in water and formaline, whereas the quoted measurements of continental examples (if from spirit) would show divergence through shrinkage of the soft parts.

the tarsi of the thoracic feet were composed of from seven to eight segments. The contour of the indent of the telson corresponds very nearly with the figure given by Sars, the convexity at the base of the terminal spines being very moderate.

If the generally accepted theory is correct, namely, that *Mysis oculata* was introduced into freshwater lakes by the Glacial sea when subsidence of portions of the present land-surface took place, no difficulty arises as to its introduction thus into Lough Neagh, for geologists agree as to the submergence of a part of the east of Ireland as well as the central plain. A subsidence of only about 10 feet now would bring the floor of the greater portion of that lake to the level of the sea. But with regard to Lough Erne there is some room for doubt whether the introduction can have taken place from the Atlantic seaboard, because although its proximity would suggest that to be probable, and its present surface-level is only about 130 feet above the sea at high-water spring-tides, while a considerable area gives soundings of between 100 to 200 feet in depth, one spot reaching about 220 feet, yet geological maps do not give the Glacial sea of Pleistocene times such a western extension, the western seaboard of Ireland being supposed by many authorities to have been tilted up, except where the central plain reaches Galway Bay. But since the large basin occupied by Lough Oughter in Co. Cavan, now about 250 feet above sea-level, is included in the eastern area referred to which was submerged, it is very probable that marine organisms would have found their way thereto, as in the case of Lough Neagh. With an elevation of the west coast the drainage of the Erne district would have then flowed easterly; but when the land-surface attained its present relative level, and the transgression of the sea over the eastern area ceased to exist, and the watershed became changed, the drainage of Lough Oughter flowed westward into Upper Lough Erne as at present, and such marine organisms as survived would have had an opportunity of colonizing its waters.

I hope at an early date to explore a portion of Lough Oughter with the object of finding *Mysis relicta*. I desire to express my obligations to the Rev. Canon Norman for access to his valuable library and other assistance.

Drumreask House, Monaghan.