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 IN AUSTRALIA AND NEW ZEALAND.**

By CHARLES CHILTON, M.A., D.Sc., M.B., C.M., LL.D., F.L.S.

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**INVERTEBRATE
 ZOOLOGY**
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ART. XXXIII.—*A Fresh-water Crab, and its Distribution in Australia and New Zealand.*

By CHARLES CHILTON, M.A., D.Sc., M.B., C.M., LL.D., F.L.S., Professor of Biology, Canterbury College, New Zealand.

[Read before the Philosophical Institute of Canterbury, 2nd November, 1914.]

IN a small collection of *Crustacea* made towards the end of 1913 by Mr. W. R. B. Oliver on Lord Howe and Norfolk Islands there is one specimen of a small fresh-water crab, *Hymenosoma lacustris* (Chilton), which was obtained under a stone in a fresh-water stream on the top of Mount Gower, about 3,000 ft. above sea-level, in Lord Howe Island.

This crab is already known from some northern parts of New Zealand, from Norfolk Island, and from localities in Victoria, and its occurrence in Lord Howe Island is therefore of considerable importance, and affords another link in the chain of evidence that will finally lead to the explanation of its geographical distribution. A brief account of the history of this crab seems, therefore, desirable.

It was described by myself in 1882 under the name *Elanena* (?) *lacustris*, from Lake Takapuna (also called Pupuke), North Shore, Auckland. The waters in Lake Takapuna are fresh; but as the lake is only a very short distance from the seashore, and there was no similar crab then known from other fresh waters in New Zealand, I did not for some time attach particular importance to its fresh-water habitat, but considered it as being possibly a "relict" form that had only recently adapted itself to life in fresh water. A fuller knowledge of Lake Takapuna would, in itself, have shown that this view was erroneous, as will be seen from the account I give below; but at that time little was known of the fauna of the lake.

In the next year (1883), having obtained further specimens, I re-described the species and placed it under the genus *Hymenosoma* as defined by Haswell in his catalogue of the Australian *Crustacea* published in 1882.

Nothing more was added to our knowledge of this form till the year 1901, when I received, through the kindness of Messrs. W. and R. M. Laing, specimens from fresh-water streams in Norfolk Island which appeared to me to be practically identical with the New Zealand species. About the same time Mr. S. W. Fulton, of Melbourne, obtained specimens from Norfolk Island, and also from Lake Colac, Victoria, and these, together with a single specimen collected some years previously by Dr. T. S. Hall in the Moorabool River, Victoria, also appeared to belong to the same species.

I sent New Zealand specimens to Mr. Fulton for comparison with those from the other localities, and, although he detected some slight local variations, he found that they were all so much alike that in the account published by himself and the late F. R. Grant in 1902,* he referred them all to *Hymenosoma lacustris* (Chilton).

About a year later Messrs. Lucas and Hodgkin, in their investigation of some of the fresh-water lakes of New Zealand, obtained one male and one female specimen from Lake Waikare, Auckland. These were afterwards submitted to me for examination, and in my report published in 1906† were assigned to the same species, which was therefore evidently more widely distributed in the northern part of New Zealand than I had originally

* Proc. Roy. Soc. Victoria, vol. 15 (n.s.), p. 59.

† P.Z.S., 1906, p. 702.

thought. Its area of distribution was afterwards still more extended by its discovery in the River Waipa, specimens having been sent to me from that locality by Mr. Cheeseman, and recorded by me in *Trans. N.Z. Inst.*, 1912, p. 128.

To this must be added its occurrence in Lord Howe Island, as mentioned at the beginning of this paper. Mr. Oliver has, however, called my attention to the fact that in 1889 Mr. R. Etheridge recorded a fresh-water crab in Lord Howe Island. In his account of "The General Zoology of Lord Howe Island" (*Australian Museum, Memoir No. 2*, p. 34) he says, "By far the most important member of the *Decapoda* was Mr. Whitelegge's discovery of a fresh-water crab, plentifully distributed in the water-carrying gullies of the North Ridge, behind the Old Settlement, at a height of from 200 ft. to 300 ft. above high-water mark. It is a species of *Hymenicos*." This crab is recorded in the list of species on p. 36 as "*Hymenicos* sp." There can be little doubt that it is the same species as the single specimen obtained by Mr. Oliver—*i.e.*, *Hymenosoma lacustris* (Chilton).

It will thus be seen that this crab, *Hymenosoma lacustris*, is known from three localities in the north of New Zealand, from Norfolk Island, Lord Howe Island, and from two localities in Victoria, Australia, and that it is therefore a fresh-water species widely distributed in localities now separated by broad tracts of ocean.

Its true fresh-water character was not at first recognized owing to ignorance of the nature of Lake Takapuna, in which it was first found. This lake is situated very near to the sea, its eastern edge being not more than 200 ft. from the high-tide mark in Rangitoto Channel, while its western edge is within 400 yards of Waitemata Harbour; the deepest part is stated to be 168 ft., which is about 100 ft. below the bottom of the neighbouring Rangitoto Channel. It was formerly thought that there might possibly be some connection between the lake and the neighbouring sea, and it was doubted whether there was not a substratum of sea-water in the lake at depths below that of the channel. In 1899 Mr. J. A. Pond undertook the investigation of the waters of the lake, and the following facts, together with those already given, are taken from his paper published in 1900.* He took samples of the water from the surface at various distances from the margin, and also one from the pump-well at the pumping-station which supplies the suburb of Devonport. These samples were submitted to analysis, and "yielded chlorine 2.87 gr. per gallon in each instance, while the total solids at 105° C. were 8.68 gr. per gallon from the lake and Devonport samples, the pump-well 8.96 gr. per gallon." He also obtained samples from different depths—*viz.*, 50 ft., 100 ft., 157 ft., 160 ft., and 163 ft. "The results of analysis gave chlorine 2.87 gr. per gallon, equal to chloride of sodium 4.73 gr. in each sample, while the total of solids gave 8.68 gr. per gallon in each instance, the water from the bottom of the lake being decanted from the precipitated matter. There is, therefore, not the slightest difference in these two factors of the waters at varying depths, and these agree with our analysis of samples taken at various periods."

Mr. Pond's results show the Takapuna is a genuine fresh-water lake without any connection with the neighbouring sea. This character is also confirmed by the fauna of the lake, for Mr. H. Suter, to whom I applied for information, informs me that the general fauna of the lake is decidedly

* Pond, J. A., "On the Percentage of Chlorine in Lake Takapuna," *Trans. N.Z. Inst.*, vol. 32, pp. 241, 242.

fresh-water, no marine or relict forms being known to him. Of fresh-water *Mollusca* he has collected the following: *Potamopyrgus corolla* Gould, *Potamopyrgus corolla salleana* Fisher, *Isodora tabulata moesta* H. Adams, *Latia neritoides* Gray, *Cornucyclus novae-zelandiae* Prime, *Diplodon menziesi depauperatus* Hutton; the small fresh-water leech *Glossiphonia novae-zelandiae* Dendy was discovered in the lake by Mr. Suter, and he has several times seen in it specimens of the fresh-water crayfish *Paranephrops*.

It is therefore evident that this little crab is a genuine fresh-water species, and judging from its distribution it must be of very considerable antiquity. Owing to the difficulties of its dispersal across wide tracts of sea by ordinary means, it seems almost certain that the localities at which it is now found were formerly connected by land, though, of course, the land connections need not have been continuous throughout the whole length of its area of distribution at any one time. Nothing is yet known of the animal's life-history. Presumably it has a free-swimming zoea stage, but even if this could reach the sea from the lakes and rivers in which the adults live it is difficult to imagine how it could cross the seas and ascend other fresh waters so as to account for its present distribution. In one female from Lake Takapuna there are about twenty zoeae lying free under the abdomen of the female. They are of rather a large size for such a small crab; the abdomen is still folded under the thorax, which is fully 1 mm. in length, and they appear to have been only recently hatched from the eggs; the appendages are short and do not look as if they could be of much use for locomotion, and it is possible that in this species, as in many fresh-water forms, the young are carried about by the female for a longer time than in the case of corresponding marine species.

Its distribution is an important addition to the evidence showing connection between the north of New Zealand and lands lying farther north. A full explanation of the phenomena would involve discussion of the origin of the whole fauna and flora of New Zealand so far as the northern element is concerned, and this would be quite out of place in a paper such as this. It may, however, be desirable briefly to recapitulate what is known with regard to the distribution of other fresh-water Malacostracous *Crustacea* from New Zealand.

The New Zealand fresh-water crayfishes belong to the genus *Paranephrops*, which is confined to New Zealand, its reported occurrence in Fiji being probably due to an error in the locality labels. Three species are usually recognized, of which the one generally known as the northern form, *P. planifrons* White, is found throughout the whole of the North Island, and also from the north-western and western portions of the South Island—*i.e.*, the north of the great chain of mountains formed by the Southern Alps and their northern continuations. From the discussion of these species of crayfish as given in Mr. Arcey's paper in this volume (p. 295) it will be seen that the North Island species, *Paranephrops planifrons* (White), is composed of two or three varieties, one of which is found only to the north of the parallel of latitude passing through Tauranga, its area of distribution, therefore, corresponding fairly well with the New Zealand area in which the crab *Hymenosoma lacustris* is found. The fresh-water crayfish of Australia belong to different genera—*viz.*, *Astacopsis*, *Chaeraps*, and *Parachaeraps*. (See Geoffrey Smith, "The Fresh-water Crayfishes of Australia," P.Z.S., 1912, p. 144.)

The small New Zealand fresh-water prawn, *Xiphocaridina curvirostris* (Heller), is found in practically all suitable fresh-water streams throughout

the whole of New Zealand, and also occurs in fresh waters at the Chatham Islands. It is not known from any part of Australia, but, curiously enough, appears to occur again in Assam, specimens from this locality being in the collections of the Indian Museum, and, according to Mr. S. Kemp,* proving to be indistinguishable from those obtained in New Zealand. On the other hand, the fresh-water prawn known in Australia as *X. compressa* (De Haan) extends as far as Norfolk Island, and though it is placed by Bouvier in the same genus as *X. curvirostris* it differs markedly from that species in the character of the rostrum. *X. compressa* is a species of wide distribution, and extends from Australia right up to Japan.

The former northern extension of New Zealand which seems necessary to account for the distribution of the crab *Hymenosoma lacustris* seems also indicated by the range of the large land-shell *Placostylus*,† a genus which is represented by two species in the north of New Zealand, and by others in Lord Howe Island, New Caledonia, New Guinea, Fiji Islands, New Hebrides, and Solomon Islands, and by the fact that the predominant earth-worms in the North Island belong to the subfamily *Megascolecinae*, which is characteristic of Australia and Tasmania, and is also represented in Norfolk Island.‡

I append the following brief description :—

***Hymenosoma lacustris* (Chilton).**

Elamena (?) *lacustris* Chilton, Trans. N.Z. Inst., vol. 14, p. 172.

Hymenosoma lacustris Chilton, *l.c.*, vol. 44, p. 128 (with synonymy).

The chief points in the description of this crab may be given as follows :—

Carapace nearly circular, rather broader than long; flat, naked, or with a few scattered hairs. Rostrum broad, strongly depressed, its upper surface

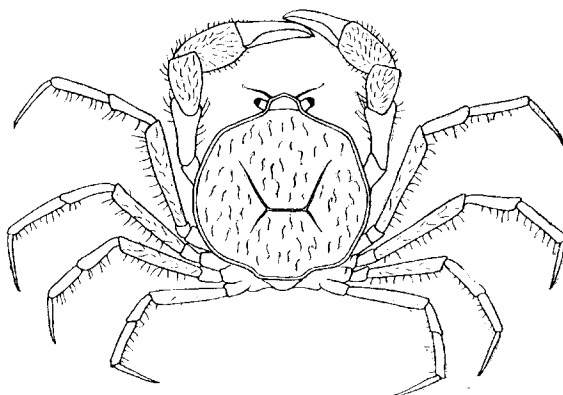


FIG. 1.—*Hymenosoma lacustris* (Chilton), ♂. Drawn from Norfolk Island specimen.

concave from side to side, extremity in form of an obtuse angle. Antero-lateral margins of the carapace with 2 obscure teeth. Cheliped of male small, propod only slightly broader than the carpus, hairy. Ambulatory

* Kemp, S., "Notes on Decapoda in the Indian Museum, No. 4," Records Indian Museum, vol. 7, p. 113.

† Suter, H., "Manual of the New Zealand Mollusca," p. 763.

‡ Benham, W. B., Trans. N.Z. Inst., vol. 37, p. 282, and vol. 35, p. 273.

legs somewhat densely covered with long hairs, tarsi long, slender, compressed, densely haired. Last pair of legs somewhat shorter than the preceding. Abdomen of male of 5 joints subequal in length, 3rd rather narrower than the 1st and 2nd, 4th nearly as wide as the 3rd, last broadly rounded at the end; margin fringed with very short hairs, some longer ones being scattered on the surface. Abdomen of female with slight median ridge along its whole length.

Fulton and Grant have pointed out that the specimens from different localities differ slightly as to the prominence of the obscure teeth on the margin of the carapace, the hairiness of its surface, and the small teeth or tubercles on the wrist and hand of the cheliped of the male. These features were, however, found not to be constant, and I agree with them in considering all the forms as belonging to one species. Even if it should be necessary for systematic purposes to distinguish local varieties, it would not affect the importance of the fact that the same fresh-water crab is found in several lands now widely separated by sea.