EXPLANATION OF PLATE VIII.

Fig. 1. Outline of *Hirudo antipodum* (× 2) taken from a small specimen, which was not curved. (It appears desirable to insert this figure, as so few people in New Zealand seem to know a "leech"; the land-planarian is commonly referred to by this name.)

„ 2. View of the dorsal surface of the head (enlarged), showing the arrangement of eyes and sensillæ and pigmentation.

„ 3. View of a short portion of another individual, dorsal surface, in which the median black band is broken up into three narrow streaks. (× 2.)

„ 4. Under-surface of the head; *a*, *b*, the peculiar fleshy lips. (Enlarged.)

„ 5. The same, still more magnified, after a median incision through the body-wall and ventral lip has been made; the lips are turned aside so as to expose the three jaws (*j*). *m*, the muscles thereof.

„ 6. One of the jaws (camera, Oct. 1, obj. 3, Leitz), showing the feeble development of the denticular ridges.

„ 7. A cocoon (enlarged), the surface only partly filled in. In the middle is seen the external surface of the basal membrane; and, marginally, the felt-work. A, shows a piece of the surface, still more enlarged. B, the cut edge of the wall, showing the relation of the felt-work to the basal membrane.

Art. XXII.—*A Note on the* Oligochæta *of the New Zealand Lakes.*

By W. B. Benham, D.Sc., M.A., F.Z.S., Professor of Biology in the University of Otago.

[*Read before the Otago Institute, 11th August, 1903.*]

During the year 1902 two young naturalists from the Old Country — Messrs. Keith Lucas and Hodson — visited this colony for the purpose of making a biological and topographical survey of the principal lakes. Mr. Lucas was good enough to hand over to me for identification all the *Oligochæta*, or annelids, which were collected by him. Naturally, I was delighted to have the opportunity of investigating the character of the deep-water fauna of our lakes, especially as, in the first place, such an opportunity is, in all probability, not likely to recur for several years; and, secondly, because our knowledge of the fresh-water annelids of the colony can be compressed into a very small compass. I propose to-night to give merely a brief summary of my results, a full and illustrated account of which I have sent to the Zoological Society.

The material upon which this paper is based consisted of thirty-three small tubes, containing about a hundred and fifty specimens, which, after examination, I find represent about a dozen species, all new to science, referable to nine genera (of which one is new), belonging to five families.

Family PHREODRILIDÆ.

Phreodrilus, Beddard.

1. *P. lacustris,* n. sp. Wakatipu and Manapouri.
2. *P. mauiensis,* n. sp. Taupo.

Family TUBIFICIDÆ.

Taupodrilus, n. gen.

3. *T. simplex,* n. sp. Taupo, Waikare, and Manapouri.

Limnodrilus, Claparéde.

4. *L. lucasi,* n. sp. Taupo and Rotoiti.
5. *L vejdovskyanus,* n. sp. Waikare and Waikaremoana.
6. *L.* sp. incert. (immature). Wakatipu and Manapouri.

Tubifex, Lamarck.

7. *T.* sp. incert. (immature). Taupo, Rotoiti, and Waikaremoana.

Family ENCHYTRÆIDÆ.

Enchytræus, Henle.

8. *E. simulans,* n. sp. Taupo.

Achæta, Vejdovsky.

9. *A. maorica,* n. sp. Manapouri.

Family HAPLOTAXIDÆ.

Haplotaxis, Hoffmeister.

10. *H. heterogyne,* n. sp. Wakatipu.

Family MEGASCOLECIDÆ.

Sub-family MEGASCOLECINÆ.

Diporochæta, Beddard.

11. *D. aquatica,* n. sp. Manapouri.

Plutellus, Perrier.

12. *P. lacustris,* n. sp. Wakatipu.

All these worms are of small size, none exceeding 3 in., the majority but little more than 1 in. in length, while one was only about $\frac{1}{6}$ in.; and the diameter of the majority does not exceed the thickness of a stout pin. Hence the work of identification was by no means an easy one, necessitating the constant use of higher powers of the microscope, for the external differences between these fresh-water worms lie chiefly in the form and number of the small bristles with which each segment of the body is provided, and these

bristles had to be examined under an oil-immersion lens for thorough investigation. After sorting the worms into groups in this manner one or more of each group was then stained and mounted entire for a preliminary examination of the internal structure; and further examples of each had to be cut into a series of transverse sections and series of longitudinal sections, each section being about $\frac{1}{200}$ in. in thickness, or even less, in order that the internal anatomy might be thoroughly explored, for by this method alone can the differences between species, and even genera, be properly determined. Those who have had experience in this minute microscopic work will perhaps appreciate the length of time required and the tedious nature of the work of identification.

Of the nine genera, five are common in Europe and North America, the only localities in which these annelids have received adequate attention; these five are—*Tubifex*, *Limnodrilus*, *Enchytræus*, *Achæta*, and *Haplotaxis*.

Of these probably cosmopolitan genera *Limnodrilus* and *Haplotaxis* have already been recorded from New Zealand, but the species of *Limnodrilus* referred to by Beddard was immature, and was too insufficiently characterized to be identifiable; I have found it necessary to make two new species of *Limnodrilus*. Of *Haplotaxis* one species has hitherto been recorded from New Zealand, one from Europe, one from America. I thus add a fourth to the list—a second from New Zealand.

A sixth genus, *Phreodrilus*, has hitherto been found only in South America, Falkland Islands, Kerguelen, and New Zealand. I have to add, as a result of my investigations, two new species, one of which, unfortunately, is represented only by a single immature individual; but the other, *Ph. lacustris*, is common in Lake Wakatipu, and one interesting fact about it is that it is more nearly allied to the Kerguelen Island species than to the other New Zealand species. This is a very remarkable fact, especially in conjunction with similar facts observed in the case of certain of our earthworms (*Notiodrilus*) presenting a similar distribution, where the species from the Macquarie and from the Auckland Islands are more nearly related to the South American and Falkland Island species than to those living on our mainland.

Two other genera, *Plutellus* and *Dyporochæta*, are Australian. The former has not hitherto been met with here, though two species of the latter have been recorded.

The ninth and last genus differs from any hitherto known to science, and I have named it *Taupodrilus*, to indicate the fact that it occurs characteristically in Lake Taupo.

When we consider the many endemic genera of terrestrial worms occurring in New Zealand, and the generally unique

character of the earthworms, it appears somewhat disappointing to find such an absence of peculiar genera in the case of the aquatic worms. Nevertheless, this is in accordance with the usual character of fresh-water fauna the world over—at any rate, in the case of the smaller invertebrates—and especially of the *Oligochæta*, for there is a remarkable uniformity in the aquatic annelids in all parts of the world hitherto explored, with a mere sprinkling of peculiar forms. And this difference in the facies of the terrestrial and aquatic annelids is due to the difference in the manner in which the two kinds of *Oligochæta* are transported from one country to another.

Now, as I have pointed out in previous communications, earthworms can only be distributed by their own active locomotion or migration through or on the earth, hence continuous land-areas—at some period or another—are necessary to explain the occurrence of allied species in two spots now isolated by stretches of sea. But in the case of the fresh-water worms, which are of small size, the means of dispersal from one country to another does not necessarily depend on their own emigration; and though in this case we are still somewhat in the dark as to the exact manner of transport, yet from analogy with what we know to be the mode of dispersal of the smaller aquatic molluscs, crustacea, and insects it appears extremely probable that these small aquatic worms may be conveyed by birds, especially by wading-birds, such as the red stilt and heron, and by ducks like the teal, grey duck, and crested grebe, which, dabbling in the mud at the margin of a lake or in the neighbouring swamp or stream, carry away some of this mud on their feet. The occurrence, for example, of *Plutellus* in Wakatipu and of *Dyporochæta* in Manapouri, both of which worms have their home in Australia, is probably to be explained by their being carried, or by their cocoons being carried, in this mud adhering to the feet of such birds. The length of time required by a fairly strong-flying bird with a wind behind it in passing across the Tasman Sea would not be more than thirty-six to forty-eight hours — and perhaps even less—and during this time, if the worm were enclosed in a ball of earth, it is quite possible that sufficient moisture would be retained in the centre of the ball to preserve the life of this small worm. At any rate, the cocoon would easily withstand a considerable amount of drying-up, and when the bird alights on the shore of the lake the cocoon, deposited in the water, would give the species a start in the new locality, and as each cocoon contains several eggs the species would have a fair chance of survival. Since the mud continues to adhere to the feet, it is clear that a certain amount of moisture persists, otherwise the mud would crumble away during the journey. Now, M. De Guerne has investigated the mud ad-

herent to the feet of wild ducks in Europe, and found it to contain, or, rather, to give rise to, after proper cultivation, numerous small creatures, such as nematodes, rotifers, eggs of water-fleas, and other small organisms, while other records state that small mollusca have been found adhering to the feet of birds after long periods of flight.

The lakes that were explored during the survey are Wakatipu and Manapouri in the South Island, and Taupo, Rotoiti, Waikare, and Waikaremoana in the North.

The annelid fauna of the northern set of lakes is quite different from that of the southern couple, not merely in the species, but in the genera; and, as we should expect, the different lakes in each group are occupied by different species, though there are one or two species common to two or more lakes. Only in the case of one species—viz., *Taupodrilus simplex*—do I find the same worm occurring both in the northern and southern lakes.

The richest—*i.e.*, most varied—fauna was obtained from Manapouri, where five species, representing as many genera, belonging to four families, were collected in only six spots. But Taupo is nearly as rich, where five species, belonging to five genera, representing three families, were collected at four stations.

TABLE SHOWING FAUNA OF THE LAKES EXPLORED.

Species.	Number of Individuals.	Depths, in Feet.	Number of Stations.
WAKATIPU: Maximum depth, 1,242 ft.; number of stations at which *Oligochæta* were obtained, 10; total number of individuals obtained, 37.			
Plutellus lacustris	17	300–1,200	7
Phreodrilus lacustris	10	300–1,000	3
Haplotaxis heterogyne	2	550	1
Limnodrilus, sp. A, inc.	1	1,000	1
MANAPOURI: Maximum depth, 1,458 ft.; number of stations, 6; total number of specimens, 16.			
Phreodrilus lacustris	6	150–500	1
Taupodrilus simplex	6	10–1,000	2
Limnodrilus, sp. B, inc.	1	150–500	1
Achæta maorica	1	350	1
Diporochæta aquatica	2	350–500	2
TAUPO: Maximum depth, 534 ft.; number of stations, 4; total number of specimens, 32.			
Taupodrilus simplex	11	150–500	2
Phreodrilus mauiensis	1	150–500	1
Limnodrilus lucasi	12	300–450	1
Enchytræus simulans	7	?	1
Tubifex, sp. inc.	1	?	1

TABLE SHOWING FAUNA OF THE LAKES EXPLORED—*continued.*

Species.	Number of Individuals.	Depths, in Feet.	Number of Stations.
ROTOITI: Maximum depth, 228 ft.; number of stations, 2; number of specimens, many.			
Limnodrilus lucasi	Numerous	100–228	1
Tubifex, sp. inc.	2	..	1
WAIKARE: Maximum depth, 9 ft.; number of stations, 1.			
Limnodrilus vejdovskyanus ..	30	9	1
Taupodrilus simplex	1	9	1
WAIKAREMOANA: Maximum depth, 846 ft.; number of stations, 3; number of specimens, 16.			
Limnodrilus vejdovskyanus(?) ..	6	800–840	1
Limnodrilus, sp. inc.	1	200–750	1
Tubifex, sp. inc.	1	..	1
Indeterminable fragments	8	80	1

REMARKS ON THE ABOVE TABLE.

Lake Wakatipu thus yielded, in eleven hauls at different stations, a total of thirty specimens, which fall into four species, belonging to as many genera, and representing four families. Of these *Limnodrilus* was represented by a single immature individual. But the commonest species is *Plutellus lacustris*, which was obtained at eight stations widely separated and at depths varying from 300 ft. to 1,200 ft. It occurs both in the North Arm and in the South Arm of the lake. *Phreodrilus* was obtained at only three stations in the South Arm, in depths from 300 ft. to 1,000 ft.

Lake Manapouri, whose greatest depth Mr. Lucas found to be 1,458 ft., yielded sixteen specimens for six hauls. These fall into five species, belonging to as many genera, and representing four families. But here again a single specimen of *Limnodrilus* too immature for identification is included. It is possible that the hauls were made in depths beyond that at which the members of this genus dwell, for they are more numerously represented in the shallower lakes of the North Island. The remaining worms, however, are very interesting —firstly, the small worm *Achæta maorica*, represented, unfortunately, by only a single individual, is the fourth species of the genus, and has hitherto only been known in Europe. Then, the new genus *Taupodrilus* occurs at two stations, ranging from 10 ft. to 1,000 ft. in depth—the only species which is common to the lakes of the two Islands. *Phreodrilus* is represented by the same species as in Wakatipu. And, finally, *Diporochæta aquatica*, the first member of the genus

recorded from such deep water—indeed, hitherto the New Zealand species have only been recorded from swamps.

Turning to the North Island lakes, Taupo presents us with the richest fauna. Its depth is only 534 ft., very shallow as compared with Wakatipu. It yielded thirty-two specimens for four hauls, belonging to five genera. Of these *Taupodrilus* is the most interesting, and is widely distributed, having occurred at two spots ranging from 150 ft. to 500 ft. in depth; and it is apparently pretty common, as about a dozen individuals were collected. *Limnodrilus lucasi* and *Enchytræus simulans* are also about as numerous, though only obtained at one spot each. In this lake I find a single specimen of a second species of *Phreodrilus*.

Waikare, with a maximum depth of 9 ft., yields chiefly *Limnodrilus*, which genus is represented by a distinct species in Rotoiti, where it occurs in abundance.

From Waikaremoana, which with a depth of 846 ft. ought to have yielded some interesting forms, I only received sixteen specimens, which, unfortunately, are so badly preserved as to be unidentifiable, though some at least belong to the genus *Limnodrilus*.

ART. XXIII. — *An apparently New Species of* Regalecus (R. parkeri).

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[*Read before the Otago Institute, 9th June, 1903.*]

Plate IX.

IN November, 1902, I received a silvery Oar-fish, which was washed ashore in Deborah Bay, near Port Chalmers, in Otago Harbour. It was observed with its head downward and the tail flapping above water in the air.

The colour was silver, without—so my informant states—any other coloration. The long nuchal fin-rays were broken off at the base, as also were the pelvic fin and the tail, so that it is possible that the two former fins may have had the bright-red colouring known in *R. glesne*. The silver was marked by 14 dark transverse bands set at fairly regular intervals from the back of the head to the end of the body. Each band extends over the entire depth of the body, and is separated from its neighbours by a space about equal to its own length, which varies from 1½ in. to 2 in. (30 mm. to 50 mm.), the latter being the length of the bands near the