4. The mean fork lengths at ages I to IV are 14.4 cm., 24.9 cm., 35.8 cm., 45.8 cm. respectively.
5. Estimates of the annual mortality plus emigration rate from age II on vary between 80 and 90%.
6. There is a positive correlation between native fish density and brown trout density in the main river; however, no correlation was found between bottom fauna density and trout density.
7. There appears to be a negative correlation between trout size and density.
8. The present regulations are having an adverse effect on the fishable trout population and the following changes are recommended:
   (a) size limit reduced to 9 inches total length;
   (b) lure restrictions be liberalized to allow all flies, threadline spinners and worms;
   (c) the present 7 month season be extended to 12 months.

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REFERENCES

ALLEN, K. R., 1951. The Horokiwi stream, a study of a trout population. *Fish. Bull. Wellington, N.Z.* 10.

ALLEN, K. R., and CUNNINGHAM, B. T., 1957. New Zealand Angling 1947-52, results of the diary scheme. *Fish. Bull. Wellington, N.Z.* 12.

BURNET, A. M. R., 1959. Some observations on natural fluctuations of trout population numbers. *N.Z. J. Sci.* 2:410–421.

CASSLE, R. M., 1954. Some uses of probability paper in the analysis of size frequency distributions. *Aust. J. Mar. Freshw. Res.* 5: 513–522.

HEINCKE, F., 1913. Investigations on the Plaice. General report. I-Plaice fishery and protective measures. Preliminary brief summary of the most important points of the report. *Rapp. Conseil Expl. Mar.* 16.

RICKER, W. E., 1958. Handbook of computations for biological statistics of fish populations. *Bull. Fish. Res. Bd. Can.* 119.

ROBSON, D. S., and CHAPMAN, D. G., undated. Catch curves and mortality rates. *Research under N.S.F. Grant No. G* 10365. Mimco rep., U.S.A.

A SURVEY OF LAKE ROXBURGH, A RECENT HYDRO-ELECTRIC DAM

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INTRODUCTION

This survey was carried out for the Otago Acclimatisation Society which was considering the introduction of the Mackinaw Char or Lake Trout *(Salvelinus namaycush)*.

As the lake was formed by the impoundment of the Clutha River in July, 1956 it was 5½ years old when the data were collected in January, 1962, and is still undergoing fairly rapid development. A description of the lake at this stage may be of value as a basis for study of its later development and for comparison with other similar dams such as the Waitaki and Benmore dams on the Waitaki River.

Though Lake Roxburgh lies in the rain shadow area of Central Otago, with an annual mean rainfall of less than 20 inches, its catchment area drains the much higher rainfall area on the east side of the Southern Alps. The catchment area lies almost entirely on schist. Lakes Hawea, Wanaka and Wakatipu act as settling ponds at the foot of the Alps, but the Clutha River gains a considerable load of sediment from tributaries such as the Shotover, Nevis and Manuherikia Rivers.

The Alexandra Bridge was taken as an arbitary upper limit of the lake as there is no clear cut distinction between river and lake. Shingle and Gorge Creeks are the two largest creeks that drain into the lake itself.

MORPHOMETRY

The data in Table 1 were provided by the New Zealand Electricity Department or extracted from a contour map (1000 ft. = 1 inch) made by the Ministry of Works prior to the building of the dam. All measurements using length and width were taken at the 131.1 metre (430 ft.) contour.

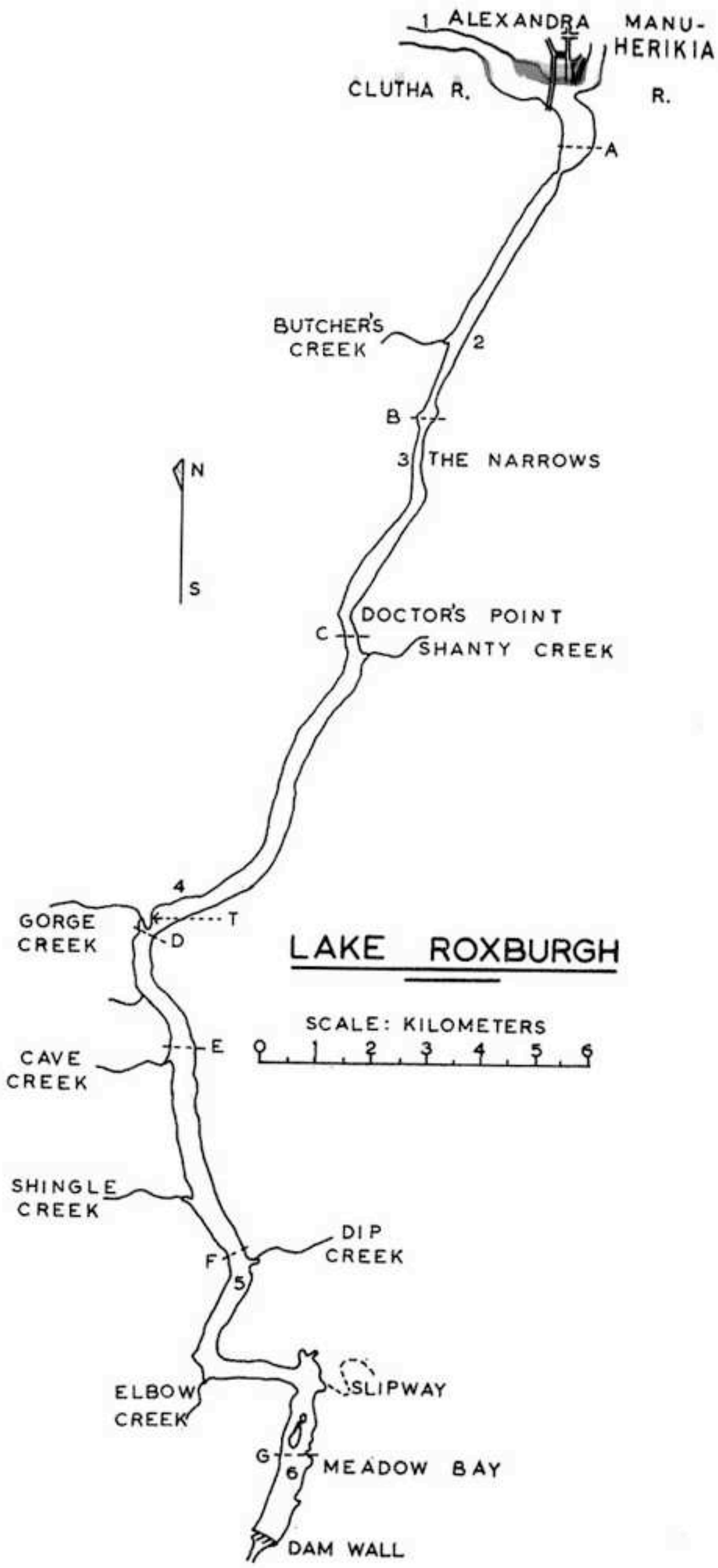

FIGURE 1. *Map of L. Roxburgh showing the stations for current measurement (1-6), bottom transects (A-G) and mud bank transect (T).*

TABLE 1. *Morphometry of Lake Roxburgh.*

Max. length	28.50 km.
Shore length	59.87 km.
Max. width	667 m.
Min. width	32 m.
Mean width	206 m.
Area	5.9 km^2
Max. depth	42.7 m.
Mean depth	18.0 m.
Volume	107 X 10^9 1.

The replacement time for the water in the lake is very short, and even at times of low river flow is only about 5½ days (Table 2).

TABLE 2. *River flow and replacement time of the total volume of water in Lake Roxburgh.*

Water Level	Flow 1000L./sec.	Flow cusec.	Replacement time days
Low	226	8,000	5.5
Medium	340	12,000	3.6
High	722	25,500	1.7

A current could be detected with a floating cork throughout the lake, except in the last 3 or 4 km. (Table 3). This and the rapid replacement time for the water, place the lake on the border line between a large slow-flowing river and a true lake.

TABLE 3. *Current velocity in km./hr.*

Station	Current
1	5.1
2	3.0
3	3.3
4	1.3
5	0.4
6	0.0

Ellis (1941) has pointed out that there are some important differences between an impoundment such as L. Roxburgh and a natural lake, the most important being that an impoundment is only half a lake as its greatest depth is at or near the dam, whereas the greatest depth of a natural lake is generally near the centre. In many impoundments the outlet is well below the surface and this can disrupt the normal distribution of dissolved gases and temperature gradients. The outlet is at 18 m. in L. Roxburgh but this is not likely to be of importance because the current and the short replacement time would eliminate gradients and the accumulation of stagnant water, except possibly in the last two or three kilometres of the lake.

CHEMICAL ANALYSIS

Two samples of surface water were taken just above the dam wall and analysed by the Dominion Laboratory, Dunedin (Table 4). As a comparison water analyses for Lakes

Wanaka, Wakatipu and Hayes are also shown (Jolly, 1959). Her results for L. Wanaka and L. Wakatipu resemble fairly closely those for L. Roxburgh, which is not surprising as the Clutha river drains these lakes. L. Hayes, though in the same catchment area, is a small lake surrounded by cultivated land.

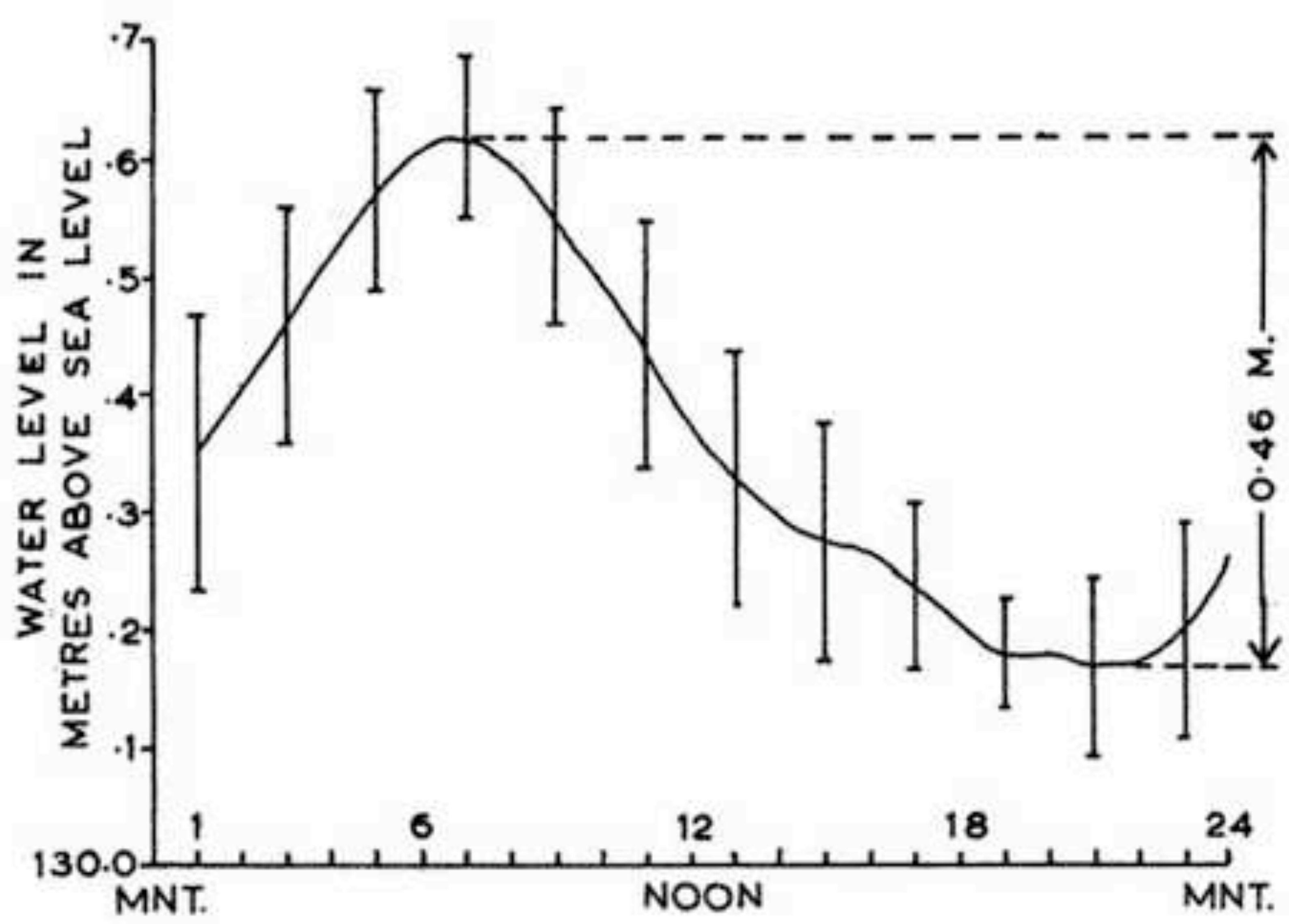

FIGURE 2. *The hourly water level of L. Roxburgh plotted as the mean of 8 days, 23-30 January 1962, with vertical lines showing standard deviation.*

WATER FLUCTUATION

Being an hydro-electric lake with a comparatively small volume and rapid turnover, Lake Roxburgh has a marked daily fluctuation of water level which is governed by the demand for electric power. This daily fluctuation is very regular with a range of about 0.46 m. in summer and increasings to about 0.76 m. in winter (Fig. 2). This exposes about 15 to 70% of the littoral zone and has a marked influence on its nature.

In Windermere, Moon (1935) found that the more active littoral organisms could keep pace with a rise in water level of 0.63 cm/hr., but were left behind by a rise of 1.25 cm/hr. In L. Roxburgh the water rises at 5 cm/hr. and drops at 3 cm/hr. so that the littoral fauna would find it impossible to keep pace with the rise and fall of the water level. This water fluctuation undoubtetdly reduces the littoral fauna considerably.

Figure 3 shows the amount of the littoral zone which is exposed by this daily fluctuation. It is approximately 25% for Figure 3A, 70% for Figure 3B, and 15-20% for Figure 3C.

There is also a slight seasonal fluctuation, but it is of little imporance in comparison with the daily fluctuation.

TABLE 4. *Results, in p.p.m., of chemical analysis of surface water from L. Roxburgh and from Lakes Wanaka, Wakatipu and Hayes.*

	Roxburgh		Wanaka		Wakatipu	Hayes
Date	5.2.62	25.6.62	1.5.53	21.8.53	28.2.53	10.8.53
pH	7.2	7.1				
Nitrite nitrogen	–	<0.002	7.1	7.0	7.05	7.15
Nitrate nitrogen	Nil	<0.16	Nil	Nil	Nil	–
Ammoniacal nitrogen	–	0.003	Nil	Nil	Nil	Nil
Albuminoid nitrogen	–	0.010	0.005	Nil	0.004	0.010
O_2 absorbed, 4hr 80°F	0.08	0.47	0.021	0.021	0.014	0.080
*Alkalinity, phth	–	Nil	–	–	–	–
*Alkalinity, total	29.0	31.0	–	–	–	–
*Hardness, total			–	–	–	–
(EDTA)	30.5	31.0	38	36	38	91
*Hardness (calcium)	29.0	26.0	–	–	–	–
*Hardness (magnesium)	1.5	5.0	–	–	–	–
Total solids	44	75	40	50	38	96
Chloride (C1)	2.0	1.0	4.0	2.5	6.5	2.5
Sulphate (SO_4)	7.0	6.7	–	–	–	–
Iron, total (Fe)	Nil	–	Nil	Nil	0.05	Nil
Silica	2.0	4.0	2.0	3.0	2.5	2.0
Manganese	Nil	<0.05	–	–	–	–
Phosphate	Nil	<0.05	trace	0.15	trace	1.3

* As calcium carbonate

WATER TEMPERATURES

The water temperature shows a seasonal range of from 6°C to 18.5°C. One very hot calm day a slight vertical temperature gradient was detected 2 km. above the dam, with a surface temperature of 21.5°C grading to 17.5°C at a depth of 30 metres but there was no sign of a thermocline. Throughout most of the lake the water is kept well mixed by the current and at times slight temperature inversions were detected which were most likely caused by current eddies.

SILTATION AND TRANSPARENCY

The Ministry of Works has estimated that the lake basin will silt up in 150 years. The sediment consists of loess, much of which has come from the eroded shores of the lake, and of weathered schist. Many of the particles are minute flakes with a diameter much greater than their thickness, and glistening flakes of mica are abundant.

Secchi disc readings varied from 0.3 to 3 m. and could fluctuate rapidly, and at times a distinct line could be seen between clear blue and muddy water.

Following Hutchinson (1957) the maximum depth at which the disc disappeared (3 m.) was taken to be the lower limit of the littoral zone.

SHORE PROFILES AND SHORE CLASSIFICATION

The development of the shore line has been governed by the slope of the bordering hills, soil type and wave action.

The lake is generally bordered by steep hills, the most common angle of slope being 25° to 30°. The hills are covered with dry tussock grass growing on a very powdery loess soil. In many places there are shingle slips and bare rock faces.

Wave action is not very great because the wind is channelled up or down the lake by the hills so the waves follow the main axis of the lake. Even though waves of two to three feet can quickly develop in the middle there is always a calm strip along each shore where the waves are only a matter of inches high. Despite this, a narrow but well developed wave-cut platform has developed because of the steep banks and powdery soil.

Figure 3 shows three typical examples of shore profiles that have developed. The profiles in both Figures 3A and 3B have developed where the soil is fine and powdery, the extent of the wave-cut platform depending on the slope of the bank. Both profiles are usually devoid of vegetation but 3B shows the distribution of the vegetation as found at the mouth of Butcher's Creek. Figure 3C shows the type of profile found where the slope is about 18° and soil firm. Here the wave action has had very little effect and no wave-cut platform has been formed.

The shore line was classified as follows:—

1. Rock faces or steep rubble slips with the soil washed away leaving bare shingle (31%).
2. Steep shore profile with a narrow platform of silt, as in Figure 3A (57%).
3. Wide mud banks as in Figure 3B and gently sloping shores as in Figure 3C (9%).
4. Shingle or gravel beaches at the mouth of creeks and in the last 3 km. of the lake (3%).

MACROFLORA

Lupins *(Lupinus arboreus)* formed a continuous 3 m. wide border down each side of the lake, starting about 0.4 km. below the Alexandra bridge and continuing for about 5.2 km. Below this they occurred in clumps which became progressively more isolated further down the lake.

Typha augustifolia formed fairly extensive beds in a series of small bays on the east side of the lake adjacent to Meadow Bay, otherwise it only occurred at the mouth of Butcher's Creek and as small clumps in four other places.

The rush *Juncus vaginatus* was common in the series of small bays mentioned above, and as about 60 isolated groups of one to a dozen clumps dotted all the way up the lake.

Juncus lamprocarpus formed an extensive bed on the mud bank at the mouth of Butcher's Creek. It grew below the high water mark but not as far down as the low water mark (Fig. 3B) possibly because it is only about 14 cm. high and can not withstand total submergence. However, it seemed to be the most successful coloniser of the mud banks between low and high water mark. It occurred in one other place about 1 km. below Butcher's Creek.

Potamogeton, *Myriophyllum* and *Tillae sinclairii*, were the main submerged plants where the bottom was stable. *Potamogeton* preferred the soft silty bottoms, while *Myrio-*

phyllum preferred the firmer less disturbed bottom shown in Figure 3C. *Tillae sinclairii* was also found on a similar type of bottom at Meadow Bay where it formed a lawn-like covering.

The submerged vegetation occurred only below the low water mark of the daily water fluctuation, so there was always a strip devoid of either submerged or emergent vegetation between the low and high water marks.

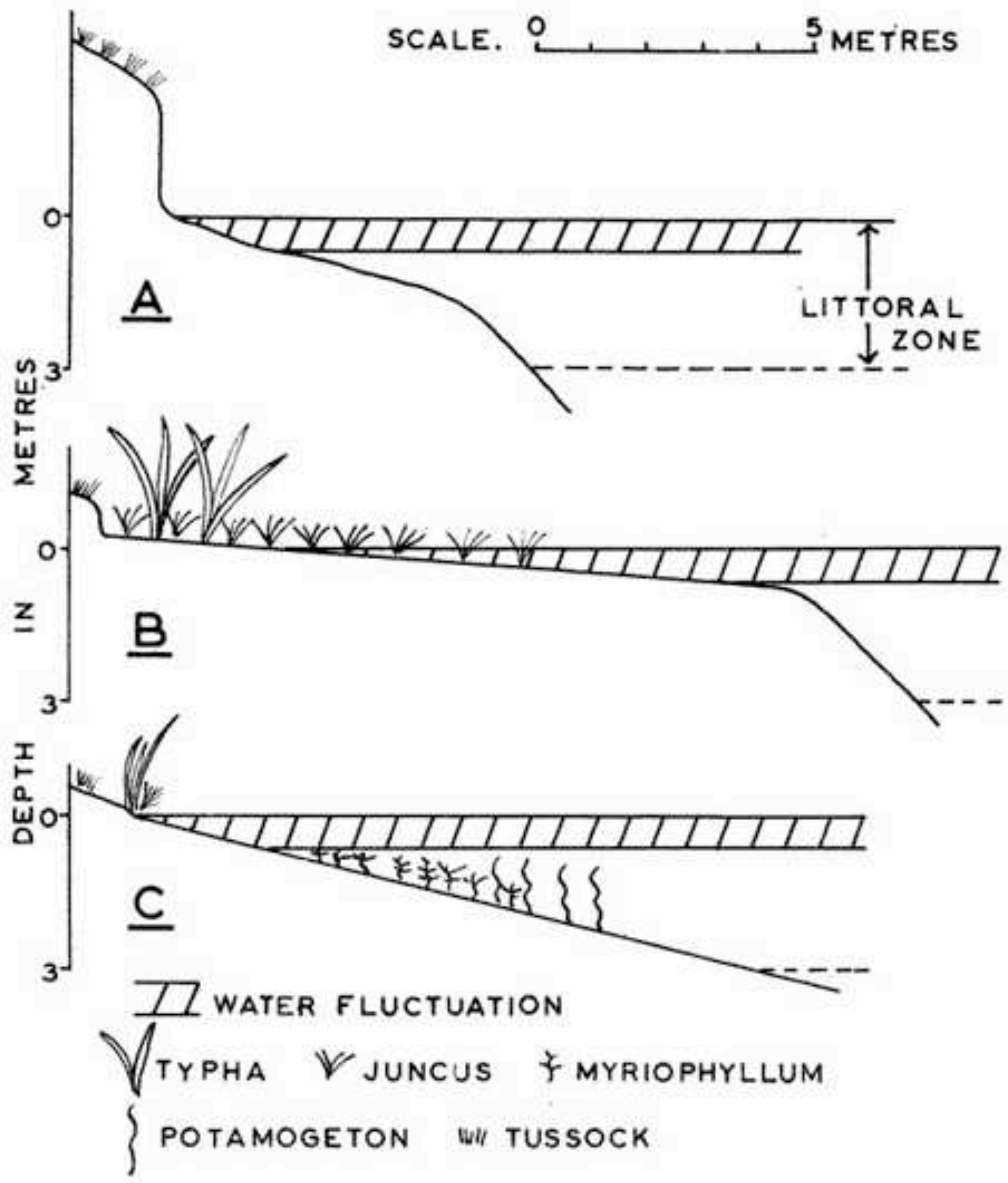

FIGURE 3. *Typical shore profiles showing the proportion of the littoral zone exposed by the daily water fluctuation, and the distribution of macrophytes.*

As the lake basin was originally tussock grassland very little of the original terrestrial vegetation remained below the high water mark. The type of shore shown in Figure 3C still had the stumps of rotting tussock, and from Dip Creek to the slipway the steep rocky hillsides were covered by *Leptospermum* which formed a belt of dead plants sticking out of the water. In all the bottom samples brought up by the Petersen grab, only one contained rotting vegetation. It would seem that after $5\frac{1}{2}$ years the tussock and scrub have either completely rotted away or else been covered by a layer of silt.

PLANKTON

Three surface plankton hauls were taken with nets just above Gorge Creek at dusk on January 1962 (Table 5).

TABLE 5. *Surface plankton hauls taken near Gorge Creek in January*, 1962.

Net Gauge (threads/cm.)	19	19	36
Diameter (cm.)	35	35	15
Time of starting	21.00	20.15	20.15
Duration of tow (minutes)	20	30	30
Entomostraca	4	1	49
Other organisms	6	3	9

In June 1962 ten vertical plankton hauls were taken within 3 km. of the dam. The net (36 threads/cm.) was pulled up from a depth of 20 m. The total catch was 14 entomostroca giving a mean of 1.4 per haul.

Though inadequate these samples indicate the scarcity of the plankton. This is almost certainly related to the high rate of water renewal (Table 2) (Brook & Woodward 1956).

BOTTOM FAUNA

All samples were taken with a Petersen grab (area 550 sq. cms.) and washed through a brass wire sieve with apertures of 0.26 mm. The sample was preserved in 4% formalin and the organisms counted later. For the small oligochaetes the sample was made up to 500 ml. and the mean of four 2 ml. aliquots taken, the number counted was halved to allow for fragmentation of the worms. Seventy samples were taken but only fifty eight were usable, the rest being discarded.

Table 6 shows the total mean density of the bottom fauna, the main organisms being microdrile oligochaetes, sphaerid molluscs, and chironomid larvae. The depth distribution given in Table 7 shows that oligochaetes, sphaerids and chironomid larvae were found throughout the depth range but *Potamopyrgus* was not taken below 25 m.

TABLE 6. *Average density of the bottom fauna per square m. based on* 58 *samples.*

	Mean per sq. m.	%
Oligochaetes	13,767	86.85
Sphaerids	1,400	8.83
Chironomid larvae	329	2.07
Gasteropods†	288	1.82
Miscellaneous*	67	0.43
Total	15,851	100.00

†*Potamopyrgus* and *Planorbis*
*Trichoptera, Ostracods, Harpacticoida, Coleoptera, Acarina.

TABLE 7. *Depth distribution of bottom fauna.*
Mean densities per sp. m. for 5 m. depth classes

Depth in m.	Total No.	Oligochaetes	Chironomid larvae	Sphaerids	*Potamopyrgus*	No. of samples
0– 5	15,601	13,508	391	1,099	362	33
5–10	12,893	11,830	402	624	33	8
10–15	37,123	35,890	528	679	18	3
15–20	14,349	12,574	102	1,656	13	7
20–25	55,255	30,940	510	23,660	73	1
25–30	9,164	8,044	36	552	0	1
30–35	–	–	–	–	–	0
35–40	5,273	5,096	18	158	0	3

TABLE 8. *Longitudinal distribution of the bottom fauna taken as transects at Stations A to G.*

Sediment particle size mm.	1.4		1.0				0.1
Bottom type	Sand		Silt				Fine silt
Station	A	B	C	D	E	F	G
No. of samples	6	4	5	5	5	2	6
Max. depth in m.	8	?	19	23	28	10	39
Current km/h.	3.2	3.2	1.2	1.2	0.8	0.4	0
Mean no. oligochaetes/sq. m.	0	5	27,002	11,502	17,472	14,697	397
Mean no. other fauna/sq. m.	0	5	1,638	5,733	1,256	473	104
Mean total fauna/sq. m.	0	9	28,640	17,235	18,728	15,170	501

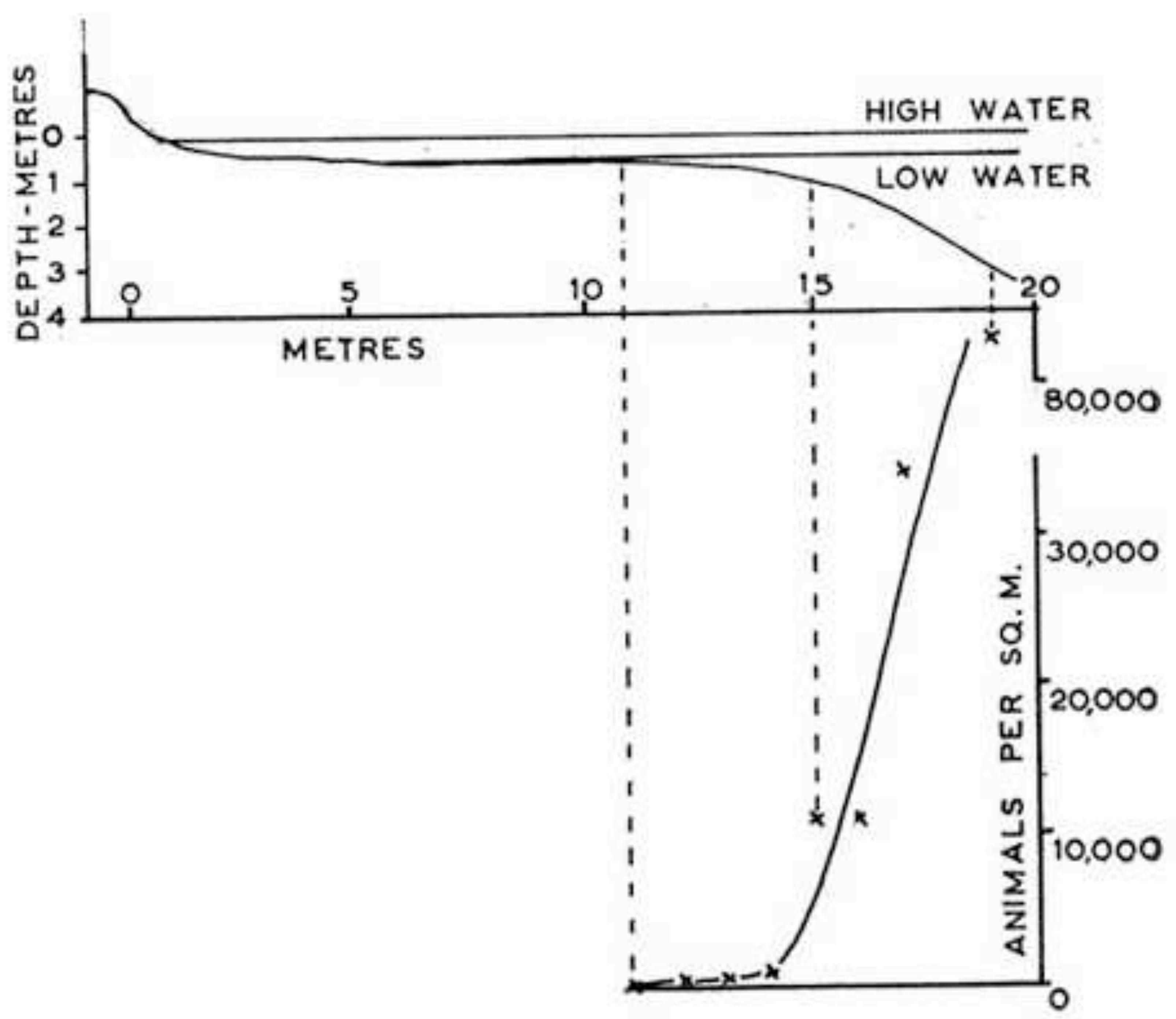

FIGURE 4. *A line transect of animal no./sq. m. taken at Station T, showing the rapid increase of animal no. below low water mark.*

Figure 4 is a line transect taken down a mud bank at Station T. The samples were taken from low water mark to a depth of 2.5 m., none were taken between high and low water but from general observation these would be very close to the first sample (i.e. zero animals/sq. m.). There was a very rapid increase of animal numbers (80% oligochaetes) below low water mark. This is almost certainly correlated with the bottom type. In the region of water fluctuations the mud bank has been sorted and compacted by the lapping water as it rises and falls, making the bottom an unfavourable environment for the fauna. Below this the silt rapidly becomes much softer so favouring higher animal numbers particularly oligochaetes. This shows the effect of the water fluctuation on the littoral zone.

Table 8 shows the results of a series of bottom transects across the lake at stations A to G. The bottom can be divided into three main types, expressed as particle size. Stations A and B were on clean quartz sand and the bottom fauna was very sparse. Stations C to F were in the middle region of the lake where sedimentation is rapid and high concentrations of animals, particularly of microdrile oligochaetes occur. Station G, was in the region of zero current and so more like a natural lake, and there is a significant drop in the number of oligochaetes ($P < .05$). The reasons for the quantitative variation of the bottom fauna would require further work.

Oligochaetes

The number of oligochaetes is much higher than in typical oligotrophic lakes such as the Swedish lakes Blasjon and Ankarvattnet (Grimas, 1961) with respective oligochaete densities of 405 and 718 per sq. m. In an eutrophic N. American lake, Third Sister Lake, Eggleton (1931) frequently recorded densities over 9,000 per sq. m. with a maximum of 18,000. In Lake Fort Smith in Arkansas, which was formed by the damming of a bare steep-sided valley with thin poor soils like L. Roxburgh, Causey (1953) recorded a density of 70,000 oligochaetes per sq. m. which was 81.5% of the total bottom fauna. Professor B. J. Marples (pers. comm.), using the same method as the author, recorded no oligochaetes from a depth of 30 m. in Lake Johnson, a small oligotrophic lake in Central Otago.

The high density in Lake Roxburgh is possibly due to the rapid rate of sedimentation and the continual mixing of the water by the current.

Mollusca

The sphaerid genus *Pisidium* was very patchily distributed and was confined to the middle section of the lake (Station C to F) except for one record in a shallow bay below F. The maximum density was 19,900 per sq. m. with a mean of 1,400.

Potamopyrgus was the most common gastropod with a mean density of 216 per sq. m. and was found on firm muddy bottoms mostly at a depth less than 5 m. Many of the shells at greater depths were empty and probably washed from shallower water. An exceptional lowering of the water level by 3 m. exposed the snail on mud flats at the mouth of Cave Creek showing a clumped distribution with numbers ranging from 2,000 to 710 per square meter.

Planorbis sp. with an average density of 72 per sq. m. was recorded from depths less than 2.5 meters, where water weed grew.

Six specimens of *Physastra* sp. were obtained from trout stomachs, caught near Meadow Bay.

Insecta

Chironomid larvae were an important element of the bottom fauna with an average density of 329 per sq. m. which is typical for oligotrophic lakes. Boud and Eldon (1958) recorded 406 and 740 per sq. m. for the Canterbury lakes Camp and Clearwater respectively, while for two Canadian oligotrophic lakes, L. Paul and L. Maligne, Dawson (1942) recorded 671 and 484 per sq. m. Several genera were present in L. Roxburgh including a red *Chironomus* sp. In the shallow bay at the mouth of Dip Creek pupae of a much smaller chironomid not recorded from any other station were found in high concentrations (2,500 per sq. m.).

Trichoptera larvae were very scarce and found only on bottoms with water weed. The three most common were a sandy cased *Pycnocentria*, a horny cased *Olinga* and the minute *Paroxyethira*.

Ephemeroptera nymphs were not collected even though adult mayflies were a common sight on a calm day. On one calm morning 32 adult *Deleatidium* sp. were counted on a transect 800 × 1 meter taken from the boat. The adults were seen the full length of the lake and probably came from the river or from the small tributaries.

The aquatic caterpillar of *Nymphula nitens* and damsel fly nymphs (Odonata) were taken from trout stomachs caught near Meadow Bay.

Three dytiscid larvae were taken from the bed of *Tillia* at Meadow Bay.

Miscellaneous

Small numbers of nematodes, mites, ostracods and harpacticoids were also recorded.

FISH

Nine large brown trout *(Salmo trutta)* beween 26.0 and 43.5 cm. in length were caught. Three had been feeding on *Potamopyrgus* (132, 650, 325 per stomach), two on adult mayflies (123, 60 per stomach), two on insect nymphs and gastropods, and two on only a few chironomid pupae and larvae. The two trout feeding on adult mayflies, were taken away from the shore as they were rising to feed. The others were all taken near the shore, either off the mouths of creeks, or where the bottom had a covering of weed.

A seine net 14 meters long with a mesh of 1.25 centimeters was used to catch small fish on the shore platform. Twenty hauls yielded 61 *Gobiomorphus basalis* and 50 fingerling *Salmo trutta*. Of the *Gobiomorphus* 42 were caught in one haul over a shelving bottom near Doctor's Point. The largest catch of *S. trutta* was 10, taken at the slipway. Length frequencies showed a range from 2 to 7 cm. with the mode at 3 cm. for *G. basalis*, and a range from 5 to 11 cm. with the mode of 7 cm. for *S. trutta*.

An examination of 8 stomachs showed *G. basalis* to be feeding mainly on chironomid pupae and larvae; no oligochaetes or their chaetae were found. The *S. trutta* were returned to the lake. Eels are present but as upstream migration has been largely prevented by the dam their numbers should decrease.

ACKNOWLEDGEMENTS

I wish to thank the Otago Acclimatisation Society for initiating the survey and for their generous help both financially and by the loan of nets and boat. I also wish to thank Dr. D. Scott for his help and criticism throughout, Mr. K. W. Duncan for his help and ideas in the field, the Department of Zoology for their willing co-operation, the Department of Botany for help in identifying the plants and Miss R. Mason for identifying *T. sinclairii*.

REFERENCES

BOUD, R., and ELDON, G. A., 1958. An investigation of the trout food supply in Lakes Clearwater, Emma and Camp. *Marine Dept. N.Z. Inves. Rep. Freshw. Fish. Advis. Service Job* 11.

BROOK, A. J. and WOODWARD, W. B., 1956. Some observations on the effects of water inflow and outflow on the plankton of small lakes. *J. Anim. Ecol.* 25: 22–35.

CAUSEY, D., 1953. Microdrili in artificial lakes in Northwest Arkansas. *Amer. Mid. Nat.* 50: 420–425.

EGGLETON, F. E., 1931. A limnological study of the profundal bottom fauna of certain freshwater lakes. *Ecol. Mon.* 1:231–332.

ELLIS, M. M., 1941. Freshwater impoundments. *Trans. Ameri. Fish. Soc.* 71: 80–93.

GRIMAS, U., 1961. The bottom fauna of natural and impounded lakes in northern Sweden. (Ankarvattnet and Blasjon). *Rep. Inst. Freshw. Res. Drottingholm* 42: 183–237.

HUTCHINSON, G. E., 1957. *A treatise on limnology. Vol. I. Geography, Physics and Chemistry*. Wiley, New York.

JOLLY, V. H., 1959. A limnological study of some New Zealand lakes. *Unpub. Ph. D. thesis Univ. of N.Z.*

MCLINTOCK, A. H. (editor), 1959. *A descriptive atlas of New Zealand.* N.Z. Govt. Printer. Wellington, N.Z.

MOON, H. P., 1935. Flood movements of the littoral fauna of Windemere. *J. Anim. Ecol.* 4: 216–228.

RAWSON, D. S., 1942. A comparison of some large alpine lakes in Western Canada. *Ecol.* 23: 143–161.

WELSH, P. S., 1948. *Limnological methods.* Blakiston Co. Philadelphia and Toronto.

PARASITIC ISOPODS ON TROUT

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Although parasitic Crustacea are not uncommon on migratory salmonids in the northern hemisphere, there appear to be no records of such an association in Australasia. A trout (*Salmo trutta* L.) was taken in Lake Waituna, Southland in April 1963 and seven parasitic isopods found attached to it. Three specimens were examined and identified as *Nerocila orbigni* (Guéren, 1832). The specimens were females and the lengths were 24, 28 and 28 mms.

Lake Waituna is coastal and is fed by several streams. Drainage to the sea is dependent on a temporary opening in a sand bar so that the lake discharges at irregular intervals. During these intervals sea water may enter the lake. The trout weighed seven pounds and our informant stated that in his opinion the fish had not recently come in from the sea. Records for the parasite (Hale, 1926, 1940) give teleosts and elasmobranchs as hosts, but there is no suggestion that this species might inhabit brackish water. The simplest explanation seems to be that the parasites attached themselves to the trout in the sea and retained their position for some time after the trout entered L. Waituna.

Trout appeared in the coastal waters of Tasmania and New Zealand from about 1870 onwards, and it will be of interest to see whether they acquire a large complement of marine parasites.

I am indebted to Mr. R. Sutton for the specimens and information and to Miss A. J. A. Green of this department for the identification.

REFERENCES

HALE, H. M., 1940. Report on the Cymothoid Isopods obtained by the F.I.S. "Eendeavour" on the coasts of Queensland, New South Wales, Victoria, Tasmania, and South Australia. *Trans. Roy. Soc. S. Aust.* 64:288–304.

HALE, H. M., 1926. Review of Australian Isopods of the Cymothoid Group, Part II. *Trans. Proc. Roy. Soc. S. Aust.* 50: 201–234.