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Notes on Lake Ellesmere Trout

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IN 1958 arrangements were made for investigating the trout of Lake Ellesmere. It appeared that the fish were neither as plentiful nor as large as they used to be, and while no comparison of abundance was possible, as no records of the amount of fish taken yearly had ever been made, several scientific works giving data on size and growth and one recording food had been published. A comparison of these data of present-day fish with those recorded some years ago seemed likely to give general information of value.

The principal material collected in 1958 consisted of the scales and internal organs of a hundred trout taken by an angler, who modestly wished to remain incognito, about the mouth of the Selwyn River in October, November and December. Some of the fish were taken in the lake off the mouth of the river and others at various points along the deep channel of the river from the mouth to about two miles above. Particulars of the length, weight and date of capture together with the serial number were recorded on the scale packets which were identified with the internal organs by means of a numbered tag attached to the latter before preservation in formalin solution. Investigation of the material was commenced, but the work was interrupted by illness and was never completed.

In the present dearth of information on trout, a summary of the information available should be of some value, particularly as the section dealing with food was complete. Examination of scales had only commenced, but size, condition factor and sex ratio had been worked out. Other unpublished data existed in the form of particulars of 122 spawning fish collected by the writer from the Selwyn River at the Main South Road on 24 July 1950. These various data, all bearing on Lake Ellesmere trout, have been brought together and compared with such published records as exist.

Lake Ellesmere is a brackish lagoon some 40,000 acres in extent situated on the Canterbury coast just south of Banks Peninsula. Its site was once occupied by the sea, from which it has been separated by a shingle spit thrown up by the waves and composed principally of material transported from the south (Speight, 1930). In its natural state the lake remained isolated from the sea for the greater part of the time, but about once a year the water of its tributary streams ponded behind the spit would rise sufficiently to effect an opening, and the level would fall to about that of half tide. The opening would remain for days or weeks, but would be blocked by the first southerly storm of sufficient magnitude to cause the necessary

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amount of shingle to be cast up. As settlement of the district progressed the natural outbreak was anticipated by cutting a pilot channel through the spit before the water rose to the normal breaching level, and the drainage of nearby farms thereby improved. With the advance in engineering methods the openings have been made more frequently and the maximum level progressively lowered until at the present time it is usual for the opening to be made whenever the water level rises to about $3\frac{1}{2}$ feet above mean sea level. Soundings of the depth have been made by the writer when the level stood at $4\frac{1}{2}$ feet, and depths of from 5 feet to 6 feet recorded over a considerable area. The middle of the lake gave soundings of about 8 feet and the maximum depth observed was $9\frac{1}{2}$ feet some three or four miles south-east of Kaituna. Most of the inland margins are very shallow and merge gradually into the deeper water. As a result of this, the mud bottom and the exposed position of the lake, the water is usually more or less turbid.

The principal tributary of the lake is the Selwyn River which, together with several tributaries, rises in the foothills of west Canterbury. It carries permanent water in its upper and lower sections, but the long shingle mid-section across the plains is frequently dry in summer. The lower four miles of the river are deep, mud-bottomed and sluggish. The Halswell, the Number 2, the Irwell and Hart's or Hall's Creek are deep spring-fed creeks rising in the swampy belt adjacent to the lake and all flowing into it. Another tributary, the Kaituna, is a hill stream rising in Banks Peninsula but having a deep sluggish mouth. There are also several other small streams, and ditches which have been cut for drainage purposes.

Native fishes occurring abundantly in the lake are *Retropinna* species, *Aldrichetta forsteri*, *Anguilla australis*, *Anguilla dieffenbachii*, and *Rhombosolea retiaria*. Less abundant are *Rhombosolea plebia*, *Rhombosolea leporina*, *Galaxias attenuatus* and *Rhombosolea tapirina*. The last appears to be rare, as only one specimen from this locality has been seen by the writer. Juvenile specimens of *Cheimarrichthys fosteri* have been taken in the lake adjacent to where the outlet is usually opened, and various marine fishes are taken occasionally. *Gobiomorphus basalis* is abundant at the mouths of all tributary streams, but has not been taken by the writer in brackish water. The only introduced fish occurring plentifully in the locality is *Salmo trutta* which established itself early in the history of acclimatisation and has persisted ever since as a migratory form. It has, by competition in the juvenile stage, contributed largely to the great reduction in the river-dwelling trout which once abounded in the upper Selwyn and its tributaries. The Lake Ellesmere stock receives some reinforcement from sea-living brown trout which gain access to the lake when the outlet channel is open. Specimens showing sea-formed structure on their scales are taken occasionally in the lake or lower Selwyn.

LENGTH

The lengths of the 100 fish collected in 1958 ranged from 12 inches to 23.5 inches and averaged 18.24 inches. The first authentic records of length of Lake Ellesmere trout were published by Godby (1919), from whose data the average of 238 fish taken at the stripping trap operated in the Selwyn River at that time has been computed as 20.9 inches. These fish were mature migratory trout taken at the completion of the season's growth, and should consequently show a slight advantage over the 1958 group which was taken during the growing season and contained a few young fish. The difference of 2.11 inches is much more than can be accounted for by this circumstance. Parrott (1932) records 60 fish from the Selwyn River, 24 from the Number 2 and some small groups from other tributaries. The Selwyn River fish averaged 16.4 inches and the Number 2 fish 20.1 inches. At that time a moderate stock of river-dwelling fish still inhabited the shingly

section of the Selwyn, and it seems probable that a proportion of these was included in the sample. The next group consists of 66 fish taken in 1929-31 and recorded by the present writer in 1936. This material was taken under conditions similar to those of the 1958 group except that a few large specimens came from the lower part of the Number 2, which has always been noteworthy for large fish. The average length of the 66 fish recorded in 1936 is 21.8 inches. The same work (Stokell, 1936) records the average length of 23 fish taken at Meadowbank in 1929-31 as 19.04 inches. These were mature migratory trout which had run up into the shingly part of the Selwyn for spawning, and were taken from the resting pools by angling in the evening.

On 24 July 1950, large numbers of Lake Ellesmere trout were stranded in the Selwyn about the Main South Road. The river had been low for some time but a small flood had occurred and subsided very quickly. Many fish moved up during the fresh and were trapped when the water went down. The group of 122 shown in Plate 1 was collected by the writer, the length measured, scales taken and the sex determined by trial stripping or opening the abdomen. Most of the fish had partly or completely spawned. They ranged in length from 13.75 inches to 22 inches and averaged 17.4 inches. These fish, being spawning migrants, are directly comparable with those recorded by Godby in 1919 and the small group of 28 fish recorded by the present writer in 1936. The various data discussed are tabulated below.

TABLE I.—Average lengths of Lake Ellesmere Trout.

Group	Number of Specimens	Average Length
Godby, 1919	238	20.9 inches
Stokell, 1936	66	21.4 inches
Stokell, 1936b	23	19.04 inches
Collected, 1950	122	17.4 inches
Collected, 1958	100	18.24 inches

The groups giving the most valid comparison are the first, third and fourth. All of these were composed of Lake Ellesmere fish which had finished growth for the season and were on their spawning migration. Godby's fish, recorded in 1919, were actually collected in 1915 and 1917, thus giving a reduction in length from those dates to 1950 of 3.5 inches. The second and fifth groups, which were taken during the growing season, are not so truly comparable, by reason of the 1936 group including some large fish from the Number 2, but indicate a definite reduction.

CONDITION FACTOR

The condition factor of the 100 fish taken in 1958 ranges from 20 to 62 and averages 43.25. Thirteen specimens had had the adipose fin removed during counting, some time previously, at a trap operated in the Selwyn about Coe's Ford. Most of them appeared not to have resumed a normal state since the operation, as the factor of the mutilated fish is much below that of the normal ones. Monthly factors for the normal fish and the average for the thirteen mutilated specimens are given in Table II.

TABLE II.—Condition Factor of 100 Lake Ellesmere Trout.

Group	Number of Specimens	Average Factor
October	37	42.1
November	33	44.7
December	17	48.0
Mutilated	13	33.8

The normal fish show a progressive monthly improvement, while the mutilated fish are much below any normal group. No really comparative data are available. The low factor of the mutilated group indicates the existence of a serious detrimental influence. Six mutilated specimens received intact from the collector after the group of 100 specimens was completed were in subnormal condition as shown in Plate 2, fig. 1. One had the posterior part of the caudal peduncle sharply deflected upward as shown in Plate 2, fig. 2. A similar misshapen fish, which had been mutilated previously, was observed at the trap in 1958 when fin-cutting was being performed. It would appear that the subnormal condition of the mutilated fish is, at least, not wholly caused by actually cutting off the adipose fin. After the operation the fish were taken by the caudal peduncle and thrown, sometimes several yards, into the water. Dissection of the specimen shown in Plate 2, fig. 2, revealed a fracture of the neural spine of the third vertebra after the rear of the anal fin. The spine was separated completely from the centrum, and the broken end was quite free, no indication of knitting being present.

SEX RATIO

The group of 100 specimens taken in 1958 consisted of 43 males, 45 females and 12, principally small fish, in which the stomach had been cut too short and the genital organs were missing. The sex is not recorded in the writer's 1936 paper, and Godby's figures, which are the only valid data published, must necessarily have been influenced by the requirements of spawn taking. Fresh data are available from the group of 122 stranded fish taken from the Selwyn while on their spawning migration in 1950. These fish had died recently and were examined intact either by trial stripping or opening the abdomen. There were 85 males and 37 females. The remarkable disproportion, compared with the approximate equality of the sexes in the 1958 collection, would seem to suggest the existence of some influence associated with spawning and the abnormal conditions occurring at the time. Armistead (1920) recorded that the sexes would become unbalanced by exclusive fly fishing, as a result of the males being the freer risers, but there is no evidence that live-bait fishing at night, as practised at Lake Ellesmere, would take an undue proportion of females.

FOOD

The 1958 specimens were taken in the evening when they were feeding freely, and the organisms present in the stomachs had been little affected by digestion. Fifteen of the food fishes which had been considerably reduced in bulk were determined from skeleton parts and included in the tallies. The food consisted almost entirely of fishes, and only two species were present. Eleven stomachs were without food of any kind. The remaining 89 contained 167 *Gobiomorphus basalis*, 195 *Retropinna* species, 1 larva of the damselfly *Zantagrion*, and 5 had fragments of waterweed. A table showing the monthly results is given below.

TABLE III.—Stomach Contents of Lake Ellesmere Trout.

Month	Number of Stomachs	<i>Gobiomorphus</i>	<i>Retropinna</i>	Insect	Water Weed
October	41	85	89	1	5
November	34	45	70	—	—
December	25	38	38	—	—



Spawning trout from Lake Ellesmere stranded while on their spawning migration.

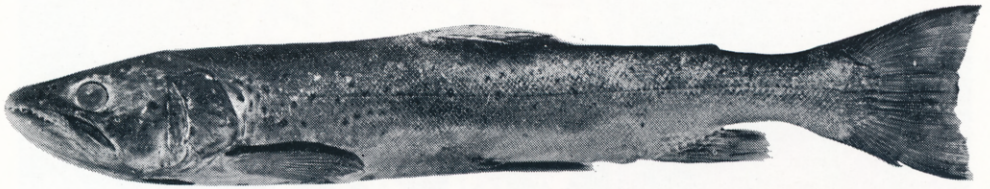


FIG. 1.—Fish with adipose fin removed.

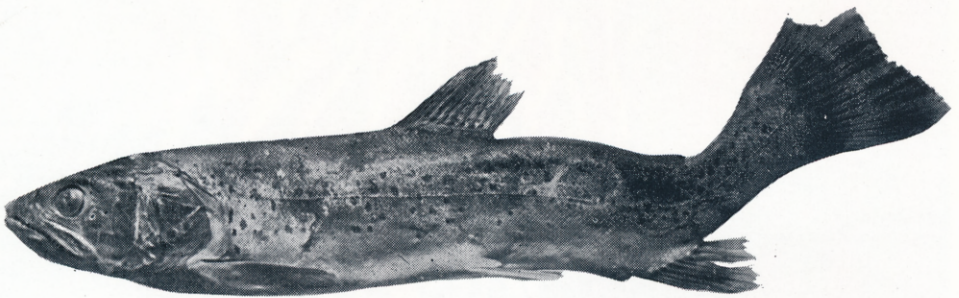


FIG. 2.—Fish with adipose fin removed and third vertebra after anal fin fractured.

The greatest number of *Gobiomorphus* found in one stomach was 12 and the greatest number of *Retropinna* was 21. Both of these fishes would average about 65 millimeters in length, but *Gobiomorphus* is much the stouter bodied. They were frequently associated in the same stomach, but when a very large number was present it was usual for one to occur exclusively.

The only record of the food of trout from this locality is given in the writer's 1936 paper. Table I of this paper records the food of 66 trout averaging 21.4 inches in length as consisting of 167 *Gobiomorphus*, 41 *Retropinna*, 1 *Galaxias attenuatus*, 33 larvae of Trichoptera, 1 of Perlaria, 5 gastropods and a small quantity of waterweed. In comparing the data given in these two papers it must be noted that the species of *Gobiomorphus* and *Retropinna* are the same in each. The earlier paper was published before the writer's revisions of these genera in 1941. Previous to this the four eleotrids abundant in the South Island were regarded as *Gobiomorphus gobioides*, and only one species of *Retropinna* was supposed to exist in New Zealand. The eleotrid concerned has been referred to *Gobiomorphus basalis*, but the species of *Retropinna* has still to be described and named. These two fishes form the principal food of the two groups of trout, the only important difference being in the relative numbers of the two species. Whereas *Gobiomorphus* outnumbered *Retropinna* by four to one in the 1936 group, the numbers do not differ greatly in the present collection.

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