

seventy miles distant by road from Christchurch. This lake formerly had an outflow into the Harper River, a tributary of the Rakaia River. Since the waters of the lake were "harnessed" for the purpose of the Lake Coleridge hydro-electric scheme (started in 1916) this Harper River outflow has been cut off and the only outlet is by way of the penstocks to the power-station turbines. There is, therefore, no possible access to the lake for any fish returning via the Rakaia River from the sea.

It was on this account that the supply of ova above mentioned was granted to the North Canterbury Acclimatization Society in 1930, in order that an indubitable stock of "landlocked" lake-fed Atlantic salmon might be produced. So far as this Department was concerned, the main object was to enable light to be thrown on the natural history of lake-dwelling salmon in order to assist our understanding of the salmon of Lake Te Anau. All the evidence available goes to show that, in spite of the fact that there is easy access to the sea by way of the Waiau River, the majority of the salmon taken in Lake Te Anau and its tributaries have never been to salt water, but have remained and fed in the lake up to the time of attaining maturity. A small proportion of the Te Anau fish appear, from their difference in coloration, to have come up from the sea, and from time to time salmon have actually been caught at the mouth of the Waiau and in its lower (tidal) reaches. Salmon have also been caught in the Waiau River in its course between Lake Te Anau and Lake Manapouri, the pools of which have become increasingly popular with salmon-fishermen for both minnow and fly fishing. Some of the salmon caught in this part of the river between the two lakes contained food, consisting of insects or small fish, in their stomachs, and were obviously feeding—a condition that is in no way comparable with that of the sea-run salmon taken in British rivers.

Attempts to interpret the history of Te Anau salmon by examination of their scales have not thrown any very definite light on the subject though it is quite possible that a detailed study of representative samples of scales taken from fish caught in the tideway and from the lake respectively would afford a key to the solution of the problem. So far we have been unable to collect sufficient material for this study, and all that can be said for the present is that the scales of all these salmon are in most cases difficult to "read" with any degree of certainty.

With regard to the Lake Coleridge experiment, it was hoped that the capture of some of these 1928 fry at a later stage of growth would provide definite data as to the growth and condition attained in a known time, together with specimens of scales the markings of which could be exactly correlated with known conditions.

The desired data made their appearance at an unexpectedly early date, early in December, 1930—less than two years and one month after the liberation of the fry—when three specimens of Atlantic salmon caught by anglers about the 23rd, 24th, and 30th November, were forwarded to Wellington from Christchurch by Mr. A. W. Parrott, Biologist to the Fresh-water Research Committee, at the instance of the North Canterbury Acclimatization Society. These fish were respectively 22 in., 22½ in., and 23 in. in length, and weighed respectively 3¼ lb., 3 lb., and 3½ lb. There could be no possible doubt as to their specific identity. In appearance they were typical *Salmo salar* at the grilse stage, though probably more slender in shape than the average European grilse of the same length. In anatomical characters—scale-count, number of gill-rakers, and body-measurements—they conformed to the specific characters of *Salmo salar*. The most remarkable character about them is the exceptional growth and development which have taken place at an age of but little over two years. This is not an effect of being placed in "virgin water," for Lake Coleridge has been stocked with brown trout for many years, though rainbows at present are the dominant game fish, and in recent seasons numerous landlocked quinnat salmon reputed to be of excellent quality and fighting-power have been caught in the lake. These latter have been derived from stock which originally ascended from the sea by way of the Rakaia River before connection with that waterway was cut off by the hydro-electric scheme.

In Britain the majority of young salmon at this age are just about to migrate from the river to the sea, having grown to a length of about 4 in. or 5 in. in the Scottish rivers and 6 in. or 7 in. in the more clement waters of such rivers as the Wye. A small proportion of salmon bred in English rivers reach the smolt stage early and go to sea after completing their first year. These would certainly put on considerable growth as the result of a marine diet in their second year. Nevertheless, a comparison with the estimated lengths, at the end of their first year in the sea, of the salmon of the river Spey which have been exhaustively studied by Menzies and MacFarlane* from scale-samples and measurement data, shows that these Lake Coleridge fish are at least 10 centimetres (4 in.) longer than the average length of Spey salmon which have fed in the sea for a year after migrating as two- or three-year-old smolts. It should be noted, however, that these Scottish fish would begin their first summer's feeding as tiny individuals, the size of a sprat, and the North Sea winter season, with its retarding effect on growth, would be upon them by the time they had attained a size which would enable them to feed upon prey of substantial size.

To what factors can the rapid growth of the Lake Coleridge salmon be ascribed? At present we know practically nothing of the fish-food supplies in this—or, for that matter, any other—lake. The stomachs of trout caught here in summer have been found to contain mainly insects, aquatic and terrestrial. "Water-boatmen" appear to be particularly abundant and caddis-flies are plentiful. Coleoptera, Hymenoptera, and Orthoptera are all represented. The only fish found in nine stomachs examined were bullies (*Gobiomorphus gobioides*). Eels are abundant in the lake, and doubtless those of small size as well as young individuals of the Salmonoid family afford nourishment to trout and salmon. There are also probably plenty of small fishes of the Galaxiid family. But the factor which probably has most to do with the phenomenon is that of temperature. Here again considerably more data are required for the full elucidation of the question. I understand that the winter

* "Salmon of the River Spey": Fisheries, Scotland, Salmon Fish, 1928, Nos. I and III.