THE FISHES OF OKANAGAN LAKE AND NEARBY WATERS

By W. A. Clemens

In the study of the fishes of the lakes, collections were made by means of a gang of seven gill nets of $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, 4 and 5-inch stretched mesh, each 50 yards in length. This string was set 40 times in various localities at depths from 9 to 375 feet (3 to 115 metres). Numerous seine hauls were made with a thirty-foot quarter-inch net and a ninety-foot half-inch net. In addition specimens of Kamloops trout were provided by a number of anglers, particularly by Mr. J. C. Child, and of kokanee by Mr. G. N. Gartrell and Mr. R. Leckie-Ewing.

The following fourteen species of fish were obtained:

Rocky Mountain whitefish...*Prosopium williamsoni* (Girard)
Eastern whitefish.....*Coregonus clupeaformis* (Mitchill)
Kokanee.....*Oncorhynchus nerka kennerlyi* (Suckley)
Kamloops trout.....*Salmo gairdneri kamloops* (Jordan)
Fine-scaled sucker.....*Catostomus catostomus* (Forster)
Coarse-scaled sucker.....*Catostomus macrocheilus* Girard
Carp.....*Cyprinus carpio* Linnaeus
Lake shiner.....*Richardsonius balteatus* (Richardson)
Squawfish.....*Ptychocheilus oregonensis* (Richardson)
Chub.....*Mylocheilus caurinus* (Richardson)
Long-nosed dace.....*Rhinichthys cataractae* (Cuvier & Valenciennes)
Silver-grey minnow.....*Apocope falcata* (Eigenmann and Eigenmann)
Sculpin.....*Cottus asper* Richardson
Ling.....*Lota maculosa* (Le Sueur)

Reports of the occurrence of a few additional species were received, namely, a species of lamprey, a species of sturgeon and the Eastern speckled trout, *Salvelinus fontinalis*, which was introduced some years ago into a stream at Kelowna. Three species of Pacific salmon, namely, the sockeye, *Oncorhynchus nerka*, the spring, *O. tschawytscha*, and the coho, *O. kisutch*, are said to have entered the lake in the early days.

ORIGIN OF THE FISH FAUNA

During the last glacial period there could, of course, have been no fish present in what is now the mainland of British Columbia. With the retreat of the ice and the establishment of drainage streams to the south, many species undoubtedly gradually spread northward. In recent years the carp has come by this route and the large-mouthed black bass has at least reached Osoyoos lake, both species having been brought into the state of Washington waters from Eastern United States. It is probable that the ling and the fine-scaled sucker came from

the north before the Shuswap lake drainage changed from the Okanagan to the Fraser outlet since these are species common in the Great Lakes region of eastern Canada and also indigenous across northern Canada including northern British Columbia.

Finally two species have been introduced directly, the Eastern whitefish and the Eastern speckled trout. The former has established itself but there seems to be no evidence that the latter has done so.

DISTRIBUTION AND ABUNDANCE IN THE LAKE

The fish tend to form two distinct groups in respect to their distribution in the lake, namely, the shallow-water shoreward species and the open-water species. The former group comprises the coarse-scaled sucker, carp, lake shiner, squawfish, chub, long-nosed dace, silver-gray minnow and sculpin; the latter group, the fine-scaled sucker, Rocky Mountain whitefish, Eastern whitefish, kokanee, Kamloops trout and ling. The two associations are illustrated in figure 7. There is a certain amount of overlapping and there are times when the above segregation is tem-

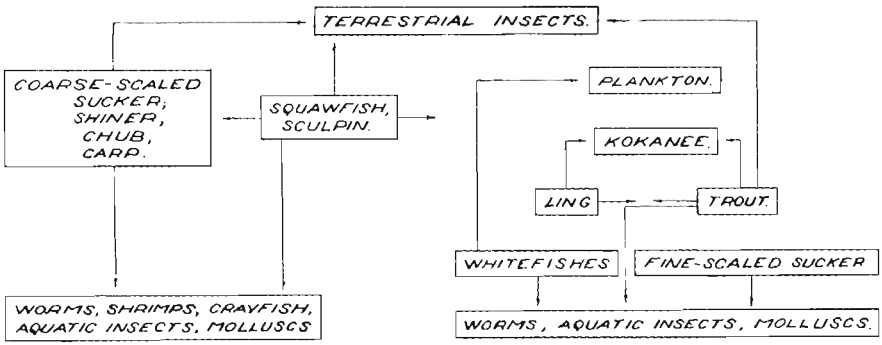

FIGURE 7. Distribution and food relations of fish in Okanagan lake.

porarily abandoned, as, for example, in the early autumn when the whitefish, kokanee and ling enter the shallow waters to spawn, and in the spring when the Kamloops trout enter the streams or shore-waters to spawn. The chief food relations of the adult fish are shown by arrows.

Certain species are exceedingly abundant, as, for example, lake shiners, chub, squawfish and coarse-scaled suckers. Large numbers of the young of these fishes inhabit all the shoreward areas where growths of aquatic plants occur.

The kokanee is probably abundant in the open waters. The summer observations were entirely inadequate for the formation of an opinion as to numbers but statements by residents as to spawning individuals would seem to indicate a considerable population.

Carp, Rocky Mountain whitefish, Eastern whitefish, Kamloops trout and sculpins occur abundantly, the fine-scaled sucker and ling much less so, and the long-nosed dace and silver-gray minnow apparently in very limited numbers.

Kokanee, *Oncorhynchus nerka kennerlyi* (Suckley)

This lake-locked sockeye salmon occurs in considerable abundance in Okanagan lake. Since it is a fish occupying the open waters at intermediate depths, only a very few specimens were taken in the bottom sets of gill nets. Spawning occurs in the autumn along the shores and in some of the streams. The kokanee mature for the most part at four years and the males develop the red coloration, the hooked snout and the deep body as do the sea-run sockeye. As far as known all individuals die after spawning. The size at maturity varies considerably, ranging for the most part between 8 and 10 inches but in some cases reaching 12 inches or more.

The food consists almost entirely of water-fleas (Cladocera) and copepods of the plankton, with midge larvae and pupae and microscopic diatoms occurring as minor items. The food of 14 individuals taken chiefly in July and October was examined and the occurrences were as follows: copepods 5; water-fleas 14; midge larvae and pupae 2; algae 1.

The chief cladoceran was *Daphnia longispina*, but *Bosmina longispina* occurred in abundance. The gill rakers are relatively fine and numerous (about 34) and make possible the use of these small organisms as food.

The kokanee is a very important fish in the food cycle of the lake because it feeds upon plankton and in turn forms a rich food supply for the Kamloops trout. There is no doubt that the abundance of kokanees determines the production of large trout in Okanagan lake and that a population of considerable size should be maintained. That there has been a considerable decrease in abundance in recent years is the opinion of many residents and two remedial measures have been suggested, namely, the prohibition of the taking of kokanee for food purposes and the introduction of fry from other areas. In 1933 the Department of Fisheries introduced 239,250 and in 1935, 149,200 fry. It may be pointed out that before a sound policy can be developed it is necessary to obtain information concerning: (1) the life-history of the fish, (2) the numbers of kokanee in the lake, and (3) the relation of the numbers of kokanee to the plankton supply on the one hand and to the numbers and size of trout on the other.

Kamloops trout, *Salmo gairdneri kamloops* (Jordan)

This species is native to the Okanagan area. Prior to the extensive development of irrigation systems, it was probably very abundant in Okanagan lake, where satisfactory conditions for growth were afforded and where the numerous tributary streams provided excellent spawning grounds. As the development of orchards extended throughout the valley and as more and more water was taken from the streams for irrigation, the streams became less and less suitable for the reproduction of trout. While the period of the survey did not cover the spawning and fry period, the summer observations together with the statements of residents provided sufficient evidence to indicate that the majority of the streams could not be relied upon in most seasons to maintain sufficient flow to insure the complete

passage of fry or fingerlings down to the lake. The extent of the escapement of the young fish undoubtedly varies greatly with the wetness or dryness of the spring and early summer.

To meet this adverse condition, two fish cultural procedures have been followed in recent years. The Dominion Department of Fisheries has brought to its Summerland hatchery considerable numbers of eggs obtained chiefly at Penask lake, and liberated the resulting fry at various points around the lake. At the same time, the members of the Kelowna Fish and Game Protective Association have established several large natural rearing ponds with some financial assistance from the Provincial Game Department. Eggs have been supplied by the Dominion

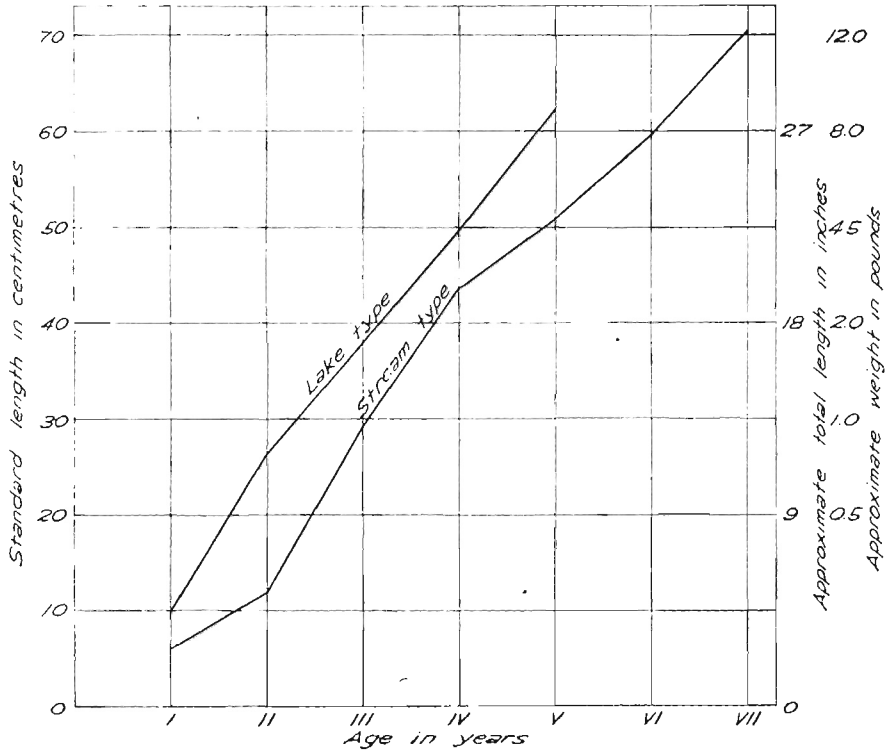

FIGURE 8. Rates of growth of Kamloops trout in Okanagan lake.

Department of Fisheries from its egg-collecting station at Beaver lake and the resulting young fish held in the ponds until the yearling stage when they have been released in the lower portion of Mission creek and directly in the lake.

The records of liberations in recent years are given in table VIII. Natural propagation and these introductions from other areas have probably served to maintain a considerable stock of trout.

The size of this stock is unknown but that it is considerable is indicated by the annual catches. In view of all the circumstances, there is every reason to

believe that the present stock can be maintained, possibly increased by a definite fish cultural policy and the matter will be discussed in a later section of this report.

Only two individuals of Kamloops trout were taken in the gill nets and one fingerling 1.6 inches (3.5 cm.) in a seine haul. Other specimens were supplied through the kind assistance of anglers. The largest specimen measured 31 inches (72.9 cm.) and weighed 14½ pounds. It was caught in November and had apparently completed its eighth summer. Reports of occasional individuals weighing as high as 36 pounds were received.

TABLE VIII. Distribution of eggs and fry

IN OKANAGAN LAKE

Year of stocking	Species	Eggs or fry	Quantity	Source of supply
1919	Kamloops trout	Fry	20,000	Gerrard hatchery
1922	"	Eggs	90,000	Lloyds creek
1922	"	Eggs	30,000	"
1923	"	Eggs	200,000	"
1924	"	Eyed eggs	75,000	"
1928	"	Fry	60,000	Penask lake hatchery
1929	"	Fry	75,000	Summerland hatchery
1929	"	Fry	10,000	" "
1929	"	Fry	10,850	" "
1930	"	Fry	45,825	" "
1931	"	Fry	145,000	" "
1931	"	Fry	34,964	" "
1932	"	Fry	5,000	Summerland (ex Penask)
1933	Kokanee	Fry	239,250	Summerland
1934	Kamloops trout	Fry	58,402	Summerland (ex Penask)
1934	Kokanee	Fry	149,200	Summerland
1935	Kamloops trout	Fry	234,379	Summerland (ex Penask)

IN OKANAGAN RIVER

1923	Kamloops trout	Eggs	160,000	Lloyds creek

Twenty-eight individuals contained a variety of food organisms. The majority were taken in October and November, 1935, and they had been feeding on terrestrial insects and kokanee. Two specimens taken in August had fed to some extent upon aquatic insects. The details are as follows.

28 fish, 10 to 27½ in. (22.8 to 66.0 cm.): fresh water shrimps 1; spiders 5; mayfly nymphs 2; caddis larvae 2; midge larvae 5; other aquatic insects 4; terrestrial insects 17; fish 10; fish eggs 1.

In addition, the stomach contents of 11 fish taken from Beaver lake during July and August were examined and the result showed that the chief food of these was caddis larvae. Kamloops trout is the only species of fish present in this lake. The details are as follows.

11 fish, 6 to 23¾ in. (13.2 to 56.5 cm.): mayfly nymphs 2; dragonfly nymphs 2; caddis larvae 10; midge larvae 4; other aquatic insects 1; terrestrial insects 4.

The data on rate of growth are shown in figure 8. Six individuals had spent the first year in streams and the remainder, 34, in the lake. The growth rates of these two groups have been presented separately and they should be considered as only approximate since such a small number of individuals is involved. The assistance of Dr. C. McC. Mottley in the interpretation of these scales is gratefully acknowledged.

Fine-scaled sucker, *Catostomus catostomus* (Forster)

This species is also known as the northern or long-nosed sucker. It usually inhabits water of considerable depth and appears to be an associate of the Eastern whitefish when the two species occur in the same body of water. Only three individuals were obtained in gill net settings, one off Summerland at a depth of 200 feet (60 metres) and two off Westside at a depth of approximately 100 feet (30 metres). A few small specimens were obtained in seine hauls.

The food of two individuals $11\frac{3}{8}$ in. (25.7 cm.) and $16\frac{1}{2}$ in. (38.5 cm.) in length taken off Westside consisted chiefly of midge larvae with considerable numbers of ostracods, copepods (*Cyclops*) and water mites in addition.

The material was too limited to attempt to determine the rate of growth of the population of the lake, but the two individuals referred to above appeared to be in their fourth and fifth summers respectively.

The fine-scaled sucker is probably not particularly abundant in Okanagan lake and is probably subject to the same limiting factors that apply to the Eastern whitefish, the chief of which would seem to be a lack of food materials on the lake bottom both in quality and quantity.

Coarse-scaled sucker, *Catostomus macrocheilus* Girard

This is the common sucker of Okanagan and connected lakes, where it inhabits relatively shallow water, no specimen having been taken below 50 feet (15 m.). It is particularly abundant around the weedy margins of the lake, including bays and backwaters, and in the mouths of streams. The young are exceedingly abundant among the reeds where they feed upon the plant and animal growths on the stems and on the lake bottom. A large size is attained. In Okanagan lake a specimen $18\frac{1}{8}$ inches (41.6 cm.) was obtained, while lengths of 15 to 17 inches were rather common. In Woods lake a specimen $21\frac{1}{4}$ inches (49.5 cm.) in length and 3 lb. 4 oz. in weight was taken in a shore seine.

The food of twenty-nine specimens averaging $3\frac{1}{2}$ inches (7.4 cm.) in length consisted chiefly of small midge larvae but with considerable numbers of copepods, water-fleas and caddis larvae. The food of larger specimens averaging $10\frac{1}{2}$ inches (23.5 cm.) was composed of large numbers of crustaceans (ostracods, copepods, water-fleas), midge larvae and other aquatic insects. Molluscs occurred in a few instances. In both small and large individuals, diatoms and other algae occurred in considerable quantities along with detritus (sand, mud, fragments of plants and animals). The following data show the number of stomachs in which each food organism occurred.

21 fish under $5\frac{1}{2}$ in. (12 cm.): ostracods 1; copepods 5; water-fleas 11; water mites 1; mayfly nymphs 1; caddis larvae 11; midge larvae 24; other aquatic insects 2; algae 6.

22 fish over $5\frac{1}{2}$ in. (12 cm.): ostracods 6; copepods 10; water-fleas 9; freshwater shrimps 1; water mites 5; mayfly nymphs 1; caddis larvae 9; midge larvae 19; other aquatic insects 5; terrestrial insects 2; molluscs 4; algae 6.

Some idea of the rate of growth has been obtained from an examination of the scales of forty-nine individuals from Okanagan lake. The determination of the annual growth areas in the scales of these fish was very difficult and the data presented should be regarded as tentative and approximate (figure 9). The rates of growth of specimens from Woods and Duck lakes appeared to be essentially similar. One large individual $21\frac{1}{4}$ inches in length taken in Woods lake was probably about 15 years of age.

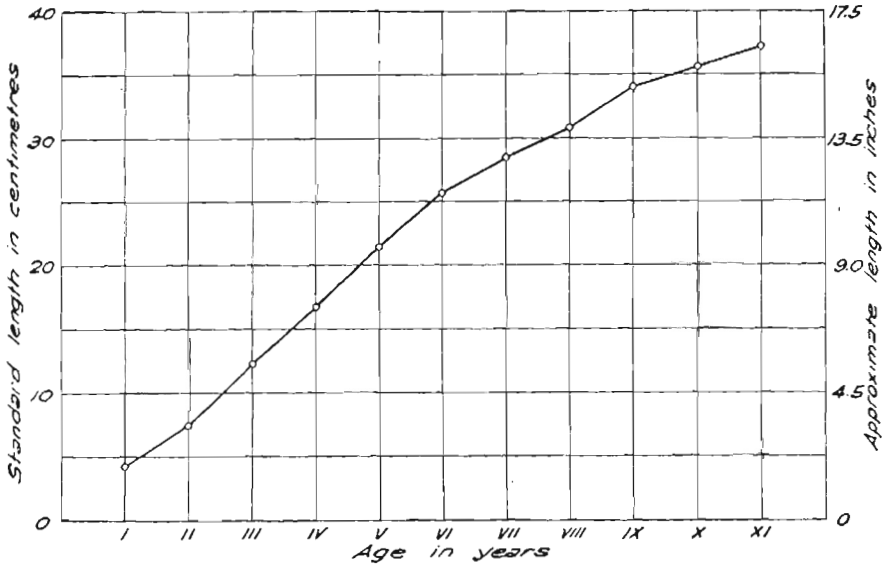

FIGURE 9. Rate of growth of the coarse-scaled sucker in Okanagan lake.

Carp, *Cyprinus carpio* Linnaeus

The exact date when carp appeared in Okanagan lake in unknown, but Mr. G. N. Gartrell, Fisheries Inspector, states that it was probably in 1917. Mr. Gartrell is also of the opinion that they reached their greatest abundance in the year 1934. Extensive observations during the summer of 1935 indicated that they were not exceedingly abundant anywhere in Okanagan lake. For some reason the young could not be located and only two small individuals were obtained, one, $5\frac{5}{8}$ inches (13.0 cm.) in length, was taken in the 2" gill net off Okanagan Mission and another, $1\frac{1}{2}$ inches (3.2 cm.) in length, was picked up dead in the backwater north of the mouth of Mission creek. Neither were young carp seen or taken in Kalamalka, Woods or Duck lakes in spite of intensive search.

It is quite possible that the history of the carp in Okanagan lake is similar to that of introduced species in other areas in which there occurs a more or less rapid increase in numbers followed by a subsidence to a certain level controlled by environmental factors. The decline may have been hastened by removal of considerable numbers in traps at the outlet of Okanagan lake and in the stream connecting Duck and Woods lakes. In 1934, a trap at the outlet of the lake captured approximately seven tons according to Inspector Gartrell. The removal of carp in the Okanagan sub-district by means of traps is given by the Department of Fisheries as follows:

1932, 7,081 fish, 14 tons; 1933, 3,000 fish, $5\frac{1}{2}$ tons.
1934, 1,114 fish, 2 tons; and in addition the 7 tons mentioned above, making a total of 9 tons.
1935, 3,625 fish, $6\frac{3}{4}$ tons; 1936, 1,002 fish, 2 tons.

In the above calculations of tons an average weight of $3\frac{3}{4}$ pounds is used, being the average of 13 fish captured by seine in Woods lake in 1935.

Carp averaging 17 inches in length (range 14 to $20\frac{1}{2}$ in.) were taken by seine in Summerland and Westside areas and in the North arm where considerable numbers occurred, and thirteen individuals obtained from Woods lake averaged $17\frac{1}{4}$ inches (range $15\frac{1}{2}$ to $21\frac{1}{8}$).

The food of fifteen individuals ranging in length from $5\frac{5}{8}$ to $21\frac{1}{8}$ inches consisted chiefly of bottom organisms such as crustaceans, larvae and nymphs of aquatic insects, worms, small snails, algae and plant fragments. The number of occurrences of the various food organisms was as follows: worms (Oligochaeta) 7; ostracods 15, copepods 10; water-fleas 13; freshwater shrimps 7; water mites 5; mayfly nymphs 7; caddis larvae 7; terrestrial insects 5; midge larvae 12; molluscs 11; fish eggs 1; algae 11; higher plant tissue 14.

In feeding habits and character of food, the carp very closely resembles the coarse-scaled sucker. In one instance a few fish eggs occurred and it is not improbable that at certain times the eggs of whitefish, kokanee and other species may be taken. It is not a fish-eating species and is therefore not a predatory enemy of trout. However, it consumes very large quantities of the basic food materials and like other coarse fishes does not appear to be contributing to the economic productivity of the lake.

Owing to the limited number of specimens examined, the lack of young fish, and the difficulty in interpreting the scales, it is not possible to determine accurately the rate of growth of the carp in Okanagan and nearby lakes. Examination of the scales shows that the fish $5\frac{5}{8}$ inches in length was apparently in its third summer. Fish of 16 inches appeared to be in the eighth summer; fish approximately 18 inches in the ninth summer; the larger fish probably in their tenth and eleventh summers. If these interpretations of the scales are correct they indicate a much slower rate of growth than in many other bodies of water, as for example Cayuga lake, New York state.

The reproductive capacity of the carp is very great. A specimen $18\frac{1}{2}$ inches (41.5 cm.) in length contained approximately 300,000 eggs.

Lake Shiner *Richardsonius balteatus* (Richardson)

Of the fishes inhabiting the shallow waters, the lake shiner is probably the most abundant. Large numbers occurred in every area where aquatic plants grew. There was considerable variation in the body form of these minnows, those taken at Summerland being particularly deep and compressed.

The food of individuals less than $2\frac{1}{4}$ inches (4.5 cm.) in length consisted largely of copepods with considerable numbers of water-fleas and midge larvae; other aquatic insects and diatoms occurred to some extent. Individuals $2\frac{1}{2}$ inches (5 cm.) and over in length fed almost entirely upon insects both aquatic and terrestrial, but slightly more upon the former. Of the aquatic insects, midge larvae, mayfly nymphs and caddis larvae predominated. The terrestrial insects were represented by a variety of beetles, flies, and Hymenoptera, chiefly ants. The number of occurrences were as follows:

17 fish, $1\frac{1}{2}$ to $2\frac{1}{4}$ in. (3.0 to 4.5 cm.): copepods 11; water-fleas 4; midge larvae 5; other aquatic insects 3; algae 3.

33 fish, $2\frac{1}{4}$ to $4\frac{1}{2}$ in. (4.5 to 9.5 cm.): water-fleas 5; water mites 2; mayfly nymphs 4; caddis larvae 4; other aquatic insects 10; terrestrial insects 17; midge larvae 9; algae 3.

No information has been obtained as to spawning and no attempt has been made to determine the rate of growth. The largest specimen recorded had a length of $4\frac{1}{2}$ inches (9.5 cm.).

No evidence has been obtained to indicate that this minnow is eaten by trout. It is evident that the distribution of the two species in the lake is such that seldom are they brought together. Were the situation otherwise the shiner would constitute an excellent "forage" fish for the trout, but as it is, only the squawfish would appear to be in a position to benefit particularly from the presence of this abundant food supply.

Squawfish, *Ptychocheilus oregonensis* (Richardson)

The squawfish is a minnow which reaches a large size and is abundant in Okanagan, Woods and Duck lakes. It inhabits the shoreward waters for the most part and probably for this reason it appeared in the gill nets only occasionally. Only five specimens were taken in this gear in Okanagan lake, as compared with 89 of the chub. A set in Woods lake in water thick with the alga *Aphanizomenon* yielded 17 squawfish as compared with 62 chub.

Its food consists largely of various species of fish and it is the chief predator of the shallow water association. During the summer of 1935 sculpins and Rocky Mountain whitefish were the chief fishes eaten but other data from the lake (*Munro and Clemens, "The American merganser in British Columbia and its relation to the fish population", Biol. Bd. Can. Bull. No. LV, 1937*) show kokanee, Kamloops trout and minnows as additional food items.

While the squawfish is essentially a fish eater it also feeds to a large extent upon aquatic invertebrates such as freshwater shrimps, crayfish and insects, as well as upon terrestrial insects falling upon the surface of the water. The young

up to about 4½ inches feed upon small crustaceans and insects. The following are the data on times of occurrence of the food items.

15 fish less than 4½ inches: water-fleas 6; mayfly nymphs 3; caddis larvae 3; midge larvae 8; other aquatic insects 3.

23 fish over 4½ inches: water-fleas 2; freshwater shrimps 1; crayfish 2; water mites 1; mayfly nymphs 7; midge larvae 7; terrestrial insects 6; fish 13.

In figure 10 are presented the rates of growth of Okanagan and Woods lake squawfish. It would appear that the fish of the latter lake grow somewhat more rapidly and attain a much greater age and size. One individual was obtained in Woods lake which was 18 inches in length (42.5 cm.) and was apparently in its 12th summer. The majority of the larger squawfish taken in Okanagan lake were from 10 to 12 inches in length and in their seventh summer.

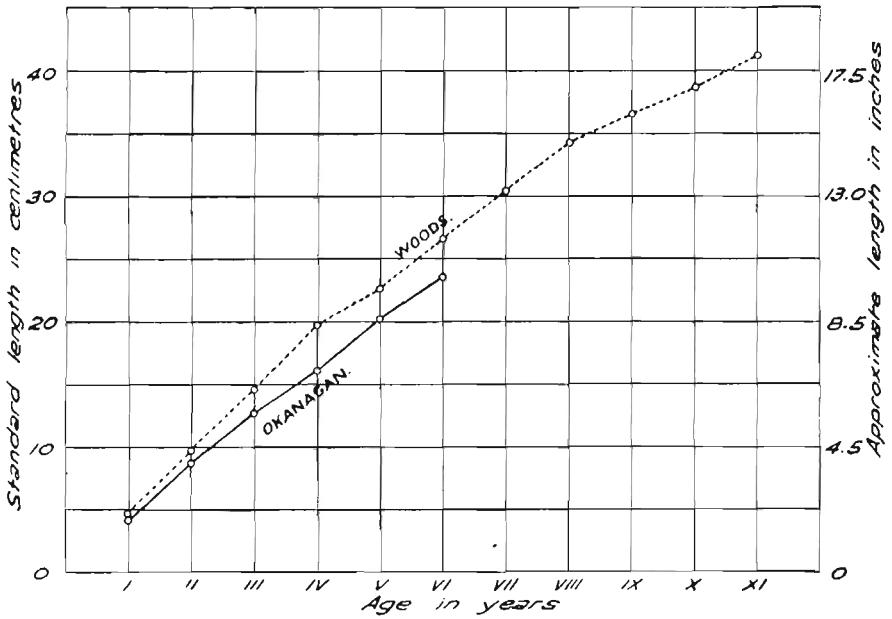

FIGURE 10. Rates of growth of the squawfish in Okanagan and Woods lakes.

Chub, *Mylocheilus caurinus* (Richardson)

The shallow shoreward waters, particularly where aquatic vegetation is abundant, are thickly populated with chub. Only the lake shiner would appear to exceed this species in numbers. It was taken more frequently in the gill nets than any other species, which fact may also indicate that it is a very active fish. The latter supposition is supported by the food data which show that larger chub feed to a considerable extent upon terrestrial insects.

The food of the very young fish consists chiefly of water-fleas, but also of copepods, water mites, small midge larvae, small aquatic and terrestrial insects.

The food of the larger fish is made up largely of insects both aquatic and

terrestrial, including mayfly nymphs, caddis larvae, midge larvae on the one hand and various moths, beetles, flies and Hymenoptera on the other. Water-fleas occur frequently and molluscs occasionally. Finally remains of small fishes occurred in four out of 46 digestive tracts examined. In a few cases the fragments were those of sculpins and it is probable that the species was represented in all cases. The following are the occurrences of the various food organisms.

6 fish, $1\frac{1}{2}$ to 5 in. (3 to 10.5 cm.): worms 1; copepods 3; water-fleas 6; water mites 2; midge larvae 3; other aquatic insects 2; terrestrial insects 1; molluscs 1; algae 1.

46 fish, 6 to $9\frac{3}{4}$ in. (13 to 23 cm.): water-fleas 14, water mites 6; mayfly nymphs 26; caddis larvae and pupae 10; midge larvae and pupae 12; terrestrial insects 24; molluscs 7; fish 4.

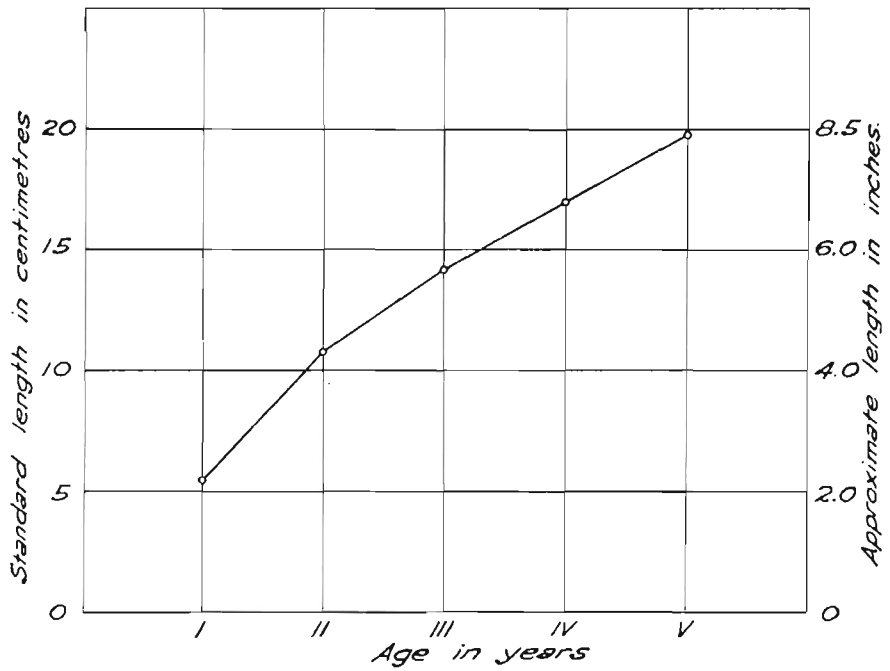

FIGURE 11. Rate of growth of the chub in Okanagan and Woods lakes.

The rate of growth is shown in figure 11. Since the Okanagan and Woods lake specimens did not show any significant differences in growth rate the graph is based upon the combined determinations of 69 fish from Okanagan lake and 13 from Woods lake. The largest individual taken measured $9\frac{3}{4}$ inches (23.0 cm.) and was in its sixth summer.

Long-nosed dace, *Rhinichthys cataractae* (Cuvier and Valenciennes)

A few small specimens of this minnow were taken in seines, chiefly in the Okanagan Mission area but also at Westside and Okanagan landing. It is readily recognized by the long pointed snout, a narrow black line from the eye to the tip

of the snout and the inferior mouth. It was found on the bottom at the mouth of Mission creek and along the more or less exposed shores of the lake. The sizes ranged from approximately $1\frac{3}{4}$ to $1\frac{7}{8}$ inches (3.0 to 4.2 cm.).

Silver-grey minnow, *Apocope falcata* (Eigenmann and Eigenmann)

This species was similar in size, numbers and distribution to the long-nosed dace. It is silvery-gray in general coloration with black markings over back and sides. One specimen taken at Okanagan Mission was $1\frac{1}{2}$ inches (3.3 cm.) in length. This minnow and the long-nosed dace usually inhabit cold and rather swift mountain streams.

Sculpin, *Cottus asper* Richardson

The sculpin or bullhead seemed to be widely distributed around the shores of Okanagan lake as it was almost invariably taken in the small-meshed shore seine. For the most part the fish were small. The largest in the seine hauls had a length of $3\frac{3}{4}$ inches (7.7 cm.). One individual caught in a gill net near Okanagan landing measured $4\frac{1}{2}$ inches in length. It is interesting to note that sculpins occurred in the stomachs of Eastern whitefish, chub and squawfish.

The food of small individuals consisted of copepods, water-fleas and midge larvae, while that of larger individuals showed a preponderance of midge larvae and other aquatic insects. The occurrences of food organisms were as follows.

10 fish, $\frac{3}{4}$ to $1\frac{1}{2}$ in. (1.4 to 2.4 cm.): ostracods 1, copepods 8; water-fleas 10; midge larvae 7.

11 fish, $1\frac{3}{4}$ to $3\frac{3}{4}$ in. (2.8 to 7.7 cm.): ostracods 1, copepods 2; water-fleas 1; fresh-water shrimps 2; mayfly nymphs 1; water boatmen 1; caddis larvae 2, midge larvae 9, fish 1.

Ling, *Lota maculosa* (Le Sueur)

Little information was obtained as to the abundance of ling in Okanagan lake. Two individuals were obtained in the gill net settings, one approximately $22\frac{1}{2}$ inches (55 cm.) and the other $6\frac{1}{4}$ inches (15 cm.) in length. A third individual of medium size was picked up dead along the bank of a stream a short distance from the mouth. Several reports were received of catches of large ling by anglers. Three small specimens were taken in seine hauls as follows: two individuals $1\frac{1}{5}$ inches (2.8 cm.) and 1 inch (2.5 cm.) near the mouth of Mission creek on July 27, and one individual $1\frac{1}{2}$ inches (4 cm.) in Woods lake on August 14.

Two specimens examined contained kokanee in the stomachs and it is probable that the kokanee is the staple diet of the ling in Okanagan and other lakes in the valley. One individual $22\frac{1}{2}$ in. (55 cm.) in length contained a kokanee $8\frac{3}{4}$ in. (20 cm.) in length. Munro and Clemens (*loc. cit.*) report the food of a specimen $6\frac{1}{2}$ inches in length as consisting of a mayfly nymph and other aquatic insects.

It may not be generally known that the ling is a member of the cod family and is the only representative of the family in fresh water. Further information concerning its life-history and its place in the economy of the waters is very desirable.