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## FEEDING HABITS OF THE POND-SMELT, *HYPOMESUS OLIDUS* AND THE PLANKTON SUCCESSION IN LAKE SUWA

(PART I)

by

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### ABSTRACT

1. The feeding habits of *H. olidus* was studied in the year 1951 referring to the succession of plankton in Lake Suwa, Nagano Prefecture, and the object of the study was directed to the filling of a gap in the information on the food-chain in the water as well as to obtaining the basic knowledge on which the management of the species could stand.

2. The pond-smelt, usually with only one year of life span, is economically the most important species, the annual catch amounting to one-third of the total fish production in the lake. Lake Suwa is 14.65 sq. miles in surface area with the average depth of 4.61 m, and 18 species of fish dwell in this eutrophic lake.

3. Samples of fish totalling 2,441 were collected monthly by cast net and gill net. The content of the stomach of each sample was examined qualitatively and quantitatively.

4. The pond-smelt in the lake was found to feed on 28 forms of both planktonic and benthic animals, of which *Bosmina*, *Cyclops*, *Leptodora* and *Diaphanosoma* were major items of food. Thus, the pond-smelt, *H. olidus* may be said to be a plankton feeder.

5. In the summer months, June to September, the fish was seen to eat more *Bosmina* than others, and in winter, September to April, *Cyclops* was the major food item, whereas the macro-plankters,

*Leptodora* and *Diaphanosoma*, were eaten abundantly in August and September. The midge larvae *Chironomus* were eaten throughout the year, but they appeared in the fish stomach more abundantly in the months of June and October and during the winter months; the chironomid insect emerges in these two months from larval form to pupae and adult; the fish tends to dwell near the bottom during the winter months.

6. By weight, *Bosmina* and *Cyclops* were found to be much less significant than when they were considered numerically. The macro-plankton *Leptodora* and *Diaphanosoma*, however, did not lose the significance whether expressed in number or in weight. The chironomids, occupied 80% of stomach content in weight, probably forming a valuable nutritive element in the diet.

7. The amount of food taken by the fish varies from 10 to 80 mg at a time, and the fish are seen to eat more before the spawning season while the survivors after spawning continue to feed subsequently. The amount of food expressed in percentage of body weight is extremely high when the fish is in the juvenile stage, but it decreases with the growth of the fish.

8. The plankton of the lake showed spring and fall swarming in the year as in other lakes in Japan.

9. The amount of stomach content did not necessarily correspond to the abundance of plank-

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ters in the water ; of *Bosmina* and *Cyclops*, the former was eaten more in summer than in spring and the latter more in winter than in fall. Of the two forms, *Leptodora* and *Diaphanosoma*, the preference of the fish for these forms coincided with the swarming of the organisms. These facts will suggest that the fish take the food organisms according to their own physiological demands, and the requirement does not depend on the abundance of the food. The rotifers are available throughout the year but they appear in the stomach of only juvenile pond-smelt in the months of March to June.

10. The forage ratio, defined as a proportion of the percentage of occurrence of an organism in the population to the percentage of its occurrence in the stomach of the fish, was calculated on major food organisms, and both number and weight of the organisms were adopted as the basis of calculation. The values of two kinds of ratio thus obtained corresponded well with each other when the percentage of occurrence was high both in stomach and in plankton, but they conflicted when the same percentages were low. Also the forage ratio seemed to be of limited significance because the ratio ranges actually from zero to infinity, which hardly explains the fish-food relation in the lake water.

The forage ratios calculated for *Bosmina* and *Cyclops* did not fluctuate seasonally corresponding to the occurrence of organisms in the stomach as well as in the water, but those for *Leptodora* and *Diaphanosoma* corresponded to such natural fluctuations.

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