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INTRODUCTION OF POND SMELT FROM JAPAN INTO CALIFORNIA

It is well known that in most outstanding trout lakes throughout the world both basic productivity and food chains are unusually good. At present, it is difficult or impossible to increase basic productivity at reasonable costs, but improvement of food chains is sometimes a simple procedure. In waters with an abundance of plankton, a forage fish serving as a link between plankton and trout should be present. In many California lakes and reservoirs, plankton consumers are absent or inadequate. A search for a good forage fish for these waters was made and, after consideration of a number of possibilities, it was decided that the pond smelt (also known as freshwater smelt), *Hypomesus olidus*, should be tried.

The pond smelt is distributed as far south as San Francisco Bay on the North American continent and as far south as Japan on the Asiatic side of the Pacific. It is primarily a freshwater fish, although it does enter brackish water. The possibility of obtaining smelt in the freshwater portions of the Sacramento-San Joaquin Delta above San Francisco Bay was investigated but found to be unsatisfactory. The Department of Fish and Game then began correspondence with Japan, where the species is well established in many lakes, with the hope that smelt eggs could be purchased. Biologists of the Research Institute for Natural Resources in Tokyo furnished a great deal of information on the ecology of the fish and put the Department in contact with a Tokyo firm from whom eggs could be purchased.

The requirements of this smelt in Japan are similar to those of the rainbow trout (*Salmo gairdnerii*) there. The preferred temperatures seem to be essentially the same. Both spawn in the spring in tributaries of lakes and reservoirs. The smelt eggs are small and adhesive, becoming attached to the rocks and gravel of the streams. The hatching time at 58 degrees F. is about 12 days. The fry begin to feed when about 7 mm. long. Their food is primarily zooplankton. Although the smelt can attain a length of five inches under optimum conditions, they usually do not become this large. Sexual maturity is reached at the end of the first year, and they usually do not live to spawn a second time. In Japan the smelt has been introduced successfully into reservoirs as trout forage.

The plan called for the experimental introduction of pond smelt into a few lakes or reservoirs in different parts of California. Then, if they became established in any of these waters, they could be transferred elsewhere. Six lakes and reservoirs, which appeared to meet the ecological requirements of smelt and could be chemically treated if it were found that the smelt were undesirable, were selected. The six waters

were : Dodge Reservoir, Lassen County ; Dwinnell Reservoir, Siskiyou County ; Freshwater Lagoon, Humboldt County ; Spaulding Reservoir, Nevada County ; Jenkinson Lake (Sly Park Reservoir), El Dorado County ; and Big Bear Lake, San Bernardino County.

Air shipments of eggs were received in San Francisco from Tokyo on March 18 and 31, 1959. The eggs had been taken at Suwa Reservoir, about 70 miles east of Tokyo. They had been spawned artificially onto palm fiber mats, and after eyeing had been packed into fiberboard boxes lined with plastic sheeting. The eggs and mats were wet, but no ice or other refrigeration was used. Upon arrival, many of the eggs were dead from drying, premature hatching, and bacterial decomposition ; however, enough were alive to furnish sizable plants. Approximately 3,600,000 eggs had been shipped, but the numbers going into each of the six test waters are not known.

The trays of eggs adhering to the fiber mats were arranged in stacks and anchored in the flowing water of tributaries. Observations on the plants in Dwinnell Reservoir tributaries showed that the fry began to hatch and drift away within a few days. It is presumed that in some of the plants the number of viable fry was small.

By August 1961, only one of the test waters was known to contain a good self-propagating population of smelt. This was Freshwater Lagoon, where seine hauls made by Professor John DeWitt and students of Humboldt State College indicated that enough fish could be obtained for introduction elsewhere. These fish were presumably of the first and second generations of the plant made in the spring of 1959. The extent to which these fish are being eaten by trout in Freshwater Lagoon is not known.

Chemical treatment of Big Bear Lake during the fall of 1960, to eradicate stunted crappie (*Pomoxis nigromaculatus*) and goldfish (*Carassius auratus*), resulted in the killing of some smelt. Judging by the dead specimens observed by fisheries personnel, the smelt population numbered in at least the hundreds.

In April 1961, a smelt measuring 4.3 inches was recovered from Dwinnell Reservoir. No other smelt have been seen in this reservoir.—*Joseph H. Wales, Department of Fish and Game Management, Oregon State University, Corvallis, Oregon, September 1961.*