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KOKANEE IN CALIFORNIA

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The "kokanee" (*Oncorhynchus nerka kenerlyi*) was first planted in California waters in 1941. This is a landlocked form of the Pacific sockeye or red salmon. It is native to the Pacific Northwest, where it is also called "little redfish" and "silver trout." Under highly favorable conditions it may reach a size of five pounds. Twelve to fourteen inches is average, and under poor conditions it never exceeds eight inches.

It is preeminently a lake resident, and may spawn on gravelly lake shores as well as in streams connecting with lakes. It matures and spawns at the end of its third or its fourth year, and like all Pacific salmon dies after spawning. It prefers cool waters, and therefore goes deeper as temperatures rise in summer. Although its food is made up largely of plankton, the minute animals which drift in the water, it can be easily taken in some lakes on hook and line in spring and autumn. In summer it is harder to catch. Trolling with flashers and baited hook, and still-fishing a few feet off bottom, are favored methods; fly-fishing can be successful in the late afternoon in spring or fall when the fish are near the surface. The kokanee puts up a good fight, but has a tender mouth and is hard to land. It is excellent eating. In its native regions it has furnished abundant fishing and is looked upon as a valuable element in the angling resources.

The decision to introduce it to California was based in part on its popularity in certain sections of the northwest, and in part on its plankton feeding habits, which suggested that it might do well in reservoirs where fluctuations made for poor production of bottom food. Salt Springs Reservoir on the North Fork of the Mokelumne River off the Carson Pass Road was selected for the initial test; its level fluctuates extensively, and it is so located that little harm could be done if the kokanee turned out to be an undesirable citizen. One hundred thousand eggs obtained in late 1940 from Idaho through the U. S. Fish and Wildlife Service were hatched at the Basin Creek State Fish Hatchery near Sonora, and 67,000 fingerlings were planted in July of 1941 at a length of a little under two inches. (In the State of Washington, incidentally, where great numbers of this species are produced, planting at a very small size is favored.) The Salt Springs area was closed shortly thereafter as a war measure, but tests in the spring of 1943 showed the kokanee to be abundant and easily caught, at a size of about 10 inches. In November of 1943, at the end of their third year, and at a length of 11 to 12 inches, they were ready to spawn, and some 300,000 eggs were taken from 626 females. A total of over 3,000 fish were caught in seines at this time, 4½ percent of the number planted, and since many more were present than were netted, a good survival was indicated.

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FIGURE 37. Kokanee from Salt Springs Reservoir, November, 1943. Female in center, male below and above. Photograph by Malcolm Wilson

These results were sufficiently encouraging to warrant further stocking, which has been carried out as shown in the following table :

STOCKING OF KOKANEE IN CALIFORNIA

<i>Name of water</i>	<i>Date of planting</i>	<i>Source of eggs</i>	<i>Number planted</i>	<i>Size in numbers per oz.</i>
Salt Springs Reservoir, Amador County -----	1941-7/12-16	Idaho	67,000	27
Strawberry Lake (also called Pinecrest), Tuolumne County -----	1944 8/12-19	Salt Springs	106,000	22-32
	1945-7/28	Montana	99,000	25-40
	1947-5/28 8/6 6/16	Washington	284,000	140-265
Waterhouse Lake, Tuolumne County -----	1944-8/3	Salt Springs	700	32
Echo Lake, El Dorado County -----	1944-7/5-20	Montana	69,000	51-72
	1945-8/2-7	Montana	79,000	52
Donner Lake, Nevada County -----	1944-6/22 7/19	Montana	83,000	270-280
	1945-8/3-8	Montana	74,000	52
	1947-5/28	Washington	100,000	265

NOTE:

Average lengths of fish are approximately:

11 inches at 25 per ounce.
13 inches at 50 per ounce.
1 inch at 100 per ounce.

The results have been uneven. Echo Lake has been the most disappointing. In this high, rocky basin it has been very difficult to produce good fishing, and it was hoped that the plankton-eating kokanee would solve the problem. However, growth has been poor here, the fish not exceeding eight to nine inches at maturity, and anglers have shown little interest in them. Strawberry Lake has provided the best fishing, especially when it was drawn down in late summer of 1946; large catches were made at this time, with the kokanee reaching a size of 10 inches. Donner Lake has produced the largest fish, the spawners running from 12 to 16 inches. The kokanee aroused little angler interest here at first, but their popularity seems to be growing, and more are being caught every season.

Kokanee have appeared in other waters than those in which they were planted. About 100 were found in December, 1946, spawning in the small stream formed by the water running from the Tahoe Hatchery into the lake. These had evidently escaped in 1944 from the hatchery troughs where they were reared, and were returning to the "home stream." In the Truckee River spawning kokanee appeared just below the Tahoe Dam in the winter of 1947-1948; these are presumed to have migrated out of Donner Lake. And in 1946 a number of Kokanee went out of Strawberry with the declining water and down to Lyons Reservoir. In no case has any harm come from the escape of kokanee into other waters, nor is any possibility of harm foreseen.

In California all kokanee so far observed have matured at the end of their third year. Kokanee were seen spawning by the junior author in Donner Lake in November of 1947, in water varying in depth from one-half to three feet, and from right along the shore-line to 20 feet out. Concentrations of fish were found near the mouths of the small inlet streams on the north side where the lake bottom was sandy with some pebbles and a few rocks, and many also spawned along the north shore where water trickled in from the road culverts. Water temperature was 45 degrees Fahrenheit.

The spawning pattern insofar as it could be observed resembled that described by Schultz (1937), with such differences in detail as might be attributable to stream spawning in Schultz's report as against lake spawning here. Only one female was seen in the process of building a nest, and unfortunately she was in the center of a group of fish where it was impossible to follow her actions closely, or those of any males involved. She apparently rolled over on her side and dug vigorously with the posterior part of her body for a few seconds, then circled away from the nest; occasional interruptions would be caused by a general milling around of all the fish in the vicinity. Actual pairing of fish seemed to be the rule.

Spawning activity began by male and female circling the nest, one behind the other. Eventually the female would pass over the center of the nest, and come to a stop there—sometimes on the first pass, and sometimes on the second or third. The male would then join her, and both would vibrate at which time it is presumed that the sex products were deposited. The female invariably dug into the sand near the end of the vibrations, raising a small cloud of fine particles. All of this took about

² Reports from Donner Lake received after this paper went to press tell of excellent fishing in May, 1948, with many limit catches of kokanee weighing about one pound each.

10 seconds, after which circling was resumed. Individual pairs were seen to repeat this process four or five times over the same nest, presumably with deposition of eggs each time. Covering of the eggs was apparently accomplished by the digging action of the female at the end of each period of vibrations, but it is possible that a further and final covering took place after the completion of *egg* deposition in any particular nest.

Unfortunately Donner Lake was drawn down very heavily in January and February, and all of these spawning beds were left high and dry in frozen ground.

Reference

Schultz, Leonard P.

1937. The Breeding Habits of Salmon and Trout. Report of the Smithsonian Institution for 1937, pp. 365-376.