## CONSERVATION WINS.

**The Klamath Fish Reserve measure, Initiative No. 11 on the November ballot, passed by an estimated majority of 170,000. The measure prohibits the building of dams, or other obstructions which might constitute a menace to migratory fishes, in the waters of the Klamath River between the mouth of the Shasta River and the sea. The plea for further power development, couched in terms of dollars and horsepower, made by the power company planning a 250-foot dam, failed to win over the united efforts to save the fish made by sportsmen and conservationists. Seldom before have conservationists in this state presented so united a front on a conservation measure. The Klamath is saved for the people, the egg supply for the state's hatcheries remains intact and the Klamath River will continue to be a mecca for anglers.**

1920



## INDIAN METHODS OF FISHING ON TRINITY RIVER AND SOME NOTES ON THE KING SALMON OF THAT STREAM.

(With seven photographs by the author.)

By J. O. SNYDER, Stanford University.

Trinity River is a part of the Klamath system. It is one of the largest and most important tributaries of Klamath River in northern Cailfornia, draining a mountainous area of considerable extent and contributing a large flow of clear water to the main system. The lower course of the river, including Hoopa Valley, is within the Hoopa Indian Reservation. Hoopa Valley is about four miles long and in places perhaps a half mile wide. It has a comparatively level floor, with an elevation of about three hundred feet. Parts of it are rocky and badly washed. The valley is bordered by high, steep slopes which are covered with dry transition and upper sonoran trees and other plants. The upper end narrows into a canyon, while below it passes into a gorge. Within the valley the river is a beautiful stream, with large, deep, blue pools which are usually bordered by huge, picturesque rocks on the one side, and extensive sand and gravel bars on the other. The pools are connected by long stretches of rapidly moving water, often with scarcely a broken surface except for a quiet swirl, or by relatively shallow rapids where the water is swift and turbulent. The scene in summer is one of peace and quiet, but unmistakable evidence points to a tempestuous, raging torrent in the winter which carries everything before it. Some snow falls in the valley, while the surrounding mountains are sometimes so deeply covered as to bar ingress for short periods. In summer the climate is dry, and occasionally the days are very hot.

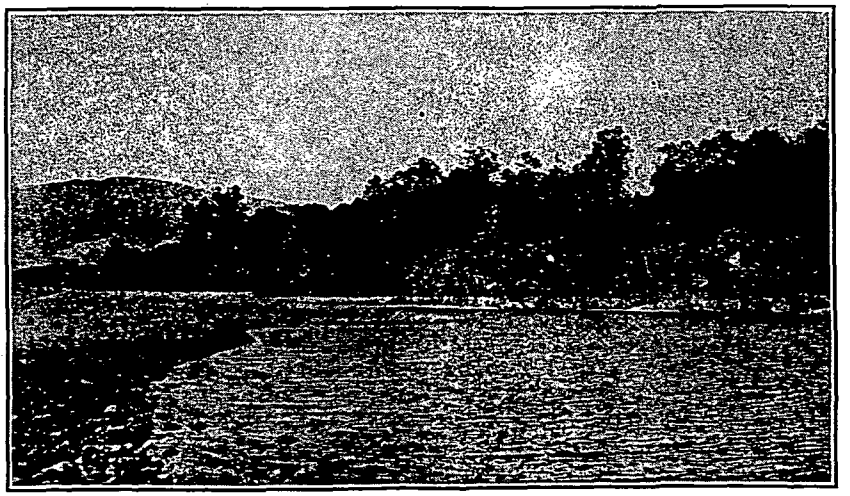

FIG. 38. A characteristic pool, Trinity River.

The valley offers a paradise to the angler, the river presenting unlimited opportunity for casting, while some of the lateral tributaries, such as Mill Creek, Camp Creek, and the Tish-tang-a-tang are more

difficult. Small trout appear to be present at all times, while a migration of steelheads invades the river upon the approach of fall. When the steelheads reach the valley their bright stream colors have begun to appear as if following a suggestion from the brilliant autumnal foliage along the banks. They are soon followed by the advancing salmon which are said to pass in great numbers.

The salmon furnish a considerable and important part of the Indian's food, although steelheads and lampreys are eaten. Lampreys are sought at a time when other fish are not easily taken. The salmon are caught by means of spears, traps and a weir.

The salmon traps are of the usual kind, consisting of an enclosed area into the funnel-like entrance of which the fish are lead by means of two long wings spreading down stream. The traps are made of stakes, boards and brush, and are located near the bank or elsewhere in a position most likely to intercept migrating fish. The body of the trap is covered with boards or brush, while the lead is left open. These traps seem to offer no formidable obstruction to the passage of salmon, and merely serve to get for the Indian his rightful share of the fish.

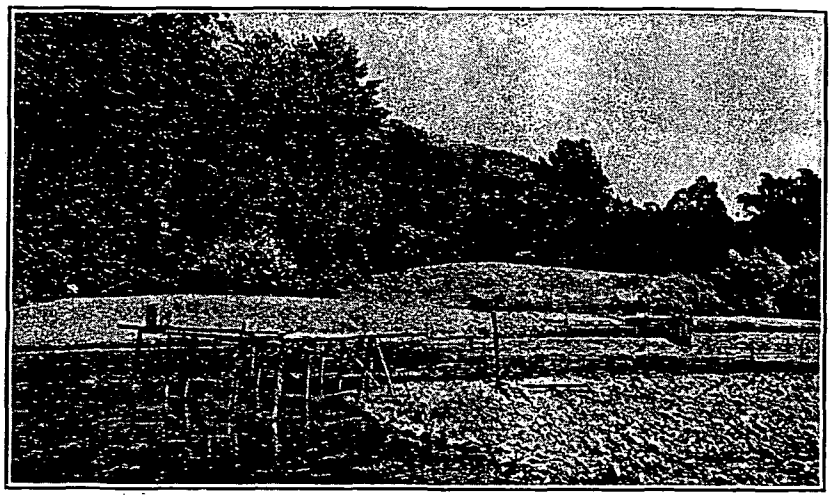

FIG. 39. A spearing platform and a salmon trap in Trinity River.

Each year the Indians build a weir across the river at some strategic point, locating it on the rapids just above a large pool. The construction of the weir is an event of some importance with the natives, as it involves some ceremony, considerable labor, thought and engineering skill. It is constructed entirely of wood, and all the work is done by the men. Not even an iron nail appears in the structure, and the women are not allowed to touch it. It was an Indian woman of unusual keenness and foresight who made the discovery that no salmon would approach the weir if her sex were allowed to assist in its laborious construction, and some tact and persuasion were no doubt necessary to convince the men. Furthermore, the elimination of iron nails must have been arrived at by some such patient observation and fine discrimination as that employed by the Indian's brother, the angler, in determining the exact tint of a particular feather in an artificial fly.



The weir is in effect a strong picket fence, impassable to migrating salmon. It is built straight across the stream, the lower ends of the pickets embedded in the gravel of the bottom, while their upper ends are lashed to heavy logs which are securely supported by bracing timbers. The pickets have a decided down stream slope, which both adds to the strength of the weir, and permits the debris to be raked up and over the top. The entire structure is substantially built, that it may withstand considerable pressure and some battering from above. The lashings are of bark or hazel branches.

Attached to the lower side near the middle of the weir is a projecting triangular platform supported by strong stakes at a level of about three feet above the water. The space between the supporting stakes is filled with boulders and gravel, and a trough is excavated on either side. The boulders are held in place by interwoven hazel boughs, the twigs and leaves of which project along the edges of the trough. The angular boulder wall with its base toward the weir, causes a swirl in the water of the trough or lateral excavation, where a migrating fish, after attemping to pass the weir, is apt to come to rest. For some reason best known to the Indians, the offering of fresh hazel boughs is an essential feature of the platform. When salmon appear in numbers other platforms with their rock foundations, hazel decorations, and lateral swirls and eddies are added.

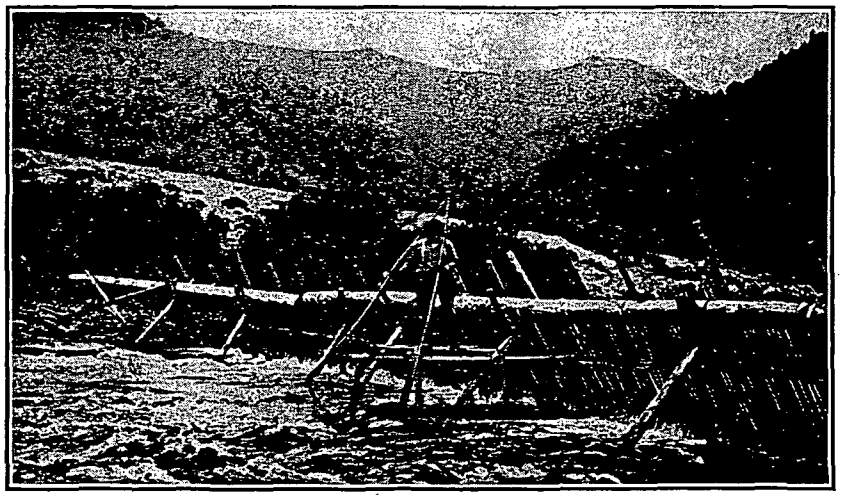

FIG. 40. Salmon are removed from the side of the platform by means of a peculiar scoop-net.

Fish are dexterously removed from the swirl by means of a large dip-net. The net is, of course, mesh, and is attached to two long pieces which are connected by a bow, the free ends of the pieces being crossed and securely lashed. After the net has been attached the bow is ornamented by a loose lash, the purpose of which was not made clear by the Indians. In use a long handle of the net is grasped in each hand, the ends passing over the shoulders with their lashed tips held well above

the head. The Indian fisherman is thus able to scoop a salmon from an eddy at the side of the platform, and easily manage the net in spite of the struggles of a heavy fish. The logs extending along the top of the weir serve as a foot-bridge in passing to and from the fisherman's platform.

The weir will not withstand the high water following early fall rains, and consequently its destruction is brought about in time to permit many of the salmon to pass safely up stream. The Indians assert that the ultimate destruction and passing of the weir is an omen that salmon will again come on the following autumn, a belief more laden with truth than perhaps even the Indian suspects, for no salmon returns to the sea, and moreover, if the mature adults were prevented from reaching their spawning beds, the race would soon disappear from the river.

There are situations under which such a contrivance would totally eliminate the salmon from a stream in a few years, and it becomes a question as to whether its construction and operation should be permitted here. The fact that the migrating salmon ascend the Trinity late in the fall, their rapid passage being apparently stimulated by floods following the autumn rains, appears to safeguard them in a measure. Mr. J. B. Mortsolf, superintendent of the agency, states that the obstruction is invariably rendered inefficient or entirely broken down before the migration is well on. Leaves, limbs and logs often float against and clog up the weir in a night so that the water pours around the ends. Also, when the supply of salmon seems assured the Indians become negligent and more or less indifferent toward the trap, thus inadvertently assisting the salmon in surmounting the obstacle.

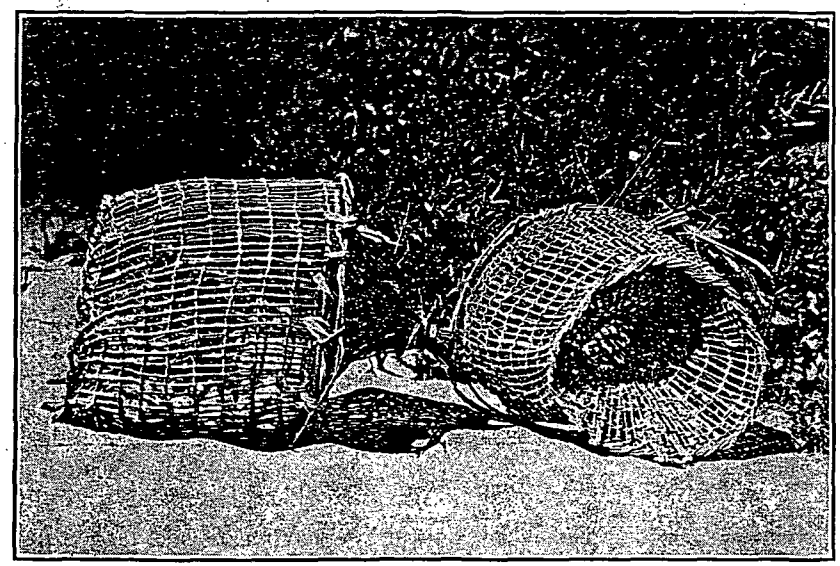

FIG. 41. Traps used by Hoopa Indians in catching lampreys. The funnel entrance shows at the right.

In the fall of 1920 the weir was placed under observation for a few days by the Fish and Game Commission. The writer visited the locality,



August 23, and found it in place, one fishing platform built, some Indians camped near by, and everything in readiness to welcome the approaching salmon. Not over a half dozen fish had been caught up to that time, however, and none was seen in the river. Steelheads had begun to arrive, but none had as yet very seriously attempted to pass the weir.

The weir extended across a rapid just above a deep pool which was clear of rocks and snags, and which had a gently sloping sand bar of considerable extent, thus presenting an ideal place for hauling a seine. It seemed quite probable that the pool would furnish a resting place for migrating fish which had been checked by the weir and so it did at a later date.

Nothing was done until September 16, when Carl D. Duncan, a very competent observer, arrived in response to a message from Mr. Mortsolf announcing the arrival of the salmon. But few fish had been taken up to this time, most of the Indians having had none at all.

Duncan was equipped with a seine net and after the Indians became fully convinced of the efficiency of the device, he was never without willing assistants. The first day's operations in the pool below the weir brought out 81 king salmon and 13 steelheads. Of the salmon, all were grilse, two or three year old fish, excepting 11. The grilse measured 15 to 22 inches in length; the others, 32 to 38 inches. The large size of the net which was also well adapted to the shape of the pool, probably prevented the escape of many fish, and it may be safely assumed that the catch represented the fish which were at the time trying to pass the weir. The fish generally spend the greater part of the day in the pools, migration being resumed at nightfall, and continued until morning.

The following record of collecting was kept:

| | *Salmon* | *Steelheads* |
|---|---|---|
| September 18 | 81 | 13 |
| September 19 | 62 | 28 |
| September 20 | 103 | 29 |
| September 21 | 19 | -- |
| September 22 | 23 | 4 |
| September 23 | -- | -- |
| September 24 | -- | -- |
| September 25 | 35 | -- |
| September 26 | 5 | -- |

On the 22d rain began to fall, and continued until the 24th; the river rose a foot or more, debris clogged the weir, water flowed around the ends, and the waiting fish, of which the pools seemed to be full, passed safely up stream. When the flood subsided the weir was extended a little from each end and again began to function, as is indicated by the seining results of the 25th and 26th, after which no more observations were made. Mr. Mortsolf wrote that a short time after, high water destroyed the weir.

Duncan examined 340 king salmon which were either taken in the pools below the weir or dipped up at the fishing platforms. Of these, 260 were males, all less than 25 inches long. Of the remaining fish there were 47 males and 33 females. All of the fish seemed to be approaching the spawning period as they were dark in color, the eggs were large, and the scales were deeply embedded.

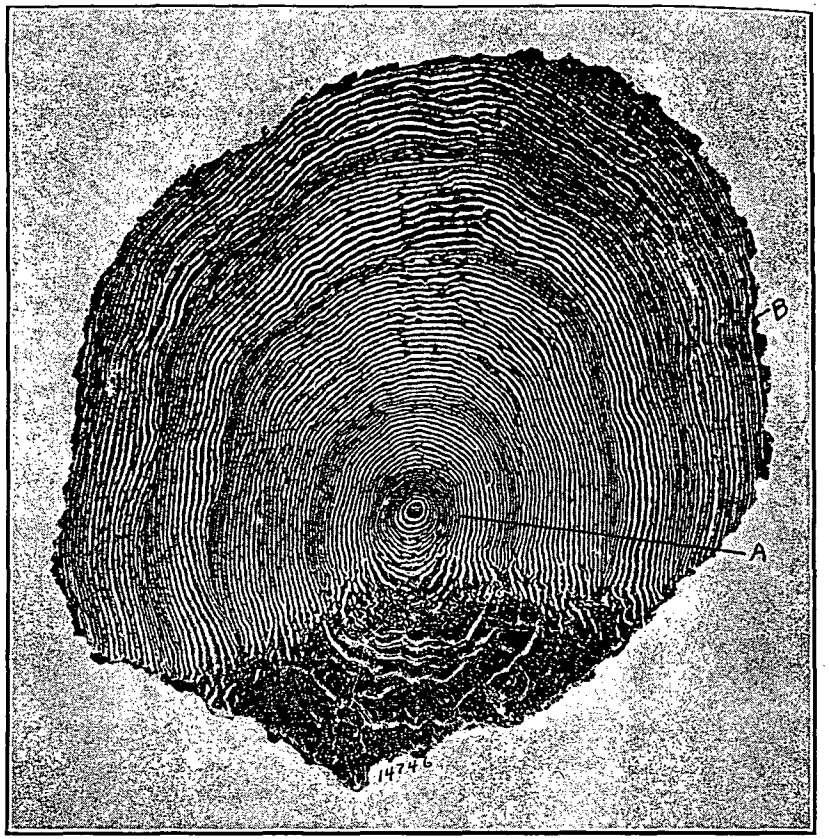


FIG. 42. A scale from a king salmon which was in its sixth year. The edge of the scale is so absorbed as to make age determination difficult. It is of the stream type.

A microscopic examination of the scales discloses the fact that in nearly every case the edges were badly absorbed. The erosion is not sufficient to very seriously interfere with age determination, and it is believed that the results may be accepted without much doubt in the 321 cases. Of these, 263 belong with a class which entered the sea early in the first year, while 58 are of a type which remained in the stream somewhat more than a year before the seaward migration was accomplished. Figure 42 will serve as an illustration of the first type, the very definite and small nuclear area **A** representing the stream growth. This scale is of a fish in its sixth year, the record of five years being well preserved, while that of the sixth is nearly effaced, the little that remains being indicated by the remnants of one or two broad circuli at **B**. Figure 43 illustrates the second or sea type, the large area **A** representing the growth of the first year. Here again the record of the last or fourth year has almost disappeared.




FIG. 43. A scale from an ocean type four year fish.

The ages of these 321 fish as determined from their scales are from 2 to 6 years. The two-year fish number 213, of which only 7 are of the stream type. They are all males, measuring 35 to 53 centimeters in length (about 13¾ to 21 inches). The longest of the stream type measures 41 centimeters. Figure 44 represents a scale of one of these two-year fish that migrated to sea early in its first year. There are 44 three-year fish of which 28 are of the stream type. The three-year fish are all males except 3, and the latter are of the ocean type, that is, fishes that migrated early to sea in the first year. Of the three-year fish the stream type measure from 42 to 55 centimeters (16½ to 21¾ inches); the ocean type from 51 to 69 centimeters (20 to 27 inches). The four-year fish number 36, of which 30 are of the ocean type. There are 16 males and 20 females. The sexes of the stream type are equally divided, while of the ocean type the females are in excess, there being 17 against 13 males. The four-year fish are from 60 to 91 centimeters long (23¾ to 36 inches), those of the stream type averaging 72.3 centimeters, while those of the ocean type average 80.9. The five-year fish number 25, of which 14 are of the ocean type and also females. There are only 5 males of

this age class and they are all stream type fish. The five-year fish measure 82 to 102 centimeters (32¼ to 40¼ inches). Here again the ocean type measures larger, 94.7 centimeters against 89 centimeters for the stream type. Of the stream type fish the males average 93.8, and the females 85.2 centimeters. There are 3 six-year fish, 2 females, 86 and 89 centimeters long, and 1 male measuring 98. All are of the stream type.

FIG. 44. A scale from a mature two year king salmon, ocean type.

Of the fish collected from the river, 257 were individuals which were approximately two and three years old, yet mature. These small fish, locally known as grilse or chubbs, differ somewhat from similar fish taken in the estuary of Klamath River earlier in the season, in that they are smaller. This difference is not so marked in the case of the two-year fish, but when the three-year examples are compared it becomes very evident, as shown in the following table. While the two-year fish of ocean type average about 46 centimeters in Trinity River, they measure about 48 in the Klamath, but the three-year stream type Trinity fish measure about 48 centimeters compared with 58 in the Klamath. Considerable difference also appears between those of the three-year ocean type.



| Length in centimeters | TRINITY RIVER | | | KLAMATH ESTUARY | | |
|---|---|---|---|---|---|---|
| | Two year Ocean type | Three year | | Two year Ocean type | Three year | |
| | | Stream type | Ocean type | | Stream type | Ocean type |
| 35 | 1 | | | | | |
| 36 | | | | | | |
| 37 | | | | | | |
| 38 | 3 | | | | | |
| 39 | 2 | | | | | |
| 40 | 2 | | | 2 | | |
| 41 | 2 | | | 1 | | |
| 42 | 17 | 1 | | 4 | | |
| 43 | 17 | 4 | | 3 | | |
| 44 | 15 | 4 | | 4 | | |
| 45 | 21 | 2 | | 9 | | |
| 46 | *28 | 3 | | 2 | | |
| 47 | 28 | 2 | | 4 | | |
| 48 | 23 | *1 | | *4 | | |
| 49 | 18 | 2 | | 10 | | |
| 50 | 15 | | | 7 | | |
| 51 | 7 | 1 | 1 | 6 | | |
| 52 | 3 | 6 | | 2 | | |
| 53 | 4 | | | 6 | | |
| 54 | | 1 | 1 | 1 | 2 | 3 |
| 55 | | 1 | | 2 | 2 | 1 |
| 56 | | | 1 | 2 | 2 | 2 |
| 57 | | | | 2 | 3 | 4 |
| 58 | | | 1 | | *3 | 4 |
| 59 | | | | | 3 | 4 |
| 60 | | | | | 4 | 5 |
| 61 | | | | | 1 | 10 |
| 62 | | | 1 | | 1 | 4 |
| 63 | | | *1 | | | 6 |
| 64 | | | 1 | | | 7 |
| 65 | | | 2 | | 1 | 8 |
| 66 | | | 3 | | | 11 |
| 67 | | | 3 | | | *13 |
| 68 | | | | | | 7 |
| 69 | | | 1 | | | 18 |
| 70 | | | | | | 15 |
| 71 | | | | | | 9 |
| 72 | | | | | | 13 |
| 73 | | | | | | 7 |
| 74 | | | | | | 4 |
| 75 | | | | | | 5 |
| 76 | | | | | | 4 |
| Totals | 206 | 28 | 16 | 71 | 22 | 164 |

* Average length.

The large proportion of small fish is apparently due to the straining process of the gill nets at the mouth of Klamath River, where the larger fish only are sought. Possibly the smaller fish precede the larger ones in the upstream migration, but if so this case is unusual, as they are not known to do so in other parts of the Klamath basin. A knowledge of the numerical relation existing between grilse and older fish would no doubt be of value.

The bag of the seine was of fine mesh, and young king salmon measuring 2½ to 3 inches were observed by Duncan among the larger fish. Stream trout and steelheads were also caught. Young green sturgeon, *Acipenser medirostris,* measuring 25 centimeters, and examples of the Klamath sucker, *Catostomus rimiculus,* the minnow, *Agosia klamathensis,* and the Klamath rifflefish, *Cottus klamathensis,* were observed. In his field notes, Duncan remarks that the small salmon far outnumber other little fish, a seaward migration of the salmon probably being in progress at the time.