JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-7-R Work Plan No. III Job No. III-A

Title of Job: Natural Reproduction of Kokanee in Flathead Lake and Tributaries

Objectives:

Reproduction is an essential and key phase in the survival of any living organism. In fisheries it is a common practice to attempt aid of nature by artificial propagation. Flathead Lake is lowered considerably in the winter months by a hydroelectric plant, thus exposing many of the spawning beds. The purpose of this study is to establish the extent of kokanee spawning in Flathead Lake and its tributaries together with the degree of successful spawning.

Techniques Used:

During the spawning season, areas of concentration of kokanee around Flathead Lake were noted and marked on a map. Tributary streams were observed to determine how far upstream kokanee had migrated to spawn. During the winter months the spawning beds were observed to follow the development of the eggs. Notes on the life history were also taken.

Findings:

Flathead Lake is the largest natural lake in Montana having an area of 120,320 acres and a shore line of 127 miles. The chief tributaries are the Flathead and Swan Rivers. The deepest part of the lake is 339 feet in the vicinity of Yellow Bay.

The lake freezes over about once every five years. This winter most of the lake was open with only the bays frozen over. The ice was occasionally broken up in the less sheltered bays during windstorms but would immediately freeze over again after the storm had subsided. The bays on the north end of the lake were frozen over by December 20, and the ice did not leave until about April 2nd. Since 1938 the water level of the lake has remained constant during the summer and then has been drawn down in the winter (Fig. 1).

The date of introduction of kokanee (Oncorhynchus nerka kennerlyi) in this drainage is confused by many conflicting reports. One report is that they were planted in a small lake near Whitefish Lake about 1920 and eventually moved into Flathead Lake. There are also reports of their being planted in Flathead Lake in 1912 (Brunson et al 1952). However they are not native to this drainage.

On October 25, 1951, kokanee were first noticed on spawning beds along the shores of Somers Hatchery Bay in Flathead Lake. The greatest number of fish appeared in the last two weeks of November. A survey showed fourteen areas being used as spawning beds around Flathead Lake (Fig. 2). Attempts were made to measure the areas but it was impractical to determine just what areas were used as the beds in some areas were not continuous as was the case in Woods Bay and Skidoo Bay. The criterion for a spawning bed appeared to be gravel and rubble or any combination of these two. Some beds were found where no seepage water existed.

The first eggs collected were on February 1, 1952 in Somers Hatchery Bay. All of these eggs were dead. On February 4th, many dead eggs were found in the debris washed up on shore in Rollins Bay. One redd was found that contained 204 dead eggs. Nearby a redd was discovered with several hundred eyed eggs. No attempt was made to count eggs in this redd as they were accidently scattered. Both of these redds were one foot above the water level of the lake, but in a seepage area. On February 5th, a redd was located at Skidoo Bay which contained 248 dead eggs and 88 eyed eggs. This redd was in a seepage area about two feet above water level. In Yellow Bay on this same date, eyed eggs were found scattered throughout the gravel in a seepage area, no doubt due to wave action disturbing the redds and scattering the eggs. On February 26th, two redds (6 inches above lake level) were found in Rollins Bay, with only two eyed eggs out of several hundred eggs. In Table Bay on March 24, one kokanee fry and two dead fry were found in three inches of gravel at the present water level of that date. These were estimated to be about two weeks old. In this same bay on March 27th, six fry about one week old were found. Nearby a redd was found that contained 80 eyed eggs. Both fry and the eggs were about four inches above water level and were kept wet by wave action and capillary water. No seepage water was noticed in this bay.

The tributary streams were also observed for spawning kokanee (Fig. 3). Many kokanee were observed in the Stillwater River below the Northwestern Dam, which is a barrier to movement upstream. Whitefish River was used by many spawning fish and a trap was installed by the Somers Fish Hatchery to collect eggs. On September 21, on the South Fork River, kokanee were captured in the diversion tunnel at Hungry Horse Dam. The Big Fork Dam on the Swan River was a barrier to movement of fish up this river but many kokanee were noticed below the dam. A fish ladder is present but was unusable during the spawning season. The ladder was repaired this spring and fish may now be able to go above the dam and spawn. Kokanee were found in the North Fork River as shown on the map (Fig. 3). The greatest concentration of spawning kokanee observed was at the mouth of McDonald Lake. Spawning fish were noticed in the Middle Fork River and in Spring Creek as marked on the map.

On February 7th, many eyed eggs were found in Spring Creek. Many eyed eggs and young fry were collected in McDonald Creek on April 2nd. The eggs were profusely scattered in the gravel the entire distance of this creek from McDonald Lake to the Middle Fork River.

A count was made of eggs of seven unspawned kokanee collected in November. The number of eggs averaged 673, with a range of 521 to 930. Brunson et al (1952) got an average of 615 eggs per female with a range of 309 to 838 of the 61 fish examined.

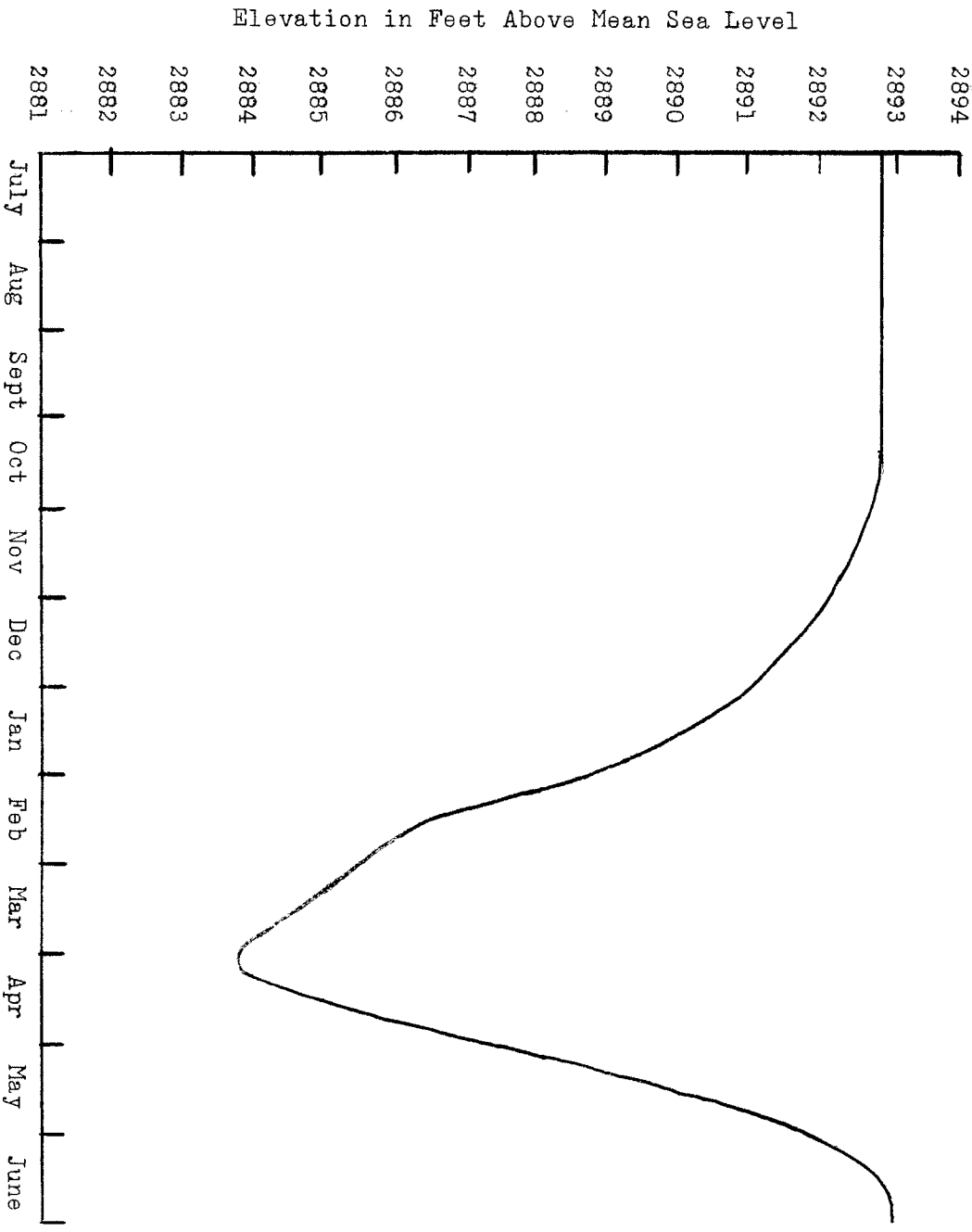

Figure 1. Fluctuation of the water level of Flathead Lake.

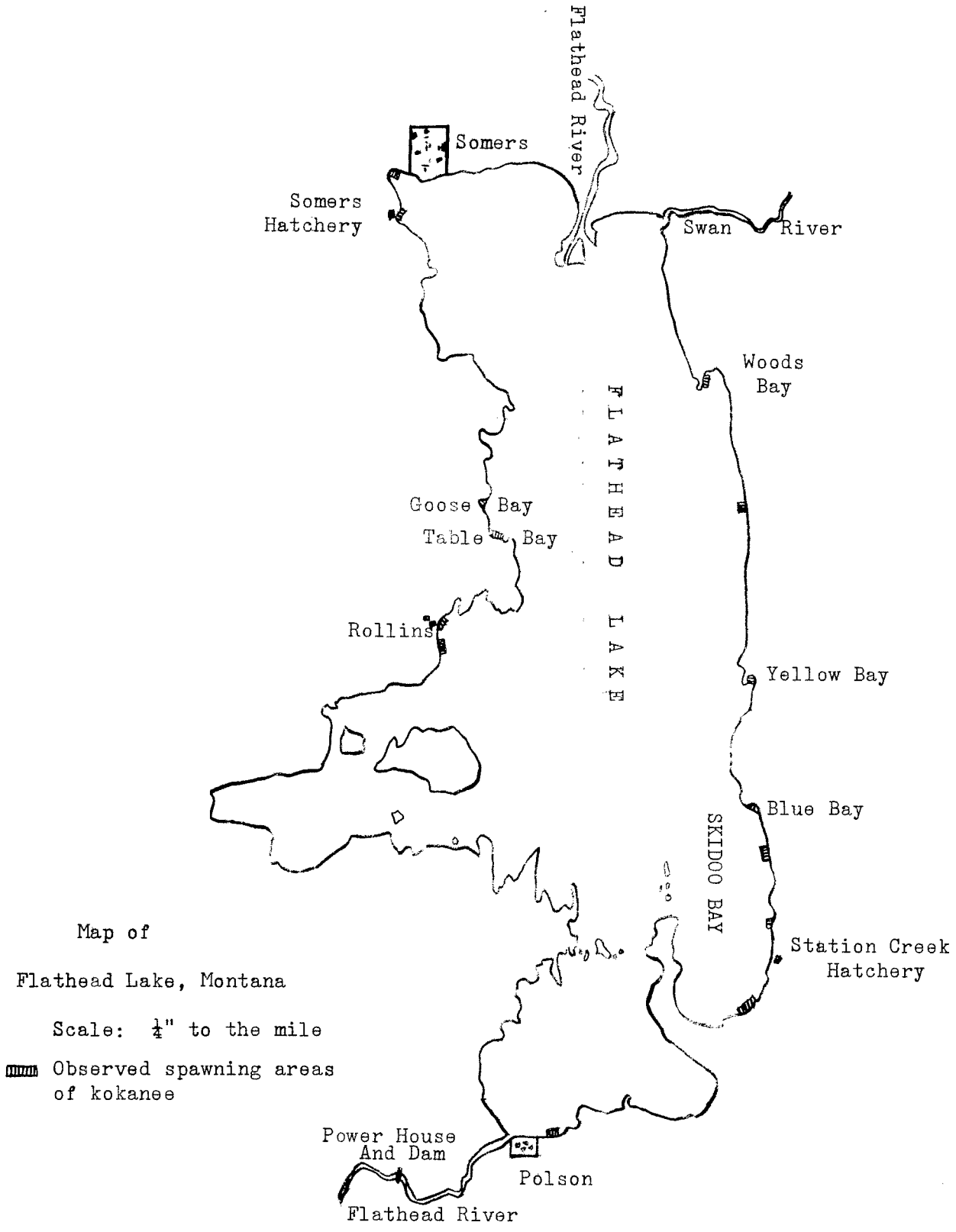

Figure 2. Shore areas used by spawning kokanee in the fall and winter of 1951-52.

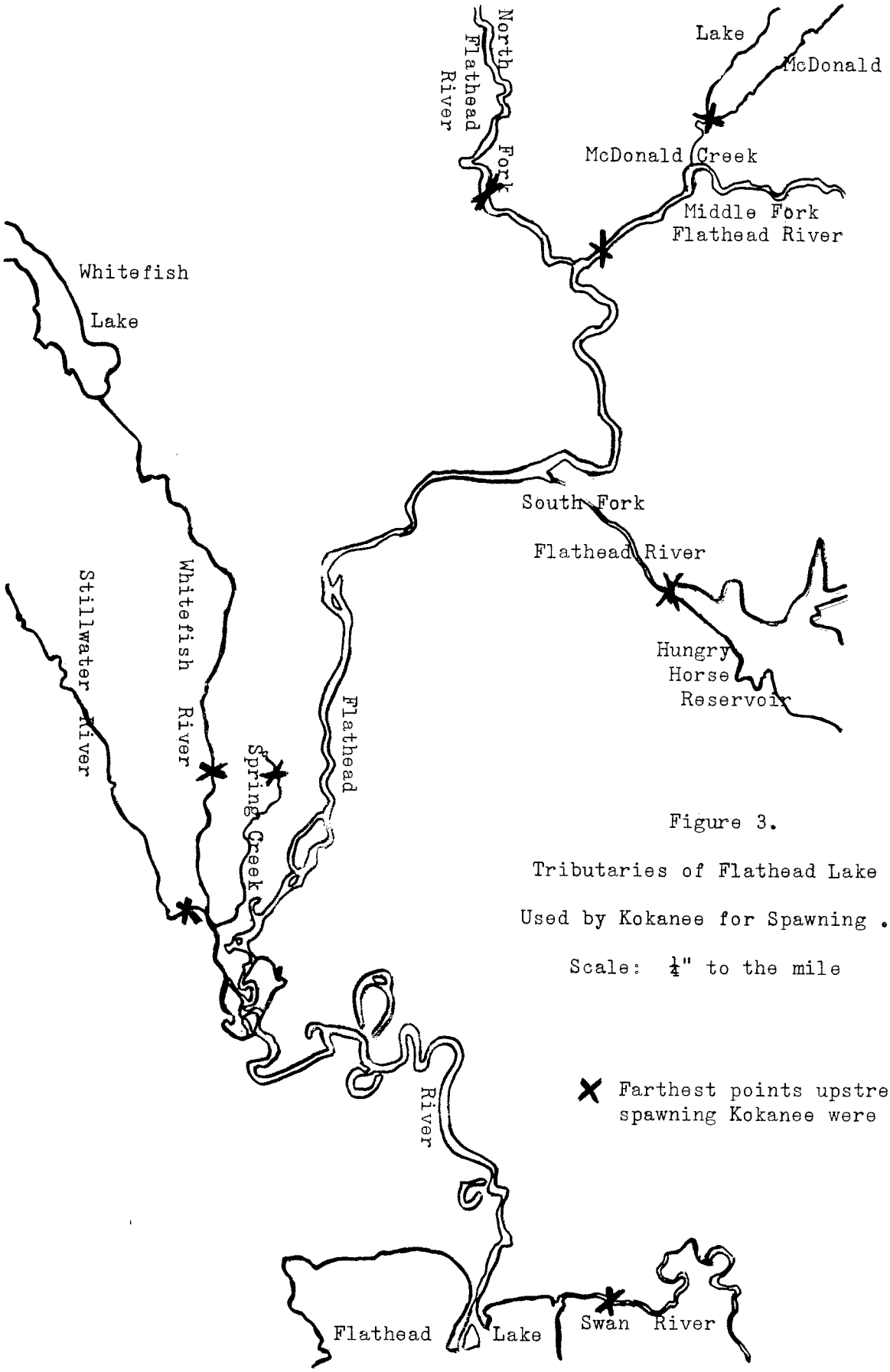

Figure 3.

Tributaries of Flathead Lake

Used by Kokanee for Spawning .

Scale: ¼" to the mile

✕ Farthest points upstream where spawning Kokanee were observed.

Twelve kokanee were aged using the otoliths. Nine of these were found to be 4 years old, the remainder were not determinable.

The length of the spawning season was difficult to determine. Brunson et al (1952) collected females on October 23rd that were either partially or completely spawned. Females were collected at Somers Hatchery Bay on February 8th, that were only partially spawned.

Lengths were taken of 400 kokanee, 100 males and 100 females from the Whitefish River, and 100 males and 100 females from the Somers Hatchery Bay. The average lengths and the range in size are given in Table 1.

Table 1. The average length and range in size of kokanee from Flathead Lake and the Whitefish River.

Location	Sex	Average Length in inches	Range	Standard Deviation
Somers Hatchery Bay	Males	13.1	11.8 to 14.1	0.49
	Females	12.6	11.5 to 13.9	0.53
Yellow Bay	Males	13.0	11.7 to 14.6	
	Females	12.6	11.3 to 13.7	
Whitefish River	Males	12.4	11.5 to 13.4	0.45
	Females	12.0	11.2 to 13.5	0.45

Brunson et al (1952)

On November 27th and December 3rd, 553 males and 503 females were taken in seine hauls at Somers Hatchery Bay and Rollins Bay giving a sex ratio of one male to 0.91 females. In the Whitefish River, 585 males and 855 females were collected on December 1st, 3rd, and 6th, giving a sex ratio of one male to 1.46 females. Brunson et al (1952) states, "The total number of males collected in 1951 was 324 compared to a total of 198 females, giving a male to female ratio of 1 : 0.611.

Analysis and Recommendations:

From the study as presented there is definite proof that kokanee do spawn along the shores of Flathead Lake, that the eggs are fertilized and some do hatch out, and that they do spawn in at least eight feet of water. There is also sufficient evidence that the kokanee go up most all of the tributaries to spawn and that the spawning in the streams is successful. There is a significant difference in the average length of fish during the spawning season of Flathead Lake and those in a tributary (Whitefish River), suggesting the possibility of there being different races of kokanee in the drainage.

The study should be continued in all phases for another year. An airplane survey of Flathead Lake during the spawning season for spawning beds is recommended. Plantings of kokanee are made in this lake from two hatcheries and it is doubtful whether they are needed. In a study of sockeye salmon in Cultus Lake, British Columbia, Foerster (1938) states, ".....", in comparing the efficiencies of natural and artificial propagation it is found that,

when the variations between the several years' results are considered, there is no statistically significant difference apparent." Brunson et al (1952) has evidence that the kokanee are getting smaller in Flathead Lake each year. The reason for this is not understood and may be the result from an overpopulation of this species in this lake.

Summary:

Kokanee were found to spawn along the shores of Flathead Lake and successful hatching was observed. Many tributaries were also used for spawning and successful hatching was found.

Data and Reports:

The original data is with the project leader at Somers, Montana.

Literature Cited:

Brunson, Royal Bruce, Gordon B. Castle, and Ralph Pirtle.
1952. Studies of Oncorynchus nerka from Flathead Lake. Montana Academy of Science. (In press)

Foerster, R. E.
1938. An investigation of the relative efficiencies of natural and artificial propagation of sockeye salmon (Oncorhynchus nerka) at Cultus Lake, British Columbia. J. Fish. Res. Bd. Can., 4 (3), pp. 151-161.

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