MONTANA DEPARTMENT OF FISH AND GAME REPORT

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FISHERIES DIVISION

Job Progress Report

July 1, 1975 - June 30, 1976

LAKE KOOCANUSA POST-IMPOUNDMENT FISHERIES STUDY

Lake Koocanusa, Montana

By

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Reservoir Investigations Project

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Project No. 2276

Project Title: Lake Koocanusa Post-Impoundment Fisheries Study

Period Covered: July 1, 1975 through June 30, 1976

ABSTRACT

The Kruskal-Wallis Ranking Test was used to compare gill net catches. Significant differences were noted between fish populations in the upper and lower parts of the reservoir.

Vertical net data indicated that cutthroat and rainbow inhabit primarily the upper 20 feet of water except during the summer when water temperatures rise above 65°F. Cutthroat trout appear to be more pelagic than rainbow trout. Most species were found primarily in the littoral areas of the reservoir.

Creel data indicated the angler catch-rate dropped from 1974 to 1976, although, it was still considered quite good. Cutthroat and Dolly Varden comprised more of the angler catch in 1976 than in 1974.

Reservoir drawdown limits recreational use due to accessibility for five or six months a year, especially in the Rexford area.

Spawning runs of cutthroat trout were observed in most suitable tributary streams.

BACKGROUND

Lake Koocanusa is the reservoir created by Libby Dam impounding the Kootenai River approximately 17 miles upstream from the town of Libby, Montana. The reservoir at full pool elevation of 2459 feet msl, is 90 miles long (48 miles in Montana and 42 miles in British Columbia) has a surface area of 46,500 acres and a gross storage capacity of 5,809,000 feet. The predicted average drawdown of 120 feet reduces the reservoir volume 69 percent and the maximum drawdown of 172 feet reduces the volume 95 percent. The drawdowns of 1973-74, 1974-75, 1975-76 were: 153, 172 and 150 feet respectively. The large drawdowns and associated reservoir fluctuations are limiting the fishery potential and recreational use of the reservoir. Water can be released through the

spillways opening at elevation 2405 feet msl, through the turbines at 2272 feet msl or through the sluiceway openings at elevation 2222 feet msl. Releases through the turbines started in August, 1975 when the first of four units went on line.

A selective withdrawal system is being constructed for each of the penstocks which will allow water to be drafted from the penstock openings to the surface. This system is designed to select water from the elevations which will enable releases through the turbines to follow closely the water quality regime in the Kootenai River prior to impoundment.

Game fish species present in the reservoir include: rainbow trout (Salmo gairdneri), westslope cutthroat trout (Salmo clarki sub-sp.), Dolly Varden (Salvelinus malma), kokanee (Oncorhynchus nerka), brook trout (Salvelinus fontinalis), burbot (Lota lota), mountain whitefish (Prosopium williamsoni), and white sturgeon (Acipenser transmontanus). Non-game species include largescale suckers (Catostomus macrocheilus), longnose sucker (C. catostomus), redside shiner (Richardsonius balteatus), northern squawfish (Ptychocheilus oregonensis), and peamouth (Mylocheilus caurinus).

The initial management for the reservoir was concerned with establishing spawning runs of westslope cutthroat and other game fish in suitable tributary streams. The strain of westslope cutthroat inhabiting Hungry Horse Rervoir was selected as the trout species most suitable for the fluctuating reservoir environment of Lake Koocanusa. This particular strain of cutthroat had adapted well to a similar environment in Hungry Horse Reservoir and has provided a good fishery without stocking for over 20 years. Approximately 500,000 young-of-the-year cutthroat have been planted in tributary streams of Lake Koocanusa which have been developed as spawning and nursery areas and about 2,500,000 fingerling cutthroat have been planted directly into the reservoir since 1970. The program to establish cutthroat was adversely affected by the loss of fish out of the reservoir in the winter of 1972-73 when the reservoir was drafted 230 feet below full pool for construction purposes and in 1974 when the spillways were used to release water from July through December.

New reservoirs generally provide excellent sports fishing for the first few years because there is an abundance of food and space resulting in excellent growth and survival of fish. As the reservoir ages, the maintenance of a satisfactory sports fishery becomes increasingly difficult. Some of the factors affecting reservoir game fish populations are (1) inadequate annual recruitment of game fish from natural reproduction, (2) increased numbers of rough fish and increased competition for food and space between all species, (3) increased predation, (4) decline in fish food production and (5) downstream escapement of game fish. Reservoir operation can vary the impact of any one of the above variables on game fish populations. The annual stocking of large numbers of hatchery fish can help maintain a sports fishery if the reservoir provides a suitable environment for their survival and growth. Thus, reservoir operation is critical to the maintenance of an environment which provides a satisfactory habitat for game fish.

Lake Koocanusa is in the first stage of its evolution and is providing an excellent fishery for rainbow trout, Dolly Varden and cutthroat trout. The rainbow and Dolly Varden populations are from natural reproduction. The

cutthroat population has been produced both by large plants of hatchery fish and natural reproduction.

Lake Koocanusa and its tributaries are part of a closely related ecosystem. The tributaries provide essential spawning habitat for game fish from the reservoir and are responsible for the production of a major part of the reservoir game fish population. The management of Lake Koocanusa tributaries as spawning and nursery areas is essential to maintaining a productive game fish population in the reservoir. Although work in the tributaries was not a part of this project, their importance to the reservoir fishery required that the Montana Department of Fish and Game collect data on these streams. This work was funded by the Department and is included in this report.

OBJECTIVES

The objectives of this project are to (1) determine the year-around vertical and horizontal distribution of major fish species in the forebay area; (2) monitor population trends of major fish species; (3) collect data on angler harvest and movement of game fish and; (4) determine growth rates and condition factors of major game species.

PROCEDURES

Fish Population Trend Sampling

Standard experimental floating and sinking gill nets were used to determine fish population trends. Catch by species was analyzed using the Kruskal-Wallis non-parametric Ranking Test developed by Gooch 1/. Montana's standard gill net is 125 feet long comprised of equal sections of 3/4 inch, 1 inch, 1 1/4 inch, 1 1/2 inch and 2 inch bar-measure mesh.

Sinking gill nets were used to determine trends in abundance for species which frequent the reservoir bottom. Target species for spring sampling in the Rexford area included mountain whitefish, Dolly Varden, burbot, largescale and longnose suckers. Reservoir elevations varied between 2350 and 2375 feet msl and surface temperatures approximated 55°F.

Floating gill nets were set to establish trends in abundance during the fall season. Reservoir elevations fluctuated between 2459 and 2439 feet msl when surface water temperatures were near 60°F. Gill net sites included the Rexford area and an area between Five Mile and Cripple Horse Creeks. An added site is planned near Elk River when permission is obtained from the British Columbia Fish and Wildlife Branch. Target species include rainbow, cutthroat, northern squawfish, peamouth and redside shiners.

Trend sampling done during this report period included sampling in September, 1975 at the Rexford and Five Mile-Cripple Horse area using floating nets and during May, 1976 at the Rexford area using sinking nets. Netting locations are shown in Figure 1. No sampling was done in British Columbia.

1/ Gooch, Burwell. 1975. The Statistical Analysis of Gill Net Catches Montana Dept. Fish & Game, Unpublished Mimeo, 40 pp.

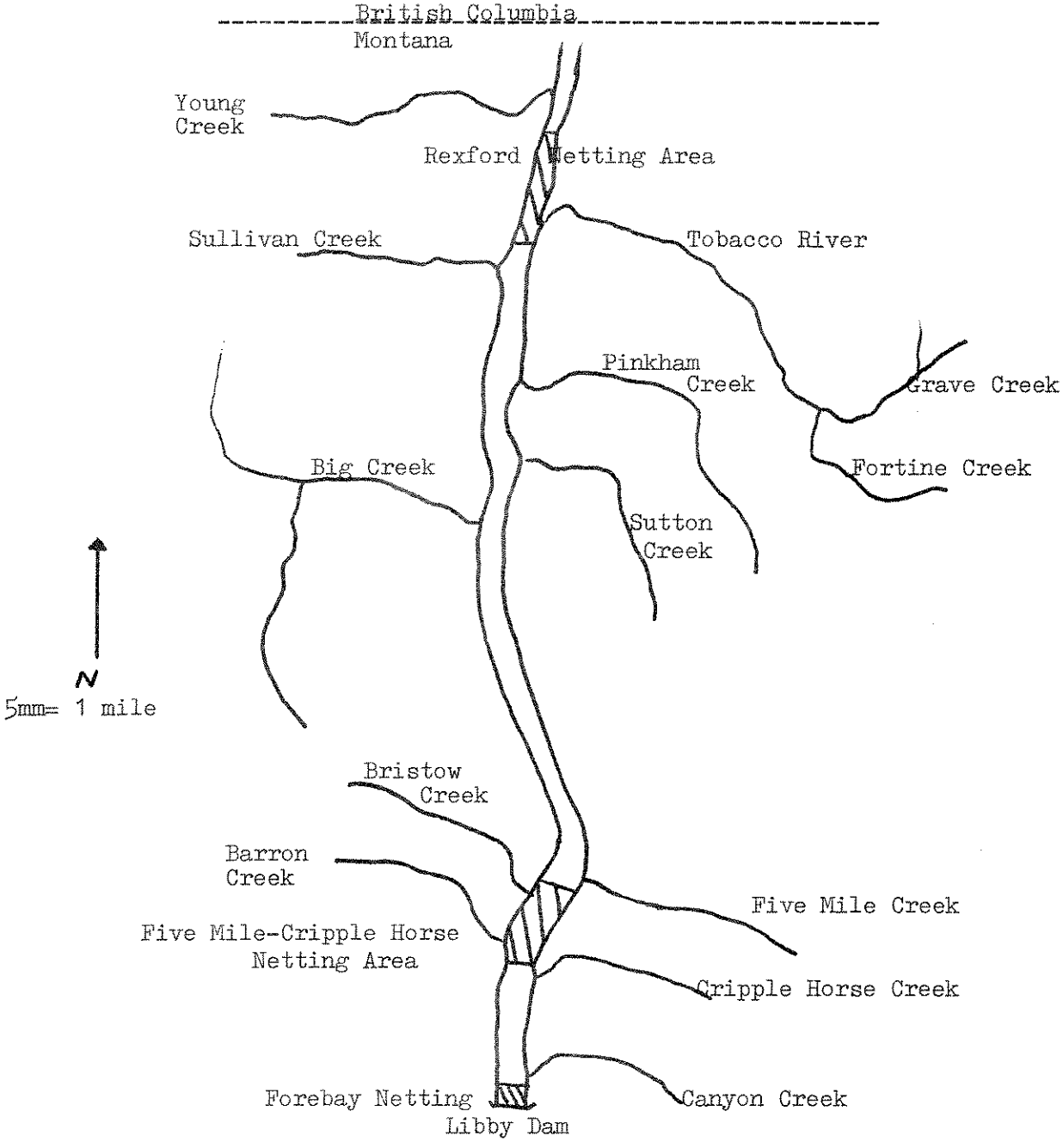

Figure 1. Map of Lake Koocanusa showing major tributary streams and netting areas.

Determination of Vertical and Horizontal Fish Distribution

Sampling to determine vertical and horizontal fish distribution has been limited to the forebay area and sampling has been done monthly or when noticeable water temperature changes occur. Equipment used included acoustical sounding gear and vertical, floating and sinking gill nets. Actoustical gear was used to determine both vertical and horizontal fish distribution and gill nets were used to determine species distribution.

Angler Success and Pressure

Creel data obtained in 1974 by contacting anglers on the reservoir included both completed and non-completed trips. Creel data based on completed trips in 1975 and 1976 were obtained at a compulsory checking station located near Canoe Gulch Ranger Station. Total fishing pressure estimates for the reservoir were obtained from a state-wide postal census.

FINDINGS

Population Trends

Data from sinking gill net catches from the Rexford area June 7-13, 1975, and May 16-19, 1976, are compared in Table 1. Reservoir elevations during netting operations ranged from 2355 feet msl to 2371 feet msl in 1975 and from 2366 feet msl to 2374 feet msl in 1976. Temperature profiles were quite similar in both years ranging from 55°F at the surface to 48°F at 100 feet in 1975, while in 1976 the temperature at the surface was 54°F and dropped uniformly to 45°F at 100 feet. Turbidities were high as indicated by secchi disc readings of 1.6 feet in 1975 and 2.0 feet in 1976.

Table 1. Kruskal-Wallis Ranking Test of Lake Koocanusa sinking gill net catches. Rexford area, spring 1975 versus spring 1976. Number of nets in parenthesis.

Species	Mean catch per net 1975 (111)	1976 (43)	P 1/
mountain whitefish	6.56	6.35	0.30
Dolly Varden	1.44	1.91	0.30
largescale sucker	37.32	26.05	0.01**
longnose sucker	7.86	11.14	0.001**

1/ Probability values of significant differences, no asterisk indicates no significant differences, 1 asterisk indicates difference at the 95 percent confidence level and 2 asterisks indicates difference at the 99 percent confidence level.

The average catch per net for mountain whitefish and Dolly Varden was almost identical in 1975 and 1976 and the Kruskal-Wallis Ranking Test indicated no significant difference in catch between the two years. The Kruskal-Wallis Test indicated a significant difference in the catch rates of largescale and longnose suckers between the two years. The mean catch of largescale suckers was 30 percent less in 1976 than 1975 and the probability of the two catch rates being different was highly significant. Catch rates of longnose suckers was 42 percent higher in 1976 than 1975 and the probability of these catch rates being different was also highly significant.

The changed catch rates of suckers in 1976 may be related to sampling and not to actual changes in fish densities. Our experimental gill nets are selective for fish of most species larger than six inches total length. Trend sampling will become more meaningful when several years of data are collected.

The floating gill net data from the fall of 1975 are summarized in Table 2. The Rexford area was sampled from September 23 to 26th while the Cripple Horse area was sampled from September 29 to October 3rd. Reservoir elevations ranged from 2454 feet msl on September 23rd to 2452 feet msl on October 3rd. Water temperature profiles were almost identical being 59°F at the surface, dropping to 54°F at the 100 foot depth at Rexford compared to 61°F at the surface and 55°F at the 100 foot depth at Cripple Horse. Secchi disc readings ranged between 17 and 19 feet.

Table 2. Kruskal-Wallis Ranking Test of Lake Koocanusa floating gill net catches. Rexford area versus Cripple Horse area, September 23 to October 3, 1975. Number of nets in parenthesis.

Species	Mean catch per net		P 1/
	Rexford (68)	Cripple Horse (61)	
rainbow	3.03	2.46	0.208
cutthroat	1.66	2.46	0.0077**
squawfish	2.74	5.79	0.0 **
peamouth	1.28	4.03	0.0001**

1/ Probability values of significant differences, no asterisk indicates no significant differences, 1 asterisk indicates difference at the 95 percent confidence level and 2 asterisks indicates difference at the 99 percent confidence level.

The Kruskal-Wallis Test indicated that there were significant differences between the catch rates of cutthroat trout, squawfish and peamouth with all three being more abundant in the Cripple Horse area. There was no difference in the catch of rainbow trout between the two areas.

The data given in Table 2 indicate that of the four species, three were more abundant in the Cripple Horse area than the Rexford area. These four species tend to be the most pelagic and surface dwelling of the numerous fish species in the reservoir. Fish distribution throughout the length of the reservoir and reasons for these patterns will become explainable only after several year's data including limnological information are available.

Horizontal and Vertical Fish Distribution

Sampling to determine vertical and horizontal distribution of major fish species in the Libby Dam forebay has been in progress since July, 1974. This part of the post-impoundment study is of importance and directly related to operation of the selective water withdrawal system. A special report detailing findings will be submitted and will include data collected from inception of this study through December, 1976 or October, 1977 if this contract is extended. Three year's data should be sufficient to predict year-to-year distribution variations caused by differing temperature patterns, light penetration and other physical and chemical and biological factors.

Data collected to date have indicated some vertical distribution patterns. When surface temperatures were 60°F or lower, most rainbow and cutthroat trout were caught from the surface down to depths of 20 feet. When surface temperatures were 65°F or higher, most cutthroat and rainbow trout retreated down to the 57-60°F strata. Surface temperatures of 60°F or cooler generally occur between the months of September through July while temperatures above 65°F may occur in July, August and September.

Horizontal distribution of cutthroat and rainbow trout was determined by fishing floating gill nets tied together (ganged), starting at the shoreline and extending out into the reservoir 750 feet. Depths near the shoreline are about eight feet deep dropping off to about 200 feet deep at the outer end of the net. The floating nets fish from the surface down six feet. At the same time bottom gill nets were set extending from the shoreline out 125 feet and fishing the bottom six feet at depths of 10 feet to 50 feet.

In the fall netting (October, November, December, 1975) rainbow trout made up 37 percent of the catch and cutthroat trout 63 percent from the shoreline out 250 feet in the ganged floating nets. Catch from 251 feet to 750 feet away from the shoreline was eight percent rainbow trout and 92 percent cutthroat trout. Catch from bottom gill nets extending out from the shoreline 125 feet was 18 percent cutthroat and 92 percent rainbow trout.

Floating gang nets fished March 30 and June 18, 1976, caught 38 percent rainbow trout and 62 percent cutthroat trout in the first 250 feet of net compared to 39 percent rainbow and 61 percent cutthroat trout in the outer net. Bottom gill net catch was 96 percent rainbow trout and 4 percent cutthroat trout.

These data indicate that cutthroat trout tend to be more pelagic and inhabit more of the total reservoir surface area than do rainbow trout. Catch from the bottom gill nets indicates that rainbow trout are more closely associated with the littoral zone than are cutthroat trout.

Food habits of the rainbow and cutthroat trout may influence habitat selection. Gross examination of stomachs indicated that cutthroat trout were feeding almost exclusively on zooplankton which is found in the pelagic as well as the littoral zone. Rainbow trout were feeding on a mixture of zooplankton, terrestrial and aquatic insects and small fish, usually redside shiners. The insects and small fish are most abundant in the littoral zone of the reservoir.

Catch of other species in nets fished in the forebay area have yielded some information on their distribution. Suckers are caught most frequently near the shoreline and almost always near the reservoir bottom. Redside shiners have been caught in the ganged floating nets away from the shoreline and in the vertical nets in mid-channel, but still are most numerous near the shoreline. Mountain whitefish are most frequently caught near the reservoir bottom along the shoreline. However, they are also caught in the vertical nets at depths extending from the surface to 150 feet.

Four acoustical sounding samples were taken while vertical and horizontal nets were being fished. Each sample consisted of three triangular transects, one in late afternoon, one near midnight and the third shortly after sunrise. Each transect started near the shoreline in Souse Gulch, went across the reservoir to the north shore of Canyon Creek Bay, across Canyon Creek Bay to near the east end of the log boom and then back across the reservoir to the point of origin.

During the daytime, fish were concentrated in Canyon Creek Bay and were within 200 feet of the shoreline. At night some fish moved away from the shoreline out into the reservoir although most fish were still in the bay and along the shoreline. Catch from the ganged floating nets indicates that cutthroat and some rainbow trout are moving out into the reservoir during the night.

Angler Harvest

Total fishing pressure for the Montana portion of Lake Koocanusa for the period of May, 1975 through April, 1976 is estimated to have been 18,568 man-days. This pressure estimate was obtained from a state-wide postal card survey. Observation by project and British Columbia fisheries personnel indicate that angling pressure is heaviest around the Cripple Horse Creek boat landing, Rexford boat landing and Kikomum Creek Provincial Park boat landing. Access into the reservoir outside of these areas is severely limited most times of the year.

Observations by project personnel indicate that fishing is the heaviest during the spring and fall and least intense during the winter. Reservoir drawdown almost eliminates access into the reservoir during the winter and

early spring months. High turbidity during reservoir filling reduces fishing pressure in the upper end of the reservoir.

Creel census data presented in Table 3 were from the lower 30 miles of Lake Koocanusa and should not be interpreted to be representative of the entire reservoir. The data collected in spring 1974 were obtained by project personnel contacting anglers as they fished and included both complete and incomplete angler-trips. Data collected in fall 1975 and spring 1976 were obtained at a compulsory check station located near Canoe Gulch Ranger Station and includes only completed angler-trip information. Thus, anglers success rates for spring 1974 are not comparable to other census data.

Table 3. Angler harvest and catch rates from the lower 30 miles of Lake Koocanusa, spring 1974 and 1976 and fall 1975.

Period	No. Anglers	CPMH*	Cutthroat trout	Rainbow trout	Dolly Varden
Spring 1974	62	1.1	40	39	10
Fall 1975	94	0.6	86	108	2
Spring 1976	264	0.4	313	158	41

* CPMH is -- catch-per-man-hour of angling effort

The data show that cutthroat trout and rainbow trout were caught in about equal numbers in spring 1974 and fall 1975, but that catch of cutthroat trout rose dramatically in spring 1976. The catch per angler of Dolly Varden was similar in spring 1974 and spring 1976, but much lower in fall 1975.

The increased catch of cutthroat trout in spring 1976 is likely related both to the reduction in downstream escapement of this species and hatchery fish entering the creel. Large numbers of cutthroat moved out of the reservoir in winter 1972-73 and summer-fall 1974. Cutthroat trout planted in the reservoir in fall 1974 and 1975 should have started to enter the angler catch in spring 1976. The different catch-rates of Dolly Varden between spring and fall is probably related to movements of this species within the reservoir. Dolly Varden are fall spawners and likely most mature fish were in the northern part of the reservoir or tributaries during the fall and not available to anglers fishing the southern part of the reservoir.

Catch rates of major game fish species should serve as an indices of reservoir populations. Collection of creel census data will be limited to the spring and fall when fishing pressure is most intense. Personnel limitations may preclude collection of data near the Rexford area.

Spawning Runs

The westslope cutthroat spawning run up Young Creek in 1976 began on May 7th and was nearly completed by June 19th, when the upstream trap was removed. A total of 692 cutthroat were caught and released upstream during the trapping operation. Since most trapping operations are not one hundred percent efficient and the trap was pulled before the run was completed, the total run is estimated to have been about 750 fish. The total run in 1975 was only 303 fish. The marked increase in the 1976 spawning population over the previous year appears to be a result of less downstream loss of cutthroat, planted fish reaching spawning age and a higher reservoir elevation which facilitated fish passage in the lower part of Young Creek in 1976. The stream channel below elevation 2360 feet msl has become braided as a result of the massive slumping of adjacent banks.

The average size of the male cutthroat trapped was 15.4 inches, whereas, the females averaged 15.8 inches. The sex ratio was 4.8 females for each male. The high preponderance of females could be affecting reproductive success and should be evaluated.

Spawning runs were also observed in 1976 in the following streams; Graves Creek, Fortine, Big Creek, Pinkham, Five Mile, Cripple Horse, Canyon and Bristow, Fish were collected by angling and by using electrofishing gear. Cutthroat spawners were not found in Sullivan Creek. Big Creek was too high during the peak of the spawning activity to sample efficiently. Creel data from anglers after the peak spawning period, however, indicated that a good run of cutthroat ascended Big Creek.

Large numbers of cutthroat were observed concentrated below the irrigation diversion on Graves Creek in June. Reports from anglers indicate that some cutthroat did manage to negotiate the dam. Two anglers reported catching 13 adult westslope cutthroat 14-18 inches in length approximately 4-5 miles above the diversion dam. However, better passage facilities are needed to ensure that cutthroat spawning in upper Graves Creek have access every year. No spawning cutthroat were found in the Fortine drainage during a brief, one-day reconnaissance, but angler reports indicate that cutthroat from the reservoir are migrating as far as Swamp Creek, approximately 31 miles from the mouth of the Tobacco River.

The passage problems in Pinkham Creek, caused by the side casting of shotrock during road construction, appears to have been corrected. Adult cutthroat and rainbow trout from the reservoir were found four miles above this site.

Five Mile, Cripple Horse, Canyon Creek and Bristow Creeks are all small drainages which had flows suitable enough for fishing during the peak of the spawning activity. These streams were surveyed in the latter part of June to determine if escapement was adequate to seed the available spawning and nursery habitat. The smallest and most heavily fished stream, Canyon Creek, was found to contain 72 adult cutthroat and 31 redds from the

reservoir upstream approximately one mile to an impassable falls. It was estimated that only about half of the cutthroat in the stream were actually observed. Undercut banks, log jams and overhanging brush precluded obtaining a total count. All suitable gravel had been worked in redd preparation and it appeared that escapement was more than adequate. A similar situation was found in the other three streams. Forty-seven redds were found in the lower one and one-half miles of Five Mile Creek and 69 redds were observed in the lower three miles of Cripple Horse Creek. The latter stream contains little suitable spawning gravel.

A fry trap was installed in the mouth of Canyon Creek on July 16th and 1308 fry had been trapped migrating to the reservoir by August 1st. Fry were quite abundant in the stream from the mouth up to the falls.

Good runs of cutthroat trout have also been documented spawning in Canadian tributaries, (personal communication, R.A. Lindsay, British Columbia Fish and Wildlife Branch). The majority of these fish appear to be the strain of westslope cutthroat planted in the reservoir by the Montana Department of Fish and Game.

Fall spawning runs of Dolly Varden and mountain whitefish were monitored in several streams. The Tobacco River system is the most important drainage for Dolly Varden and mountain whitefish in the Montana part of the Kootenai. Large numbers of Dolly Varden and mountain whitefish were observed August 28th in Graves Creek from Hiway 93, downstream approximately 1.5 miles. This drainage contains the only known run of Dolly Varden in the United States part of the reservoir. The large populations of Dolly Varden and mountain whitefish in the reservoir are produced entirely by natural reproduction of which an unknown amount occurs in the Canadian tributaries.

RECOMMENDATIONS

Recommendations for the continuation of this project are divided into two categories. One category details actions that should be done during the remainder of the current contract which expires December 31, 1976. The second category details actions that should be considered if the reservoir contract is extended in future years.

A. Recommendations -- June 30 - December 31, 1976

1. Continue sampling programs as outlined in the current contract documents.

2. Collect creel census information during fall 1976.

B. Recommendations -- for consideration if the reservoir contract is extended

1. Determine where rainbow trout are spawning in the Lake Koocanusa drainage.

2. Continue enumeration of cutthroat trout spawning runs into Young Creek. The size of this spawning run directly relates to in-reservoir populations of cutthroat.

3. Continue reconnaissance of spawning runs of cutthroat trout into other tributaries of the reservoir.

4. Determine areas of the Tobacco River drainage used for spawning by Dolly Varden.

5. Determine movement patterns of Dolly Varden within the reservoir.

6. Determine escapement of spawning cutthroat trout in those streams which may be subject to heavy fishing pressure during the spawning season. Further regulation of the fishery may be required to ensure adequate spawning escapement.

7. Determine food habits of the major fish species found in Lake Koocanusa. Special emphasis should be placed on cutthroat trout and rainbow trout since these are the most important game fish.

8. Develop a program with appropriate landowners to maintain and improve fish passage in streams used for spawning.

9. Continue sampling program and creel census as recommended in A1 and A2.

It can be predicted that changes will occur in the fish population structure of any reservoir as it ages or as reservoir operation changes. These changes can occur over many years or within months. An excellent sport fishery

in Noxon Rapids Reservoir was eliminated in about three months when this reservoir was integrated into the Columbia River flood control system. The fishery of Cabinet Gorge Reservoir has slowly improved since 1961 through reduction of drawdown. The fishery of Hungry Horse Reservoir has fluctuated in relation to changes in reservoir operation.

Fish species inhabiting Lake Koocanusa have responded to reservoir operation. An example of this was the large number of cutthroat trout and mountain whitefish which moved out of the reservoir in winter 1972-73 and July-December 1974. Effects of this fish loss reduced spawning runs into tributaries and future recruitment of young fish to the reservoir population. Reduction of downstream loss of fish since 1974 has resulted in dramatic increases in spawning populations which will result in greatly increased re-population.

Annual drafting of Lake Koocanusa for power and flood control may have drastic effects upon various fish species. Rainbow trout may have food and habitat preferences that tie them to the reservoir's littoral zone more closely than cutthroat trout. Reservoir drafting creates continual changes most noticeable in the littoral zone which may eliminate or greatly reduce rainbow trout populations. The rainbow-cutthroat trout food habit study which will be done in 1977 should provide data upon which to predict changes that may occur in numbers of rainbow trout and cutthroat trout.

Fishery studies on upper Missouri River impoundments have clearly demonstrated that fluctuating shorelines decrease numbers of fish that are either shoreline spawners or that require shoreline habitat for rearing. Lake Koocanusa contains species that are shoreline spawners and species that require stable shorelines for rearing of young fish. Reduction or elimination of these species will affect other fish species.

Fishery studies on Hungry Horse Reservoir and Noxon Rapids Reservoir have indicated drawdown levels and times of drawdown that decrease fish populations below an acceptable level. The studies enabling prediction of these draft levels and times required collection of data for eight years on Noxon Rapids Reservoir and 12 years on Hungry Horse Reservoir. Fishery investigations of Hungry Horse and Noxon Rapids Reservoirs are continuing and are expected to continue for an indefinite time. These investigations, many times, are in response to proposed changes in reservoir operations. Different fishery management measures will be attempted at Noxon Rapids Reservoir in response to the installation of a fifth generator and the possible reduction in maximum fluctuation and period of drawdown offered by this new generator.

Long-term fishery investigations should be considered for Lake Koocanusa to alleviate real and potential effects of reservoir operations and gain benefit for the fishery where possible.