MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-46-R-2 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER AND WARMWATER ECOSYSTEMS

JOB NO.: V-a JOB TITLE: FLATHEAD LAKE-RIVER SYSTEM STUDY

PROJECT PERIOD: JULY 1, 1988 THROUGH JUNE 30, 1989

ABSTRACT

A five-year fisheries co-management plan for the Upper Flathead River and Lake System in cooperation with the Confederated Salish and Kootenai Tribe was completed and submitted for approval. Mitigation for losses in fish populations affected by hydropower development by Hungry Horse and Kerr Dams is being negotiated through the Northwest Power Planning Council and with Montana Power Company through the Federal Regulatory Commission. A total of 41 stream reaches, comprising 241 stream miles, were adopted by the Northwest Power Planning Council as protected from future hydropower development. On-site inspections, project reviews and recommendations were made on 12 shoreline and 15 river projects to minimize impacts upon aquatic habitat in Flathead Lake and River system. The lake was completely frozen over for 51 days. Because of the low densities of adult kokanee in the lake there was no summer kokanee angling and a fall acoustic estimates could not be made. A hydroacoustical survey conducted during November, 1989 estimated 4.6 million fish (48.7 fish/acre) in Flathead Lake. Highest densities occurred in the nearshore areas of the east and southern parts of the lake. Of the 4.0 million kokanee fry released in the lake in 1989 1.4 million were reared in pens and 2.6 million were reared at state hatcheries. Fry were released at five sites during June. Sampling of fish at fry release sites showed little predation upon the fry while in shallow waters. A total of 170 tagged fish were recaptured including 86 cutthroat trout (14.7 percent recapture rate), 61 lake trout (7.3 percent), 19 bull trout (11.7 percent) and 3 rainbow trout (10.5 percent). Densities of crustacean and zooplankton from the shallow lake station were lower than the two previous years. Two large cladoceran species (<u>Daphina longiremis</u> and <u>Leptodora kindtii</u>) reappeared during 1988. The 1989 lakewide average <u>Mysis</u> density of $52/m^2$ shows a decreasing trend to about equal the 1985 density. Analysis of juvenile sized kokanee and lake whitefish stomachs show these two species have similar diets and eat the same larger zooplankters. Adult size mysids provided food during November. During the winter period, lake whitefish fed exclusively on yearling yellow perch. Large lake trout did not fed on the 2.4 million kokanee fry released in the lake in 1988. The 1988 index count of 269 bull trout redds in Flathead Basin streams was about 21.2 percent higher than the 1979-87 average of 222 redds. Fine sediment levels increased

significantly in three of the index streams on the North Fork Flathead River which would suggest lower trout embryo survival.

BACKGROUND

The Flathead Lake/River system located in northwest Montana consists of Flathead Lake, the main Flathead River above Kerr Dam, that portion of the South Fork Flathead River below Hungry Horse Dam, the Swan River below Bigfork Dam, the Whitefish River below Whitefish Lake, and the North and Middle Forks of the Flathead River and their major tributaries as used for spawning and rearing. The system needs to be managed as one ecosystem due to the adfluvial nature of several of the major gamefish species in the system. These adfluvial fish also interact with lake resident stocks, further underscoring the interdependency of the lake and river fisheries.

The major sportfish species in the lake include westslope cutthroat trout (*Oncorhynchus clarki*), kokanee (*Oncorhynchus nerka*), bull trout (*Salvelinus confluentus*), lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*) and yellow perch (*Perca flavescens*). The major sportfish in the river are westslope cutthroat trout, bull trout, kokanee, and mountain whitefish (*Prosopium williamsoni*). Scattered populations of largemouth bass (*Micropterus salmoides*) and northern pike (*Esox lucius*) occur in old oxbows of the river.

Flathead Lake

Flathead Lake, measuring 125,000 surface acres, is currently the third most heavily fished water in Montana. The lake supports about 75,000 angler-days per year for trout and salmon.

Kokanee populations have declined in recent years in part because of the impact of fluctuating lake levels on lakeshore spawning success.

Flathead River

Flathead River and its forks create one of the most extensive adfluvial fisheries in Montana. Westslope cutthroat and bull trout migrate as much as 140 miles to spawn in their natal stream.

PROJECT OBJECTIVES AND DEGREE OF ATTAINMENT

Lake Objectives

1. Influence management of water levels in the lake to minimize impacts on fish populations. Mitigation plans for operations of Hungry Horse and Kerr dams are being negotiated under the Northwest Power Act and with Montana Power Company. Objective accomplished with state funds.

2. Maintain water quality at present levels as measured by the Montana Water Quality Bureau (WQB). Objective accomplished through the cooperative participation and review with appropriate agencies, utilizes state funds.

3. Maintain aquatic habitat at a level capable of sustaining existing fish populations. Objective accomplished through the cooperative participation and review with appropriate agencies to enforcement stream and lake bed protection laws, utilizes state funds.

4. Maintain trout and salmon populations at present levels in face of projected increases of 35,000 angler days by 1992. Utilize hatchery plants if necessary. Objective attained to the degree of developing and implementing an experimental stocking strategy to restore the kokanee population by utilizing hatchery plants from 3 to 5 million kokanee fry under several rearing and release strategies.

5. Maintain the opportunity to catch large bull trout (>8 lb.) and lake trout (>15 lb.) at a catch rate of 0.1 fish/hour. Objective accomplished to the degree of developing and implementing a plan to restore the kokanee prey base and the monitoring of the seasonal lake fishery.

6. Manage for a 12-14" kokanee and a catch rate of 1 fish/hour. Objective attained to the degree of developing and implementing an experimental stocking strategy to restore the kokanee population and annual monitoring of kokanee year-class strength.

7. Develop management strategies to compensate for the introduction of Mysis. Objective accomplished to the degree of monitoring the annual population status of the Mysis population and defining areas of impacts the Mysis have on fish populations.

8. Encourage public participation in resource issues and decisions. Objective accomplished through dissemination of information at public meetings and public input in developemnt of a systemwide fisheries management plan.

9. Provide public access to popular use areas and develop more low water boat ramps. The review and implementation of development projects at existing sites and identification of sites needed for future acquisition. Objective accomplished with state funding.

River Objectives

1. Maintain, within legal limits, instream flows sufficient to maintain or enhance existing fish populations. Objective accomplished as described in the mitigation plans for operations of Hungry Horse and Kerr dams as negotiated under the Northwest Power Act and with Montana Power Company. Accomplished with state funds.

2. Maintain spawning and incubations flow discharges from Hungry Horse Dam as calculated by Special Projects studies. Objective accomplished.

3. Maintain streambanks and channels in present or improved condition. Objective accomplished through the annual monitoring of streams and through the cooperative participation and review with appropriate agencies to enforce stream bed protection laws. Utilized state funds.

4. Maintain water quality at or above present levels as measure by WQB and U. S. Geological Survey (USGS). Objective accomplished.

5. Maintain fish habitat at or above present levels. Objective accomplished through the annual monitoring of spawning habitat in the main Flathead, North and Middle Fork Flathead Rivers.

6. Maintain fish populations that will provide use and harvest at present levels. Objective accomplished through the monitoring of cutthroat and bull trout populations in the North and Middle Fork tributaries.

7. Provide river access sites 4-6 hours (floating time) apart. Secure public access on currently used private ground. Objective accomplished through review of access plans in coordination with the USFS. State funded.

8. Increase public awareness of the unique nature and problems of the adfluvial fisheries. Objective accomplish through public meetings and in review of the Upper Flathead System Fisheries Management Plan.

9. Increase compliance with existing angling regulations. Objective accomplished through education at public meetings and through coordinated effort of the enforcement division. State funds.

PROCEDURES

Flathead Lake Seasonal Fishery Monitoring

Flathead Lake seasonal fishing patterns were monitored by conducting periodic angler interviews by both fisheries and enforcement personnel working on the lake. Volunteer information was also obtained from interested anglers, professional guides and from anglers returning fish tags. Information obtained included angler effort, success and methods by season.

Volunteer Angler Tagging Program

A cooperative tagging program was continued with 8 volunteer anglers. Two individuals concentrated their tagging efforts in the river system, one marking primarily bull trout and the other cutthroat trout. Six lake anglers are deep-trollers who utilize either down-riggers or steel line outfits to catch lake and bull trout. This volunteer tagging program has continued since January, 1985.

Taggers were issued tagging kits which included a tagging gun, numbered Floy tags, scale sample envelopes, measuring tape, hanging spring-scale and data sheets.

Zooplankton Abundance

We measured the abundance of the macrozooplankton species that comprise the diet of planktivorous fish at three stations on Flathead Lake. The sampling stations were chosen to represent shallow, near shore, and limnetic fish habitats. Samples were collected biweekly from May through September. Replicate vertical tows were made from a depth of 30 m with a 0.5 meter diameter Wisconsin net constructed of 80 micron nitex. The net was retrieved at 0.4 m/sec with an electric winch. Water temperature profiles and Secchi disk readings were obtained at each station. The samples were preserved with 95 percent ethyl alcohol. Cladocerans and copepods were identified and counted in four subsamples, using standard microscopic techniques. Macrozooplankton in three other, or deep open water stations were sampled by personnel at the University of Montana Biological Station. Standardized sampling techniques and equipment were used in all collections. The combined efforts were designed to coordinate monitoring of plankton population changes.

The distribution and abundance of opossum shrimp (*Mysis relicta*) in Flathead Lake were determined by sampling 41 randomly selected stations in early September. This work was also conducted cooperatively with the University of Montana Biological Station personnel. Fall sampling gave an estimate of year class strength, since *Mysis* has a one-year life cycle in Flathead Lake. Vertical tows, from the bottom to the surface, were made with a 1 m Wisconsin net made of 500 micron nitex. Zooplankton sampling sites are on file at MDFWP Region One Fisheries.

Fish Sampling

A 420 Khz, portable echo sounder (BioSonics, Inc. - Model 105 sounder) with a through the hull mounted single 15° beam transducer was used to search areas of fish concentrations. Survey transect data were collected while moving at 3.0 meters/sec and were preserved on a standard magnetic tape, two channel, cassette recorder. Recording threshold levels on the echogram strip chart recorder were adjusted to allow detection of fish as small as 50 mm, with the lesser scattering layer echoes being excluded. Once concentrations of fish were located with the sounder, a 2-meter fixed frame trawl was employed to verify fish species and size.

The fall 1988 hydroacoustic fish survey and population estimate was contracted to BioSonics, Inc. of Seattle, WA. They used a dual-beam echosounder that integrates fish sizes from acoustic data collected and preserved on VCR recording tape. Measurements of fish density and target strength in 5m depth intervals were made with a BioSonics Model 281 Echo Signal Processor. Fish targets close to the bottom (within 2 meters) were manually measured with an oscilloscope. Fish density (fish/m^3) in each depth stratum for each transect were calculated by BioSonics data processing software. The survey did not include South Bay, or nearshore areas where depth was less than 12.2 meters.

Fish abundance estimates were derived for nine area strata of the lake by multiplying average fish density by surface area. Transect lengths to calculate average densities were measured during sampling with a digital knot log. Density estimates included only fish greater than 50mm.

Species composition was determined from gill-net sampling and midwater trawling preceding and following the acoustic survey, October 1 to December 22, 1988.

Experimental gill-nets, 6 x 125 feet, were generally set for 12 to 18 hours on the bottom and at midwater at the sample sites. Each net was constructed of equal lengths panel of 3/4, 1, 1 1/4, 1 1/2 and 2 inch nylon mesh. Monofilament gill nets, 15 x 100 feet, constructed with 3/4 and 1 inch mesh were also set at some midwater sites.

The 2-meter fixed frame mid-water trawl was constructed of side panels of 1-1/2 and 1-1/4 inch mesh, with a 1/4 inch mesh cod end. The trawl was held open with a 6 x 6 foot frame of 1-inch iron tubing. A 200-foot 1/4 inch wire bridle preceeded the single or main 3/8 inch towing wire. We were able to trawl to depths of 110 feet. Attachment and angle control points were made on an adjustment bar. This bar was an 18-inch piece of 1 1/4 inch angle iron with holes drilled every 1 1/2 inches. This bar was welded mid-way on the vertical frame. Weights, varying from 3 to 10 pounds, were attached to the bottom corners of the frame to weight the net to fish deeper with less line. The trawl was towed at 1.9 to 2.2 knots (1.0 - 1.2 m/sec). Net depth was measured with a Benthos time/depth recorder, while speeds and distances were monitored by a knot log.

Juvenile kokanee and lake whitefish were collected primarily from the northwest quadrant of Flathead Lake with the midwater-trawl. Gill nets set overnight in the thermocline collected yearling and older fish. Trawl hauls, all conducted at night, were directed to sampling young-of-the-year fish, though older fish were also captured incidentally. Periodic bottom set gillnets and creel checks provided additional fish samples used for habits summary.

Total length and weight were recorded, and scales, otoliths, and stomach contents taken from lake trout, bull trout, lake whitefish and kokanee. Stomach contents were preserved in ethyl alcohol. Zooplankton in these samples were identified to species and counted, while other invertebrates were classified by order.

Kokanee otoliths were cleaned and stored dry in gelatin capsules to prevent breakage.

Pen Rearing of Kokanee

Kokanee were experimentally reared in net pens attached to a floating dock near the Flathead Lake Salmon Hatchery. Pen rearing was initiated to evaluate a method of providing larger fish for release in the lake. Five floating pens were constructed of 1/16" delta nylon mesh which was supported on 1 1/2" aluminum tubing frames, 10 x 12 feet. Three of the five pens were 10 feet deep and two were 5 feet deep. The top of each net was suspended 18 inches above the water surface by four corner floats made of styrene-filled tires. Fry were fed a ration based on 4 percent live body weight which was distributed during fifteen hourly feedings starting at 0600 hrs. Surface water temperature was recorded daily.

Stream Habitat Quality and Populations Monitoring of Bull Trout and Westslope Cutthroat

Substrate Coring

Substrate coring (McNeil and Ahnell 1964; Shepard and Graham 1983; Weaver and Fraley 1988) involved removing streambed samples using a hollow core sampler; very fine silt was measured with a 1 liter Imhoff settling cone. Substrate cores were collected from seven known bull trout spawning areas (Whale, Coal, South Fork Coal, North Coal, Big, Trail and Granite creeks) and one cutthroat spawning area (Challenge Creek) in the North and Middle fork drainages. After extraction from the streambed, samples were transported to the Flathead Forest Service lab, dried, and separated by 12 sieves ranging in size from .002 to 3.0 inches. The mean percentage of material smaller than 6.35 mm (0.25 inch) and 1.70 mm (0.07 inch) in cutthroat spawning areas, and percentage less than 6.35 mm (0.25 inch) in bull trout spawning areas was compared to information from previous years.

Measures of fine materials have been considered indicative of egg incubation habitat quality for cutthroat and bull trout. Average survival to emergence in each spawning area sampled was calculated using predictive equations developed for cutthroat trout (Irving and Bjornn 1984) and bull trout (Weaver and White 1985).

Substrate Scoring

Substrate scoring is a visual classification system for surface streambed materials developed by Crouse et al. (1981) and modified by Leathe and Enk (1985). This method results in an index of embeddedness which is considered indicative of rearing habitat, particularly for bull trout juveniles because of their close association with the substrate. Substrate scoring was completed on four streams in the North Fork drainage (Big, Coal, North Coal and South Fork Coal) and on one stream in the Middle Fork drainage (Morrison).

Bull Trout Redd Counts

Bull trout redd counts were conducted in four major North Fork index streams (Big, Coal, Whale, Trail) and four major Middle Fork streams (Morrison, Granite, Lodgepole and Ole). Surveys were conducted by crews of two walking down the channel and classifying redds as definite (Class 1) or probable (Class 2) following methods in Shepard and Graham (1983). Both classes of redds were used in final totals, which were compared to counts in previous years from the same stream sections.

Electrofishing Estimates

Estimates of juvenile bull trout were made by electrofishing 500-ft (150 m) sections in important rearing areas of the North Fork drainage (three reaches of Coal Creek, South Fork Coal, Big, Red Meadow, Whale creeks) and Middle Fork drainage (Ole and Morrison creeks). Estimates of juvenile cutthroat abundance were made in important rearing areas in the North Fork drainage (two reaches of Coal Creek, South Fork Coal, Red Meadow creeks) and Middle Fork drainage (Challenge Creek). Electrofishing estimates of Age I and older fish were made by either the mark-recapture method (Vincent 1971) or the two-pass method (Seber and LeCren 1967). Block nets were used on all sections. Final estimates were compared to estimates made in the same sections in previous years to assess abundance trends.

We used the snorkel-Peterson method (Zubik and Fraley, 1988) to estimate populations of westslope cutthroat trout in the Gooseberry and Schafer sections of the Middle Fork Flathead River in the Bob Marshall Wilderness Complex. Fish were captured by hook and line and tagged with either floy tags (fish 254 mm or greater) or dangler tags (fish less than 254 mm). We then snorkeled the section (three, single-snorkeler passes) and recorded numbers of marked and unmarked fish.

The Gooseberry Section (3km in length) was located upstream from Gooseberry Cabin downstream to the mouth of Clark Creek. The Schafer section (5km in length) was located upstream from Dolly Varden Creek. Coordinates of all study sections or transects are on file at the Region One Fishery Division Office in Kalispell, Montana.

FINDINGS, RESULTS, AND DISCUSSION

Participation in Administration of Stream and Lake Bed Laws

Department personnel reviewed 15 projects under the Natural Streambed and Land Preservation Act, 8 under the Lakeshore Protection Act and 4 under the Corps of Engineers 404 dredge and fill permit. Project review was coordinated with CS&KT Lakeshore Protection, Corps of Engineers, State Department of Highways, Flathead and Lake County Commissions and the Flathead and Lake County Soil Conservation District Board of Supervisors.

Mitigation for Fish Affected by Hydro-Development

Construction and operation of Hungry Horse, Kerr and Bigfork Dams have negatively affected important fisheries in the basin. Operation of Hungry Horse Dam caused an annual loss of 96,300 river spawning kokanee. Operation of the dam also negatively affects the fishery in Hungry Horse Reservoir. The construction of Hungry Horse Dam in the South Fork Flathead River resulted in annual estimated losses of 65,500 migratory westslope cutthroat juveniles and 1,965 migratory bull trout adults. Operation of Kerr Dam caused a loss of an estimated 131,000 lakeshore spawning kokanee and unquantified losses of other fish species (Fraley, et. al. 1989., Zubik and Fraley, 1988, Beattie, et. al.

1988). Construction of Bigfork Dam blocked the Swan River for an unquantified number of migratory fish from Flathead Lake.

Mitigation for these losses is being pursued through three related processes. Mitigation for Hungry Horse Dam is being negotiated through the Northwest Power Planning Council. The Department and the Confederated Salish Kootenai Tribes will present the mitigation plan to the Power Planning Council by October 1, 1990. A joint, interagency mitigation plan for fisheries and wildlife affected by Kerr Dam will be presented to the Federal Regulatory Commission by October 1, 1989. The Department is working closely with the Pacific Power and Light Company to address fisheries concerns relating to Bigfork Dam. Mitigation measures proposed through these processes included: (1) stream habitat improvement and imprint planting; (2) direct introductory of hatchery juveniles into Flathead Lake; (3) improved fish passage; (4) minimum stream flow recommendations, and; (5) recommendations of water levels to protect reservoir fisheries.

The Department of Fish, Wildlife and Parks recommended 41 stream reaches, comprising 241 stream miles, for protection from future hydropower development under the Protected Areas program. The reaches were recommended because of their values for essential spawning habitat for species of special concern, and/or for important sport fisheries. The Northwest Power Planning Council adopted the recommended stream reaches into the program in 1988.

Upper Flathead System Fisheries Management Plan

The recent dramatic decline of kokanee has dictated a re-evaluation of management direction with the Flathead Lake and River system. There was considerable public demand to either restore kokanee populations and/or create other fishing opportunities, and to manage for native species. A management plan was developed to review the current situation, address public and agency concerns, and describe management strategies for the next five years (1989-1994) to ensure that Flathead Lake and River remain a productive fishery.

The Department developed the plan with the CS&KT which controls the south half of Flathead Lake. The final plan awaits approval by the FWP Commission and the CS&KT Tribal Council and should be implemented by August, 1989.

The management plan addresses native species management, the future possibilities of kokanee restoration, habitat protection and the potential for future hatchery fish supplementation. The plan includes a review of fish population status by species and an overview of present fish habitat within the basin. Species specific management goals, strategies needed to reach those goals and habitat protection activities are described.

Flathead Lake Seasonal Fisheries Montioring

Good success for trophy sized lake trout persisted throughout the entire year with guides experiencing success rates of 1 fish per hour or higher. Spring and fall fishing along both shoreline produced smaller (1 to 5 pound) lake trout.

This is the first year we have experienced this shoreline fishery. We encouraged angler participation of this fishery through public meetings and news media. Increased utilization of these smaller lake trout would aid in controlling numbers of younger fish and assist in maintaining optimum numbers of large trout for the desired trophy fishery.

Angling for lake whitefish was must successful during the late summer and winter periods. Good success was experienced in Woods , Yellow and Table Bays. Flathead River anglers, adjacent to and above Kalispell, were also catching mature sized lake whitefish, at success rates of better than 3 fish/hour. This river fishery for lake whitefish was first experienced during the fall of 1988. Anglers pressure and harvest during 1989 were more than the previous year. Catches of over 40 lake whitefish/angler were checked.

Spring fishing in the vicinity of the mouth of the Flathead River provided the most successful fishing for bull trout. This specific fishery (Hanzel, 1988) was again for the smaller size bull trout, 1 to 5 pounds, with over three-forths of all fish caught being released.

The lake completely froze over for 51 days (February 15, 1989 to April 7, 1989) which provided additional angling opportunities for lake trout and lake whitefish. Popular ice-fishing areas included: Yellow Bay, Skidoo Bay, Woods Bay and Table Bay.

Volunteer Angler Tagging Program

To date, volunteers have tagged a total of 1,618 fish: 919 in the lake and 699 in the river. Fish tagged in the lake included 841 lake trout, 77 bull trout and 1 cutthroat trout. Fish tagged in the river included 584 cutthroat trout, 85 bull trout and 30 rainbow trout.

The average length and weight of 259 lake trout tagged since 1 July 1988 was 29.3 inches and 10.6 pounds. A total of 86, or 33.3 percent, of the tagged fish measured 27.9 inches or less. The average length of 12 bull trout tagged was 18.0 inches. The average length of 105 cutthroat trout tagged in the river was 18.6 inches, with the largest fish measuring 21.0 inches.

A total of 170 recaptures have been reported since the start of this tagging program. They included 86 cutthroat trout (14.7 percent return); 61 lake trout (7.3 percent return); 19 bull trout (11.7 percent return) and 3 rainbow trout (10.5 percent return). Recapture percentage for all species has not changed significantly the last three years.

Since 1 July 1988, 13 cutthroat recaptures have been reported. One cutthroat trout was tagged in the river 37 miles above the lake and was recaptured 171 days later in the lake near West Shore State Recreational Area, approximately 8 miles south of the mouth of the Flathead River. Another cutthroat trout tagged in the same river area moved upstream into the North Fork of the Flathead River and was recaptured 57 days later at the mouth of Coal Creek.

All bull trout recaptures were from fish tagged in the lake. Five of the six recaptures were recaught in the same area as tagged. One bull trout tagged near Wildhorse Island moved was recaptured at the U.S./Canadian Border on the North Fork of the Flathead River, moving a distance of 134 miles in 451 days.

Three-fourths of the 28 lake trout returns since 1 July, 1988 were recaught in the same area they were tagged. The length of time between captures for lake trout averaged 567 days. Movements during late fall of the larger lake trout suggests that fish move from the mid-lake congregation area to the southeast and northern portions of the lake and then back again the following spring. Smaller sized lake trout also move from the mid-lake concentrations into shallow water along both shorelines during spring, fall and winter.

Seventeen (10 percent) of all recaptured fish were released back to the water after tag number and color was noted. No rainbow trout tag recaptures were reported during the period.

A goal of the tagging program was to evaluate the catch and release mortality. Recapture percentages, although different for the three major fish tagged, have remained constant during the four year tagging period. Techniques for successful release of fish have been stressed through the media.

Average length of tagged lake trout has decreased since 1986, Table 1. A decrease in size was also reflected in the percent of fish less than 28 inches in the catch. Both decreases suggest an increase in the number of small fish in the catch. Previous data has reflected that the size structure of catchable lake trout can fluctuate without experiencing major impacts such as a marked decline in the abundance of kokanee.

Adult Kokanee Monitoring

Adult kokanee populations have been monitored in the past by conducting angler creel surveys during the summer fishing season and by calculating populations estimates of kokanee (10 inches and larger) using hydroacoustic techniques previously described by Hanzel (1986). Periodic creel surveys of the popular kokanee fishing areas throughout the summer 1988 failed to record a single catch of a salmon, signifying the impact of low kokanee density on angling success.

Low densities of kokanee also severely hindered attempts to estimate number of large salmon using hydroacoustical techniques during early September. Over 70 miles of acoustic transects were made during early September to record fish distributions. Densities of salmon were at such low levels that a density estimate could not be made.

Hydroacoustic Estimate of Fish Abundance

A hydroacoustic survey was conducted on the lake during the nights of November 4 - 7, 1988. We estimated 4.6 million fish in Flathead Lake in

November, 1988. This figure translates to an overall fish density of 48.7 fish/acre (120.2 fish/hectare). Because of sampling design, this estimate would primarily include species that inhabit deeper limnetic zones in the lake, i.e. bull trout, lake trout, kokanee, lake whitefish and pygmy whitefish (Prosopium coulteri). This estimate excludes those species living primarily in the littoral zone, i.e. cutthroat trout, yellow perch (Perca flavescens), squawfish (Ptychocheilus oregonensis), peamouth (Mylocheilus caurinus) and suckers (Catostomus catostomus and C. macrocheilus).

Table 1. Angler creel data for Flathead Lake lake trout, 1960-1989.

Year	No. Fish	Avg Lgth (inches)	Avg Wt (pounds)	%<28"
1960's	65	27.7	10.2	49.2
1970's	9	29.4	9.3	44.4
1981	51	31.4	13.7	23.5
1985	58	27.4	10.4	63.8
1986	155	31.3	13.8	27.7
1987	235	30.6	12.5	30.6
1988	167	29.9	10.7	37.7
1989	259	29.3	10.6	33.3

Fish density varied from 0.7 to 2.3 fish/100 m^2 among the nine area strata. The highest density occurred in the shoreline areas of the east and southern parts of the lake. The lowest average density occurred in Big Arm Bay. Fish detected within 2 meters of the bottom comprised a significant part of the total fish density in all transects.

Net sampling in selected areas indicated that bull trout comprised from 1.3 to 4.8 percent of the limnetic fish community. Lake trout made up 6.7 to 25 percent and lake whitefish 61.9 to 91.9 percent. Kokanee were collected only in the northwest area and in Skidoo Bay. They comprised 5.6 to 14.3 percent of the catch in these areas, respectively. If we would assume that a large proportion of the kokanee population was aggregated in these two areas, a minimum estimate of the total population would be 65,000 fish. But the probability of kokanee being more widely distributed throughout the lake at very low density suggests that this figure is a very conservative estimate. Pygmy whitefish were sampled only in the northwest area where they comprised 23.8 percent of the catch.

The abundance of fish over 500 mm long (approximately 5 pounds) was estimated because of increasing concern over the trophy lake and bull trout fisheries. Among the nine area strata these large fish comprised from 1.4 to 7.6 percent of the total fish community. We estimated that 27,700 fish were in this large fish size class. This is a minimum estimate because of uncertainty about the range of target strengths returned by large fish. Net sampling indicated that lake trout were three to six times more abundant than bull trout. This would suggest that at least 23,000 lake trout, five pounds and larger, are present in Flathead Lake.

Because we were not able to establish the distribution of young-of-the-year and yearling kokanee by trawl surveys, the hydroacoustic survey could not estimate the overall abundance of juvenile kokanee. Considerable effort was expended in attempting to locate juvenile kokanee in the northern area of the lake during the summer and fall of 1988. Juvenile kokanee were found in areas of the lake we sampled previous years.

Since we could not follow kokanee fingerlings after the mass release of 2.4 million fish during July we concluded that these fish either experienced very high mortality during the summer or dispersed into a low overall density. Either result would preclude an estimation of their abundance.

Zooplankton and Mysis Monitoring

Zooplankton

Based on 1988 shallow lake samples, total densities of crustacean zooplankton were lower in 1988 than either of the two previous years (Figure 1.). Both cladoceran and copepod numbers were down, and the characteristic seasonal peak in total zooplankton density occurred later in 1988 than in 1986 or 1987. The delay in peak zooplankton numbers is attributed primarily to the decline in copepod abundance, since dominant clodacerans show 1988 peak abundance similar in timing or slightly earlier than the previous two years.

The reappearance of two cladoceran species (*Daphnia longiremis* and *Leptodora kindtii*) in lake zooplankton samples is notable in 1988. These species were last identified in lake samples in 1986. Reappearance at detectable numbers may reflect population responses to decreasing numbers of mysids.

Analysis of the open deep water stations by Yellow Bay personnel has not been completed; however preliminary analysis does show that total crustacean zooplankton production was lower than the two previous years and that the concentrations of large zooplankton species, primary food of the kokanee, had increased.

Mysis

Mysid shrimp were introduced into Flathead Lake by natural downstream drift from Swan Lake or Whitefish Lake (Rumsey, 1987). Mysid shrimp were first collected in Flathead Lake in 1981. Yearly monitoring documented the exponential increase in their abundance until 1985 (Figure 2.). *Mysis* numbers have steadily decreased since 1986 when their numbers peaked at $132/m^2$. The lakewide average density in 1988 was $52/m^2$, or about the equal to the 1985 density. Mysids were most abundant in water deeper than 30 m, but their abundance varied widely in any depth range. Acoustic surveys on Flathead Lake indicate mysid distribution is patchy in all areas of the lake. Adult mysids do not migrate into the epilimnion after summer water temperature exceeds 14° C. in the surface layer.

Mysis are still experiencing changes as the population attempts to stabilize. Although not thoroughly understood at this time, a change has been noted in the age structure. The smallest sized class is making an increasing contribution to the overall population density each year.

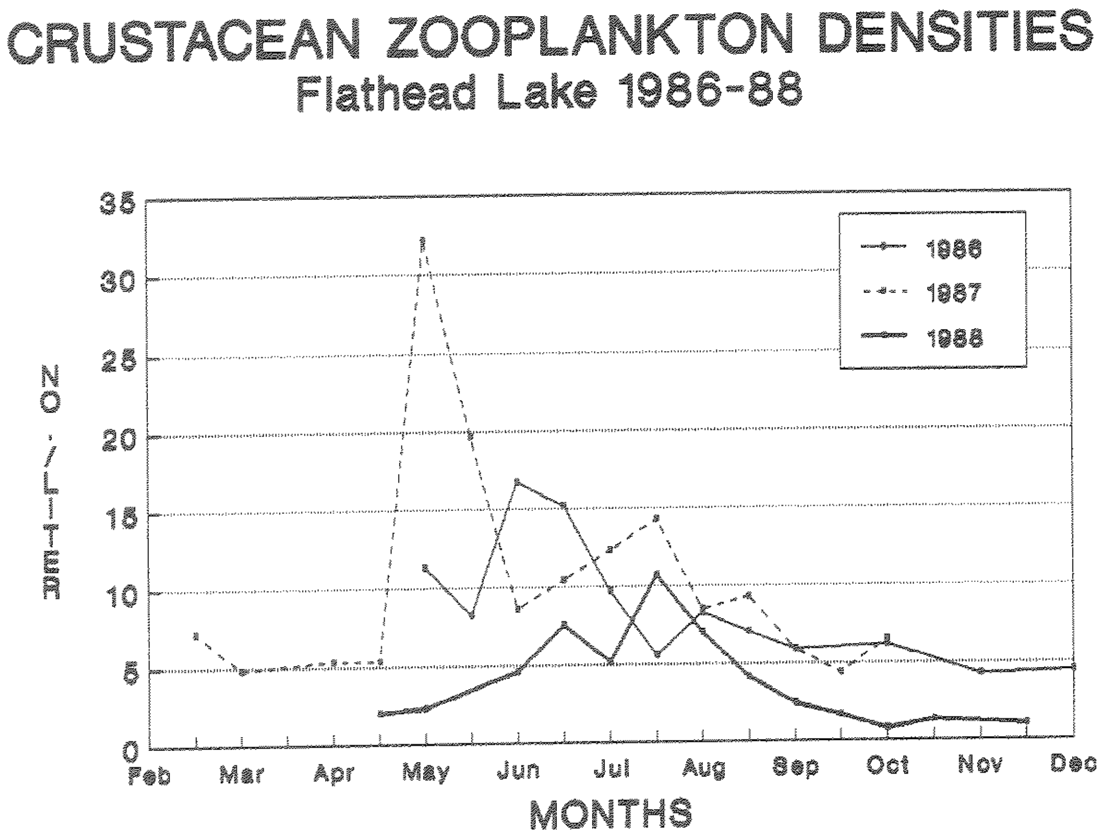

Figure 1. Densities of total crustacean zooplankton at a shallow (25 meters) northwest station, Flathead Lake, 1986-1988.

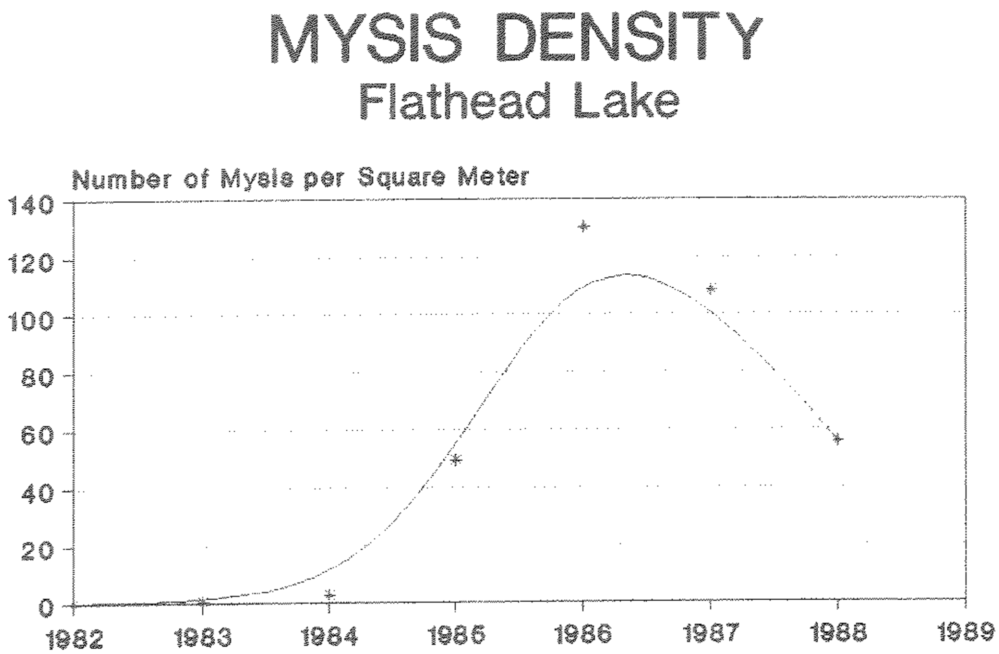

Figure 2. Average density of Mysis in Flathead Lake, from 1982 to 1988. Line depicts trend curve of Mysis densities.

Food Habits

Kokanee and Lake Whitefish

The diets of young of the year (YOY), yearling and two year-old kokanee and lake whitefish were analyzed to detect any changes in food habits that may have followed the changes in the zooplankton community and to compare the similarities in diet of these two open water dwelling fish. The diet analysis included the stomach contents of 56 kokanee and 110 lake whitefish collected in the northwest section of the lake and Skidoo Bay. Since sample numbers per age were small, analysis of diet was grouped only by species for diets measured during the April through November, 1988 sample period. Partial analysis does indicate these two species do eat the same larger zooplankters; however the frequency of the occurrence of plankton in stomachs was higher for kokanee than in the lake whitefish. Although some Mysis were found in the stomachs of both species throughout the sample season, stomachs contained the greater number of mysids in November. All mysids eaten were adult sized organisms and were in fish collected in the Skidoo Bay.

During the 1989 ice-fishery near Woods Bay, nearly all large lake whitefish checked were found to be exclusively feeding on yearling 2-3" perch found in the area.

Lake Trout

Contents of 31 lake trout stomachs provided by volunteer anglers were analyzed for food item preferences. We were particularly interested in the numbers of lake trout utilizing the 2.4 million kokanee fingerlings released during July, 1988.

Ten of the 31 stomachs examined were empty. One of 5 stomachs collected during the summer that contained fish had two fingerling kokanee. This was a 29-inch lake trout caught July 27 in Woods Bay. No further incidence of small kokanee in lake trout was reported by guides that had checked stomachs from over 300 lake trout caught thoughout the summer. Small perch, from 2-3 inches, was the major food item in 26 stomachs examined from fish taken during February and March, 1989. Two fish did have 9-inch kokanee in their stomachs. Although age was not determined, the size would suggest the kokanee were two years old and would not represent part of the 1988 yearling kokanee plant. Other large trout found in lake trout stomachs included an 18" bull trout and a 13" westslope cutthroat trout. A 21" lake trout caught in Skidoo Bay during March had a stomach full of Mysis.

Food preference of lake trout for kokanee is still apparent in Flathead Lake; however the incidence of other fish species is increasing. Again, during years of good perch production, young-of-the-year perch provide food for a variety of fishes. Fishing quides have reported lake whitefish in 50 percent of the stomachs of lake trout that contain fish. This is double the 20 percent incidence of lake whitefish in lake trout stomachs reported by Leathe and Graham, 1982.

Artificial Kokanee Enhancement

A total of 4.0 million kokanee fingerlings were released into Flathead Lake during 1989. These fish are a part of a four year experimental recovery program to plant from 3 to 5 million fish annually. The planting strategy is to hold the fish in the hatcheries until late June. The fish should be approximately 2 inches in length at the time of planting. This planting strategy should increase kokanee survival because warmer water increases plankton blooms and decreases competition with Mysis.

Pen Rearing of Kokanee

A total of 1.4 million kokanee were experimentally reared in five pens at the Flathead Lake Salmon Hatchery near Somers. The number of fish to be pen reared was excess to available state hatchery capacity. Fry were "feed trained" in the hatchery for two weeks prior to being stocked in the pens. Fish were stocked at a density of 300,000 per net for the 10-foot deep nets and 250,000 per net for the 5-foot deep nets.

Surface water temperatures were 48oF. when the fry were placed in the pens on May 17, 1989. After two weeks in the pens the fry had grown from 3,000 to 2,400 to the pound. During this same period surface waters had warmed to 54o F. At this time algal growths, 3/4 inch thick, had started to clog water circulation through the mesh pores. Attempts to clean the nets with stiff brushes failed to open the pores of the 1/16-inch mesh. Brushing further added to the growth problem when clumps of algae dropped to the bottom of the net. At this time, penned fish were checked by MDFWP's Fish Health Specialist who identified the presence of a myxobacteria that causes bacterial gill disease. Last year this bacteria caused abnormally high mortalities and necessitated the early release of pen reared fry. Although no abnormal mortality was experienced in 1989, penned fish were treated with Cloromine "T". Application concentrations were estimated by calculating volumes of the nets and applying the chemical at the rate of 1.2 grams per gallon. The liquid concentrate was mixed in 5-gal bucket and then applied to each net. Subsequent bacterial testing showed this method of treatment controlled the disease and no major fish mortalities were experienced. Two treatments were administered, one each week, until the fish were released.

Fish were released at the pen site during daylight hours on June 1 and June 6, 1989, a total rearing time of 18 to 23 days. During this period the fish had grown to 2,000/pound. The release time was scheduled to coincide with the start of the spring pulse of macrozooplankton. Although the pen rearing experiment lasted a relatively short period, 2 1/2 weeks, the released fish were healthy and were placed into an environment where food supplies were increasing.

Raceway Rearing

Present hatchery facilities were able to rear 2.6 million kokanee fry for Flathead Lake. A release date during the first week in June was scheduled when macrozooplankton at planting sites started to increase. Kokanee from all hatcheries, except Flathead Lake Salmon Hatchery were released on June 8, 1989. Release sites included Woods Bay and Bigfork Bay along the eastshore and Westshore State Recreation Area and Table Bay along the west shore. After being released, most of the salmon moved directly to the deeper offshore waters. No salmon were observed in the shallow release area within two hours of the plant. Surface water temperatures were 59o F. on planting day. The kokanee at the Flathead Lake Salmon Hatchery were late hatched fish and were held another three weeks. The final lot of fish from Somers was released on June 30, 1989. A total of 850,000 were released at night 1/4 mile off shore from the hatchery and 100,000 were released off-shore during the day in Crescent Bay, a southern westshore bay.

Predation at Release Sites

Fish predation of the newly released kokanee fry was measured by sampling fish in the vicinity of the plant. Gill nets were set at the time of the plant at four of the release sites on June 8, 1989. Each net was set overnight on the bottom in shallow water that ranged from 8 to 14 feet. Stomach were examined from all bull trout, lake whitefish and yellow perch and on all other fish species 11 inches in length and larger. We examined contents of 79 of 655 fish collected. Stomachs were only cursorily examined to determine the presence or absence of fish and any other large recognizable items.

Seven fish stomachs were found to contain recently planted kokanee fry: 3 bull trout; 2 squawfish; 1 peamouth; and 1 lake whitefish. Numbers of fry found in the stomachs averaged 7.7 fish/stomach. The highest number (21) were found in a 12-inch bull trout. Highest numbers of fry found in other species were: 10 fry in a 22-inch lake whitefish; 18 fry in a 16-inch squawfish; 2 fry in a 14-inch peamouth. Fry were eaten by fish at all four sites. One 18-inch bull trout stomach contained the remains of a 6-inch yearling salmon. Four out of 5 bull trout collected had eaten some kokanee. Although the majority (93.7 percent) of fish collected at the 4 sites were squawfish and peamouth only a small portion of the fish largers than 11 inches were found to be feeding on the kokanee fry. We found no evidence in our nets of fry predation by the yellow perch collected at the four stations; however, an angler caught perch at the Flathead Lake Salmon Hatchery was "full" of small kokanee. Crayfish remains were the only other identifiable item and all were found in stomachs of 9 larger squawfish. Other species collected that did not appear to be feeding on the fry were the largescale and longnose suckers and mountain whitefish.

Stream Habitat Quality

A cooperative study between the U.S. Forest Service and MDFWP to monitor the effects of land management activities on native fish populations and aquatic habitat was initiated in 1981 and has been renewed annually through 1988 (Weaver, 1989). The study primarily documents annual trends in fish population and habitat parameters.

Stream Substrate Composition

The median percentage of substrate material <0.25 inches in bull trout spawning areas sampled during 1988 ranged from 30 percent in Trail Creek to 44 percent in Granite Creek (Table 2). Mann-Whitney testing for changes between years revealed significant increases ($p<0.5$) in the median percentage <0.25 inches occurred between the 1987 and 1988 sampling in the Whale, Big and North Coal Creek sites. We observed no significant changes at sites in Coal Creek at Dead Horse Bridge, South Fork Coal, Trail and Granite Creeks between 1987 and 1988.

Predicted bull trout embryo survival to emergence based on the percentage of material <0.25 inches in spawning area core samples ranged from 71 percent in Trail Creek to 6 percent at the trail crossing site in Granite Creek. Predicted survival to emergence in Whale and Big Creeks dropped from >75 percent in 1987 to 38 and 32 percent respectively in 1988. Predicted survival for the North Coal site decreased from 65 percent in 1987 to 30 percent in 1988. Levels of fine material in these spawning areas are approaching the existing levels at Dead Horse Bridge and in Granite Creeks where we predicted low survival in past years.

Causes of increased levels of fine material generally remain unidentified. In addition to natural sediment loads development has occurred to varying degrees in all drainages. Sediment source surveys of the entire Coal Creek drainage during 1988 identified both natural and management related point sources and resulted in recommendations for stabilizing activities where feasible. Lack of flushing flows during the past several springs may be contributing to the increasing trend in the percentage of material <0.25 inches.

The cutthroat trout spawning area in Challenge Creek has also contained a high percentage of material <0.25 inches since sampling was initiated in 1986. We predicted survival to emergence during 1988 at 1 percent based on substrate composition. Nine of the 12 samples resulted in survival predictions of 0 percent including three taken in natural westslope cutthroat trout redds.

Substrate Scoring

All substrate scores (Table 3) were above the critical standard for juvenile salmonid rearing habitat (9.0) developed by Leathe and Enk (1985). Substrate scores above 11.0 are indicative of good rearing habitat quality. Only Coal Creek at Dead Horse bridge had a score (9.8) below this level in 1988. This decreased scoring may also reflect the lack of spring flushing flows. No definite trends can be discerned comparing 1988 data to information collected from previous years (Table 3).

Fish Population Surveys

Bull Trout Redd Counts

Counts of bull trout redds in 1988 were the highest since 1983 in most North and Middle Fork tributaries (Table 4). The 1988 count of 269 redds in the North Fork drainage was about 21.2 percent higher than the 1979-1987 average of 222 redds. The count for the Middle Fork drainage (160 redds) was slightly higher than the 1979-1987 average of 141 redds. The 1988 redd counts in both the North and Middle Fork Drainage tributaries were similar to the previous years count in all streams. Redd counts in Ole Creek (Middle Fork tributary) showed the greatest change, an increase from 45 to 59 (23.7 percent) from the previous years total. The contribution of each drainage and the annual trend of numbers of bull trout redds is depicted in Figure 3.

Electrofishing Estimates of Juvenile Bull and Cutthroat Trout

Estimated juvenile bull trout populations showed substantial annual fluctuations in most sections censused during the period of record (Table 5). Low probability of capture during the first pass of a two-pass estimate ($\hat{p}$) indicates the estimate may be questionable. Shepard and Graham (1983) recommended a $\hat{p}$ of 0.6 or greater for reliable two-pass estimates. All other juvenile bull trout estimates during 1987 approached or exceeded acceptable levels of $\hat{p}$ (Table 5). The drop in bull trout abundance is believed to be related to the loss of instream cover (large woody debris) between the 1987 and 1988 estimates.

Bull trout abundance in Morrison Creek (Middle Fork drainage) and Coal Creek at Dead Horse bridge (North Fork drainage) in 1987 was the highest on record. This is a significant finding because of the five to six year period of record on these index tributaries. Increased abundance may have been related to higher spawner escapement levels in 1982. However, there is only a weak relationship between spawner escapement and juvenile abundance in subsequent years (Weaver and Fraley 1988).

Population estimates for westslope cutthroat trout in 1987 were the highest on record for the North Fork of Coal Creek (North Fork drainage) and Challenge Creek (Middle Fork drainage) (Table 6). However, estimates were relatively low in other reaches of the Coal drainage, and in Red Meadow Creek. Low $\hat{p}$ values for estimates in the South Fork Coal Creek make these estimates questionable.

<u>Westslope Cutthroat Estimate-Middle Fork Flathead River</u>

The Gooseberry section supported about twice as many westslope cutthroat than the Schafer section (Table 6). Estimates in both sections were lower than in the South Fork Flathead River (Zubik and Fraley, 1988). Lower numbers of cutthroat and the absence of cutthroat larger than 10 inches in the Schafer section could be related to the life history of the fish, lower quality habitat and greater angling pressure.

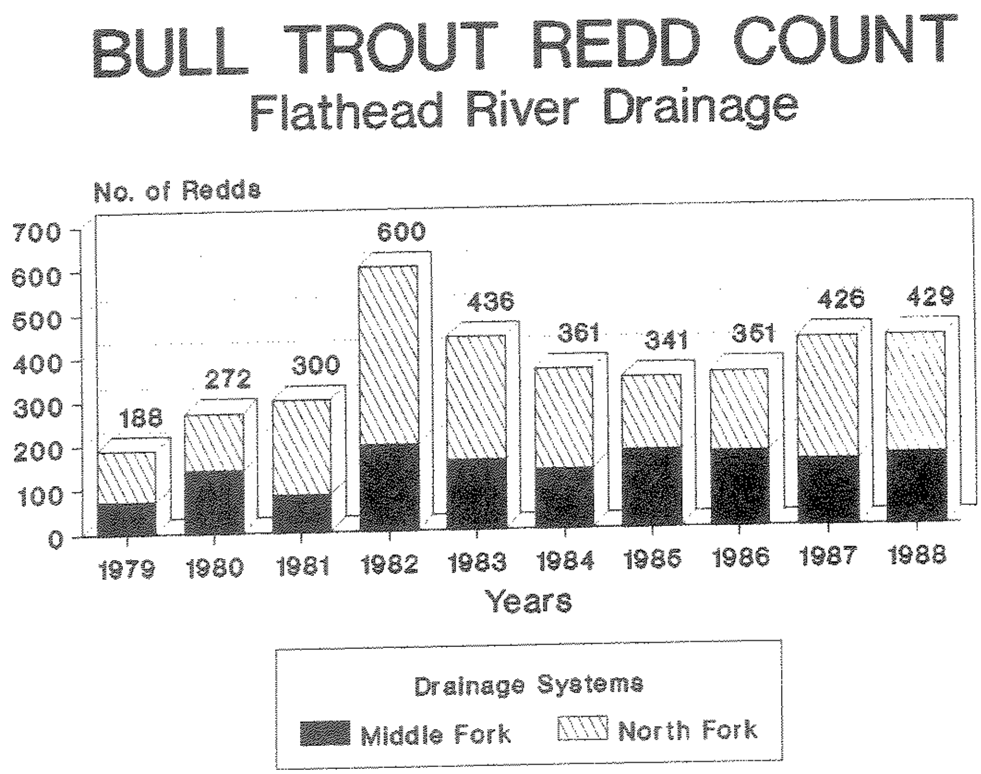

Figure 3. Number of bull trout redd counts for North and Middle Fork tributaries and combine totals for Flathead River drainage, 1979 to 1988.

Table 2. Summary of annual median cumulative percentages of substrate material smaller than 6.35 mm (0.25 inches) in diameter and mean predicted survival to emergence from McNeil core samplings in known cutthroat trout spawning areas.

Stream	Spawning area	Species	Year	Sample Size	Median Sediments Median <6.35 mm	Predicted survival (%) to survival
			North Fork Drainage			
Whale Creek[a/]		bull trout				
			1981	13	26.7	>75
			1982	11	31.2	46
			1983	12	32.6	51
			1984	12	28.9	>75
			1985	11	19.3	>75
			1986	12	27.6	71
			1987	12	27.9	>75
			1988	12	36.9	38
Coal Creek	Dead Horse Bridge[a/]	bull trout				
			1981	20	34.0	56
			1982	20	39.2	30
			1983	20	39.3	35
			1984	20	31.7	56
			1985	20	36.2	31
			1986	20	34.8	46
			1987	20	41.1	19
			1988	20	39.0	28
North Coal[a/]		bull trout				
			1985	12	34.8	39
			1986	12	29.3	>75
			1987	12	30.2	65
			1988	12	39.4	30
S.F.Coal Creek[a/]		bull trout				
			1985	12	35.8	24
			1986	12	31.1	59
			1987	12	31.4	57
			1988	12	31.4	56
Big Creek[a/]		bull trout				
			1981	12	21.6	>75
			1982	10	31.3	>75
			1983	12	28.2	>75
			1984	12	27.1	>75
			1985	12	28.6	>75
			1986	12	21.6	>75
			1987	12	29.0	>75
			1988	12	39.8	32

Table 2 (Continued).

Stream	Spawning area	Species	Year	n	Median Sediments Median <6.35 mm	% Predicted survival (%) to survival
North Fork Drainage continued						
Trail Creek[a]		bull trout				
			1981	19	23.3	>75
			1982	19	22.0	>75
			1983	12	27.2	>75
			1984	12	27.4	>75
			1985	12	26.5	>75
			1986	12	29.2	71
			1987	12	27.4	>75
			1988	12	30.0	71
			Middle Fork Drainage			
Granite Creek[a]	- Trail Crossing	bull trout				
			1982	12	44.6	13
			1986	6	50.6	4
			1987	6	47.6	5
			1988	6	44.6	6
	Other sites		1982	—	—	—
			1986	8	32.6	49
			1987	6	39.8	22
			1988	6	44.0	27
Challenge Creek[a]		cutthroat trout				
			1986	12	—	5
			1987	12	33.4	12
			1988	12	41.0	1

Table 3. Summary of annual substrate scoring in important westslope cutthroat and juvenile bull trout rearing areas in the Flathead drainage.

Streams	Rearing Area	Year	Substrate Score
	North Fork Drainage		
Big Creek	Skookoleel Br.	1986	12.2
		1987	11.5
		1988	11.2
Coal Creek	Dead Horse Br.	1983	10.3
		1984	10.2
		1985	11.6
		1986	12.3
		1987	10.0
		1988	9.8
North Coal		1983	14.0
		1984	12.2
		1985	13.5
		1986	14.2
		1987	13.7
		1988	13.0
South Fork Coal		1985	12.8
		1986	12.0
		1987	12.2
		1988	12.0
	Middle Fork Drainage		
Morrison	Reach IV	1986	12.3
		1987	12.8
		1988	12.8

Table 4. Bull trout redd counts for selected areas of tributaries chosen for monitoring in the Flathead drainage (from Montana Department of Fish, Wildlife and Parks 1988).

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
North Fork:										
Big	10	20	18	41	22	9	9	12	22	19
Coal	38	34	23	60	61	53	40	13	48	52
Whale	35	45	98	211	141	133	94	90	143	136
Trail	34 a/	31 a/	78	94	56	32	25	69	64	62
Total	117	130	217	406	280	227	168 b/	184	277	269
Middle Fork:										
Morrison	25 a/	75	32 a/	86	67	38	99	52	49	50
Granite	14	34	14 a/	34	31	47	24	37	34	32
Lodgepole	32	14	18	23	23	23	20	42	21	19
Ole		19	19	51	35	26	30	36	45	59
Total	71	142	83	194	156	134	173 b/	167	149	160
Total: North and Mid.Fork	188	272	300	600	436	361	341	351	426	429

a/ Counts may be underestimated due to incomplete survey.
b/ High flows may have obliterated some of the redds.

Table 5. Summary of electrofishing population estimates for Age I+ bull trout in areas selected for monitoring between 1982 and 1987. Data are from Weaver and Fraley (1988), MDFWP (1988) and FNF (1988).

Drainage	Creek	Section	Date	$\hat{N}$	95% C.I.	$\hat{p}$
North Fork	Coal	Cyclone Br.	8/10/82	50	±43	.40
			8/24/83	34	± 7	.71
			8/30/84	52	±13	.63
			8/10/87	30	± 2	.52
			8/16/88	18	± 3	.78
		Dead Horse Br.	8/5/82	97	±23	--
			8/23/83	99	±33	--
			8/28/84	85	± 7	--
			8/26/85	159	±61	--
			9/5/86	152	±45	--
			9/1/87	179	±55	--
			9/6/88	131	--	--
		North Coal Br.	8/4/82	17	± 9	.60
			8/25/83	18	± 3	.78
			8/29/84	48	±12	.63
			8/27/85	41	± 5	.77
			9/3/86	29	±12	.59
			8/5/87	47	±17	.56
			8/16/88	39	± 5	.67
	South Fork Coal	Section 26	8/28/85	62	± 8	.74
			8/6/87	12	± 2	.48
			8/8/88	24	± 2	.85
	Big	Skookoleel Br.	9/15/86	47	± 5	.78
			8/19/87	48	± 6	.75
			8/18/88	67	± 6	.56
	Red Meadow	1st Br. RMC Rd.	8/15/83	75	±11	.69
			9/16/86	69	± 8	.74
			8/18/87	47	± 4	.82
			10/28/88	44	±19	.54
	Whale	Shorty Cr.	8/22/83	38	± 8	.69
			9/4/86	32	--	.74
			8/13/87	63	±17	.60
			--	--	--	--
Middle Fork	Ole	Fielding trail	9/13/82	25	±12	.57
			9/12/86	39	± 5	.76
			8/27/87	42	±14	.60
			--	--	--	--

Table 5. (Continued).

Drainage	Creek	Section	Date	^ N	95% C.I.	^ p
	Morrison	Reach IV	9/01/82	95	± 6	.82
			8/18/83	70	±11	.69
			9/25/85	93	±27	.54
			8/27/86	114	±15	.67
			8/25/87	138	±10	.76
			8/30/88	126	±15	.69

a/ Population estimates for 300 m sections.
b/ Population estimate for a 122 m section.

Table 6. Summary of electrofishing population estimates for age I+ westslopecutthroat trout in areas for monitoring between 1982 and 1987. Data are from Weaver and Fraley (1988), MDFWP (1988) and FNF (1988).

Drainage	Creek	Section	Date	^ N	95% C.I.	^ p
North Fork	Coal	Cyclone Br.	8/10/82	41	±18	.55
			8/24/83	17	± 7	.64
			8/30/84	25	±11	.56
			8/10/87	23	± 2	.66
			8/16/88	25	± 6	.70
		North Coal Br.	8/4/82	32	± 6	.74
			8/25/83	27	± 4	.82
			8/29/84	31	± 9	.65
			8/27/85	36	±12	.33
			9/3/86	40	±11	.64
			8/5/87	63	± 2	.91
			8/16/88	51	± 9	.69
	South Fork Coal	Section 26	8/28/85	63	±35	.33
			8/6/87	43	± 4	.47
			8/8/88	43	± 3	.83
	Red Meadow	1st Br. RMC Rd.	8/15/83	121	± 5	.46
			9/16/86	69	±12	.63
			8/18/87	58	± 4	.88
			10/28/88	75	±18	.60
Middle Fork	Challenge	Skyland Rd. Br.	9/23/80	92	±33	--
			7/18/81	183	±50	--
			7/15/82	78	± 5	.82
			7/22/83	66	± 7	.76
			8/28/86	112	± 9	.76
			8/24/87	209	± 9	.80
			8/31/88	152	+18	.66

RECOMMENDATIONS

1. Negotiate Flathead Lake level management or mitigation with BPA through the Northwest Power Planning Act and with Montana Power company to maintain levels that are sufficient to maintain or enhance fish populations at existing levels.

2. Finalize the five-year Flathead River and Lake Fisheries Management Plan with the cooperation of the CS&KT so that it can be implemented immediately and used as a basis in future fisheries mitigation planning.

3. Evaluate the feasibility of using artificially reared late-summer kokanee releases in the lake in an effort to restore and increase kokanee numbers to meet angler demands. Assess and identify the impact of the Mysis population in the lake on kokanee and other fish species.

4. Monitor trout species in the lake and river to evaluate the effectiveness of present regulations in regulating harvest and to monitor present growth conditions.

5. Annually monitor the bull trout spawning escapement by enumerating redds on selected streams in the North and Middle Fork River drainage as part of a system population evaluation.

6. Monitor bull, cutthroat and lake trout populations through a cooperative angler tagging program to establish annual population status levels and catch rates to aid in the maintenance of fish populations that can sustain acceptable use and harvest levels.

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Waters Referred to:

Flathead Lake 07-6400
Flathead River 07-1560
North Fork Flathead River 08-5100
Big Creek 08-0680
Coal Creek 08-1620
Whale Creek 08-7700
Trail Creek 08-7330
Middle Fork Flathead River 08-4740
Ole Creek 08-5150
Lodgepole Creek 08-4240
Granite Creek 08-3080
Morrison Creek 08-4940
Challenge Creek 08-1420

Key Words: Flathead Lake, Flathead River, Co-Management Plan, kokanee, bull trout, lake trout, westslope cutthroat trout, pen-rearing, Mysis, substrate sediments.