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KOKANEE STOCK STATUS IN LAKE PEND OREILLE AND EVALUATION OF THE CABINET GORGE HATCHERY (PROJECT NO. 85-339); Edward Bowles, Idaho Department of Fish and Game, 2320 Government Way, Coeur d'Alene, Idaho 83814; (208) 765-3111; (BPA Project Officer: Fred Holm)

Kokanee salmon production at the new Cabinet Gorge Hatchery will help rebuild the kokanee population in Lake Pend Oreille. Construction and evaluation of the hatchery is listed in the Northwest Power Planning Council's (Council) Fish and Wildlife Program (Program) under measure 804(e)(5). Construction of the $2.2 million hatchery represents a cooperative effort among Bonneville Power Administration (BPA), Washington Water Power Company (WWP) and Idaho Fish and Game (IDFG). The first kokanee releases will be mid-summer, 1986; at full capacity approximately 20 million kokanee will be produced annually. Potential benefits of the Cabinet Gorge Hatchery include supporting a kokanee fishery in Lake Pend Oreille with a yield of 1 million kokanee annually and catch rates in excess of 3 fish per hour.

The kokanee fishery in Lake Pend Oreille began to decline in the late 1960's and neared collapse by the mid-1970's. Harvest declined from 1 million to 0.2 million kokanee annually. Catch rates declined from over 3 kokanee per hour to less than 2 kokanee per hour. Several factors contributed to the decline of the kokanee population in Lake Pend Oreille. Drawdown of Lake Pend Oreille associated with operation of Albeni Falls Dam (U.S. Army Corps of Engineers) exposed kokanee redds and reduced pre-emergent survival. Cabinet Gorge Dam (WWP) blocked important kokanee and kamloop spawning runs in the Clark Fork River. Overharvest of kokanee by sport and commercial anglers accelerated the decline of the kokanee population. Oppossum shrimp (Mysis relicta), introduced by IDFG to enhance the kokanee forage base, delayed production of two cladoceran zooplankton essential for kokanee forage during the first few weeks following emergence. The temporal displacement of these zooplankton reduced post-emergent survival of kokanee.

Interagency efforts to rehabilitate the kokanee fishery began with the initial decline of the fishery. Drawdown management by the Corps of Engineers minimized water level fluctuation during kokanee spawning and incubation. Idaho Fish and Game (IDFG) instigated special sport harvest regulations for kokanee and terminated the commercial fishery in 1973. Research efforts were increased to examine kokanee stock abundance in relation to possible limiting factors.

A hatchery program for kokanee enhancement began in 1974. First-year kokanee survival was increased up to 13 times by delaying releases until mid-summer to avoid early season forage deficiencies. hatchery production kept the kokanee fishery from total collapse but rearing capacity was inadequate to rebuild the fishery. The Cabinet Gorge Hatchery will increase production capabilities from 8 million to 20 million kokanee fry annually.

As mandated by the Council's Program, research evaluating the Cabinet Gorge Hatchery began in 1985 thorough cooperation with BPA and IDFG. The purpose of this research is to evaluate the success of the hatchery program and provide feedback to maximize the effectiveness of rehabilitation efforts. Specifically, the objectives are:

1. monitor kokanee stock status and the contribution of hatchery fish;

2. describe kokanee population dynamics in relation to population abundance and carrying capacity;

3. enhance survival of fry by optimizing release strategies;

4. monitor the zooplankton community in relation to fry release strategies and kokanee population abundance;

5. monitor wild kokanee spawning in tributary and shoreline areas; and,

6. monitor changes in the fishery with periodic creel surveys.

Baseline data was collected in 1985 and will be used with past research to measure the effectiveness of the hatchery beginning in 1986. Mid-water trawling techniques during September were used to estimate kokanee population abundance and structure. Abundance of kokanee in 1985 was estimated at 4.5 million fish, down from over 12 million kokanee in 1974 when the population was first monitored. Proportion of the kokanee population comprised of hatchery fish has been increasing since mid-summer planting was initiated in 1975. Hatchery kokanee were marked with tetracycline administered in the feed prior to release. Length of kokanee spawners has been increasing slightly since 1975, probably the result of low population density and utilization of Mysis by older age-classes of kokanee.

The zooplankton community was monitored with periodic plankton tows focusing on areas important for juvenile kokanee rearing. Zooplankton composition was similar in 1985 as previous years and appears to have stabilized following the introduction of Mysis, with peak cladoceran production delayed until several weeks after peak kokanee emergence. Delayed release of hatchery kokanee fry resulted in higher survival of hatchery than wild kokanee fry. Other release strategies will be examined during the next few years as more fry become available.

Although data summary has not been completed, the 1985 creel survey indicated that kokanee harvest rates remain low, with approximately 1 kokanee harvested per hour of effort from April to August. catch rates were as high as 3.5 fish per hour during the mid-1960's.

DETERMINATION OF INSTREAM FLOWS NEEDED FOR SUCCESSFUL MIGRATION, SPAWNING AND REARING OF RAINBOW AND WESTSLOPE CUTTHROAT TROUT IN SELECTED TRIBUTARIES OF THE KOOTENAI RIVER. (PROJECT NO. 85-16); Brian Marotz, Montana Department of Fish, Wildlife, and Parks, Rt. 1 Box 1270, Libby, Montana, 59923; (406) 293-7639 (BPA Project Officer: Fred Holm)

The tributaries to the Kootenai River and Libby Reservoir provide critically important spawning and rearing areas for fluvial trout populations which support one of western Montana's most popular sport fisheries. This study, initiated in August 1985, will address program measure 804(a)(9) of the the Columbia River Basin Fish and Wildlife Program by completing the following objectives:

1. Determine instream flow needs required to maintain the fisheries habitat in several tributaries to Libby Reservoir and six tributaries to the Kootenai River below Libby Dam, using the wetted perimeter method.

2. Assess the existing trout populations in the selected tributaries using the two pass and mark and recapture estimates.

3. Evaluate spawning usage and potential fish passage problems for migrants.

During fall of 1985, 5 permanent transects were established across each of the 13 selected tributaries and streambed profiles were surveyed. Profile elevations were coded and verified for analysis with the WETP.

Discharge and associated water stage measurements were made at low flow and again when runoff increased in late October and early November. Low, medium and high flow measurements are required to calibrate the wetted perimeter analysis. Data collection will be complete on 10 tributaries when discharge and stage are measured at the onset of spring runoff. Two tributaries will require additional flow calibrations, and data from Libby creek have recently been analyzed.

A graph of the relationship between discharge and wetted perimeter (the length of that portion of the profiles in contact with water) based on 5 riffle transects in Libby Creek, revealed inflection points at 9.0 and 37.5 cubic feet per second (cfs). These points will be used to recommend minimum flows during the low flow portion of the year. Average stream depth required for successful fish passage during spawning was not met in all transects unless discharge was 37.5 cfs or greater.

During October 1985, spawning-redd surveys were conducted on Graves, Quartz, and Callahan creeks which have historically supported bull trout spawning. Twenty-four bulltrout redds were positively identified in Graves Creek, 9 others were probable, and 4 were possible sites of spawning activity., The west fork of Quartz creek contained several positively identified redds and 7 other sites had possible signs of spawning. Although suitable gravel was located in Callahan Creek, no redds were found. Kokanee salmon were observed spawning in the Tobacco River near Eureka.

Kokanee also entered the Fisher River and Libby Creek, downstream from Libby Dam, during the spawning run. Redd counts and migrant trapping will be conducted during the spring to assess rainbow and westslope cutthroat trout spawning usage.

Deep and Quartz Creek were electrofished during fall to estimate resident populations. Results will be analyzed after more population surveys are completed in spring and summer.

QUANTIFICATION OF LIBBY RESERVOIR LEVELS NEEDED TO MAINTAIN OR ENHANCE RESERVOIR FISHERIES (PROJECT NO. 83-467); Ian Chisholm, Montana Department of Fish, Wildlife, and Parks, P.O. Box 67, Kalispell, Montana, 59903; (406) 755-5505, (206) 293-7639 (BPA Project Officer: Steve Smith)

This study was initiated in May 1983 to determine how reservoir operations impact Libby Reservoir's fishery, and ultimately provide recommendations for operating Libby Dam to maintain or enhance the reservoir fishery.

Study objectives are:

1. quantify available reservoir habitat for target fish species (westslope cutthroat trout, rainbow trout, kokanee, burbot, northern squawfish, peamouth and reside shiner) and fish food organisms;

2. determine the abundance, growth and distribution of fish within Libby Reservoir and its U.S. tributaries and their use of available habitat;

3. determine the abundance and availability of fish food organisms to fish in Libby Reservoir;

4. quantify fish use of available food items;

5. develop relationships between reservoir operation and reservoir habitat for fish and fish food organisms; and

6. estimate impacts or reservoir operation on the reservoir fishery.

Results of the past years data collection generally support those previously reported. Benthic macroinvertebrates were most abundant in those areas of the reservoir which remain wetted, and declined as the frequency of dewatering increased. Surface insect distribution was patchy, but the greatest numbers of terrestrials were found in the near shore areas of the reservoir. Cyclops was the most abundant zooplankton genus in the reservoir during 1984-85. Daphnia were the next most important numerically; peak number/liter varied with geographic area but was not consistently high during June. Schindler trap catch efficiency was at or above that of the Wisconsin net, but still did not match values reported in the literature. We used a new Schindler trap during the past year and this probably explains our increased efficiency.

Fish community structure has changed since impoundment; kokanee and peamouth numbers have increased and the relative abundance of Salmon spp. and redside shiners has declined. Age and annual growth of gamefish remains difficult to estimate, largely because of the varying environments juvenile fish inhabit. Also, trout growth slowed after two years in the reservoir and annual growth checks were nearly impossible to discern. Otolith analysis has enabled examination of rainbow trout growth the first two years following reservoir entry.

Kokanee were found to be spawning throughout the Kootenai drainage in British Columbia. The Tobacco River was the only U.S. tributary that produced a run which was estimated at several thousand - up from an estimated 500 in 1984. Important streams in the Canada area were Kikomun Creek, Elk and River, Sand Creek, Norbury Creek, St. Mary River, Lussier River, White River and mainstem Kootenai. A conservative estimate would place the total spawning run at well over 100,000 fish.

Using nighttime hydroacoustical sampling during August and concurrent vertical gill netting, populations of kokanee can be estimated by geographic area. We will continue to use this sampling technique. An extensive creel survey was conducted from May through October 1985 and will provide data on total harvest, catch rates, and total angler pressure. Results of this survey will be presented in the 1985 annual report.

The estimated spawning run of westslope cutthroat trout into Young Creek dropped to 70 fish in 1985 from 260 in 1983 and 354 in 1984. It is believed that overfishing caused this decline and the Young Creek trap will be operated to monitor the upcoming spawning run.

Major impacts of reservoir operations on the fishery appear to be directly or indirectly associated with physical loss of surface area and habitat from drawdowns, and/or loss of thermal structure.

QUANTIFICATION OF HUNGRY HORSE RESERVOIR WATER LEVELS NEEDED TO MAINTAIN OR ENHANCE RESERVOIR FISHERIES; (PROJECT NO. 83-465); Bruce May, Montana Department of Fish, Wildlife, and Parks, P.O. Box 67, Kalispell, MT 59903; (406) 755-5505 (BPA Project Officer: Steve Smith)

The Hungry Horse Reservoir Fisheries Study is part of the Northwest Power Planning Council's Fish and Wildlife Program to mitigate damages to fish and wildlife resources impacted by hydroelectric development in the Columbia River Basin. The purpose of the study is to quantify seasonal water levels needed to maintain or enhance principal game fish species. Any changes in reservoir operation will have to be coordinated with the many downstream uses which include water budget flows, kokanee spawning and egg incubation flows in the Flathead River, Flathead Lake water elevations, power demands and flood control needs.

The primary objectives of the study are:

1. Develop a data base on reservoir habitat, water quality, fish food organisms, food habits of major fish species, fish abundance and distribution, gamefish growth, gamefish annual mortality rates and recruitment indexes for westslope cutthroat trout.

2. Develop relationships between reservoir drawdown and reservoir habitat, fish food organisms and gamefish growth and survival.

3. Develop a model which will predict the effects of reservoir operation on primary production, secondary production and gamefish populations.

The annual refill and drawdown cycle impacts the morphometrics and possibly the thermal stability of the reservoir. The drawdown reduces surface area, volume, shoreline length, wetted bed and hydraulic-residence times. These changes in reservoir habitat appear to have adverse effects on fish food availability, and quantity and quality of living space for most fish species.

The reservoir was isothermal from approximately mid-November to May and thermally stratified from mid-June through September. Dissolved oxygen values were generally in the optimum range for westslope cutthroat trout and appeared to have little direct influence on fish distribution. Water temperature had a major influence on fish distribution and activity through its regulation of metabolism, spawning periodicity and food availability.

The biomass of dipteran larvae in the benthos averaged approximately six times greater in permanently wetted areas than areas periodically dewatered by annual drawdown. Insects on the surface film were patchily distributed throughout the reservoir. Aquatic dipteran numbers were highest in the spring and fall while terrestrial densities peaked from August through October.

There was little difference in mean zooplankton densities among the three geographic areas of the reservoir. Daphnia pulex population had peaks of abundance in August and November. Their densities were comparable to those found in Flathead Lake, but less than recorded in Lake Koocanusa.

During the summer and fall cutthroat trout feed primarily on terrestrial insects with aquatic dipterans second in importance. Daphnia pulex was the major food ingested during the winter. Fish were the principal food item consumed by bull trout and northern squawfish, whereas mountain whitefish diet consisted almost entirely of Daphnia pulex.

The catch of all fish species in shoreline gill net sets varied considerably seasonally with area differences comparatively small. Distribution appeared to be controlled primarily by water temperature and food availability. Westslope cutthroat trout concentrated in the upper six meters of the water column in the nearshore zone when surfact water temperatures were below 17 - 18°C. At higher temperatures, cutthroat moved into the deeper offshore waters. A similar distribution pattern was exhibited by bull trout and mountain whitefish, except these species are closely associated with the reservoir bottom. Northern squawfish were distributed throughout the water column in the nearshore zone during the summer and fall when water temperatures were above 12°C. When temperatures declined in October they moved into the deeper, offshore, zone, and became relatively inactive in the winter. The different temperature preferences of cutthroat and squawfish resulted in a temporal and spatial separation in use of the reservoir nearshore and offshore habitat zones except for periods in the spring and fall.

The cutthroat spawning run into Hungry Horse Creek and subsequent juvenile recruitment of the reservoir has declined markedly since 1968. The declines may be due to changes in reservoir operation beginning in 1966, habitat degradation in Hungry Horse Creek from logging and road building and increased mortality from angling.

Progress was made in developing a model which will predict the impacts of reservoir operation on habitat, primary production, secondary production and fish populations. The approach selected entails the use of component models corresponding specifically to the mechanisms by which dam operation effects the reservoir biota. The strategy consists of a physical framework component of the reservoirs morphology and thermal structure within which the primary production, secondary production and fish component models operate. A rainbow trout population simulation model which has individual fish growth as its driving variable is being evaluated.

LOWER FLATHEAD SYSTEM STUDY (Project No. 83-l); Joe Dos Santos, Jim Darling, Paul Pajak, and Bill Bradshaw, Confederated Salish and Kootenai Tribes, P.O. Box 98, Pablo, MT 59855; (406) 675-2700 (BPA Project Officer: T. Vogel)

Main River - Joe Dos Santos

A major work task during FY 1985 was the development and implementation of an instream flow assessment plan for the main river. The Instream Flow Incremental Methodology, the Water Surface Profile hydraulic model will be used to describe changes in habitat due to discharge. Two study sites were chosen, one representing the single channel and one representing the braided channel portions of the main river. Field measurements taken at 3,200 and 10,000 cfs will enable the model to predict effects on weighted usable area from 1,280 to 25,000 cfs.

Largemouth bass are primarily backwater residents of the lower Flathead River. They are rarely found in main channel areas. From March 1, 1983 to September 30, 1985, a total of 188 largemouth bass have been captured, averaging 307 mm. Age 4 and older fish comprised 76 percent of the total catch.

Northern pike are found throughout the length of the river. Combinations of riverine and lentic habitats support the largest concentrations of pike. Adult pike prefer water depth in excess of 2 m and water velocities not exceeding 0.2 m/second during non-spawning periods. Habitats utilized by pike are usually totally vegetated. Males become sexually ripe by the first week of April and females by May 1. They have shown maximum upstream spawning movements of 17 km in 27 days and downstream movements of 45 km in 15 days. Males spend up to three months in and around spawning grounds, whereas females spend only six weeks.

Population size and age class structure of trout species studied in the lower Flathead River from 1983 through 1985 reflects a lack of successful recruitment. Bull and cutthroat trout are rare. Rainbow trout are most abundant in the lower reaches of the river, with population estimates ranging from 14 to 29 fish/km. Brown trout are most abundant in the uppermost reach of the river averaging 31 fish/km. A lack of younger aged fish in both rainbow and brown trout samples from the river was observed. Age 1+ fish of each species comprise less than 2.5 percent of the catch.

Although areas of suitable spawning gravel exist throughout the river, they are apparently not being selected by spawning salmonids in the spring and fall. The combined impact of constantly changing river discharge on the actual spawning act and potentially poor survival of eggs due to sediment and changes in river discharge have combined to product trout populations far below the potential of the lower Flathead River.

Tributaries - Jim Darling

The tributary portion of this study focuses on Crow Creek, Mission and Post Creeks, the Jocko River, and the Little Bitterroot River. Ten of 22 stock-assessment stations were retained during fall 1985, and station lengths were doubled to 300 m, to improve fish population estimates in areas used by main-river salmonids. Species composition, densities, and lengths of'fish in the samples changed, often abruptly, as we moved from the valley into the foothills.

Small but distinct runs of main-river rainbow (Salmon gairdneri) and brown trout (Salmon trutta) have been documented entering the Jocko and Mission weirs during 1984 and 1985. Age 3 and 4 rainbow trout began entering in late February and continued until traps were closed due to high water. Age 3 to 5 brown trbut entered the traps from August through October. Spawning brown trout from the lower Flathead use the Jocko River almost exclusively.

Electrofishing Crow Creek for spawning trout during April and November 1985 indicates that main-river rainbow and brown trout enter this stream to spawn. Rainbow trout, perhaps attracted to warmer water released from Lower Crow Dam, enter the creek during fall.

Trapping results indicate that northern-pike spawning in the Little Bitterroot River is concentrated in the 32 km between Hot Springs Creek (km 44) and the Camas A Canal diversion (km 76). The diversion is an absolute barrier, and Hot Springs Creek introduces very trubid water, hampering growth of aquatic vegetation critical to successful pike spawning.

Redd surveys of major tributaries draining the east side of the Reservation point to the 12 km of the Jocko River between Valley Creek and Finley Creek as critical to spawning trout, especially brown trout. Based on preliminary substrate sampling and comparing our results to laboratory studies of other systems, poor trout embryo survival to emergence is predicted for spawning areas in the Jocko River, Mission, Post, and Crow Creeks.

Application of the Instream Flow Incremental Methodology this coming year, combined with our fish population, spawning, and habitat information gathered to date, will allow us to present various management scenarios to Tribal decision-makers and identify resource impacts with each alternation.

Lake Level Fluctuations: Assessing the Impacts on Fish Habitat in South Bay of Flathead Lake - Paul Pajak

Background information regarding the seasonal effect of Kerr Dam operations on Flathead Lake surface elevations is provided, and the study goals, assumptions, design criteria, and habitat evaluation methodologies discussed. Some preliminary results from the 1985 field season for several habitat variables are given.

Principle study goals are: 1) to relate target fish species abundance and distribution in South Bay to the various habitat types defined by depth and substrate criteria, and 2) to characterize the quantity and quality of habitat available to target fish species at various lake levels. A major study assumption is that physical habitat is demonstrably limiting target fish species distribution or abundance.

Nearly 20 percent of South Bay is within the drawdown zone, and 71 percent of this area is in East Bay. Woody structural cover, important to largemouth bass, is essentially absent from South Bay, and artificial woody structure such as docks, comprise less than 0.1 percent of the shoreline area. Hydroacoustic surveys of submergent macrophytes indicate a high percentage within the drawdown zone by area (19 percent), with most of the vegetation occuring in East Bay. Temperature, dissolved oxygen, pH, and conductivity data collected bi-monthly indicates a high degree of homogeneity within South Bay with the exception of surface water temperature which varies seasonally. A brief discussion of future efforts emphasized the direction towards quantifying relationships between fish habitat and lake level fluctuations.

<u>Lake Level Fluctuations: Assessing the Impacts on Resident Fish Distribution and Abundance in South Bay of Flathead Lake</u> - Bill Bradshaw

A description of the methods used to assess target fish distribution and abundance in South Bay is given, in addition to some of the trends initially apparent from the first year of data collection. All of the results presented are relative to the study design criteria previously discussed by Paul Pajak.

Results of nocturnal icthyoplankton sampling using 900 micron mesh nets at 32 locations are characterized as both seasonally variable in terms of species composition and numerically variable among stations for each species. Variability of juvenile fish abundance as indicated by beach seine samples from 24 locations was also high among stations and seasonally, with yellow perch the most commonly taken species. Adult fish species composition and abundance reflected by gill net samples from 72 locations varied by season and habitat type, with some statistically significant differences determined. Tag return data from fish caught by fyke nets during the spring were compiled, and return rates of 27 percent for bull trout, 2 percent for yellow perch, and 0 percent for lake whitefish were reported. A creel survey conducted on the East Bay winter perch fishery in 1984-1985 yielded information regarding angler demographics, harvest pressure, and catch statistics. The total harvest from this fishery was estimated at 12,000 perch. On-going analysis describing the relationships between fish distribution and abundance, and the various habitat types defined for this study are discussed.

EFFECTS OF OPERATION OF KERR AND HUNGRY HORSE DAM ON REPRODUCTIVE SUCCESS OF KOKANEE IN THE FLATHEAD SYSTEM (PROJECT NO. 81S-5); Pat Clancey and Will Beattie, Montana Department of Fish, Wildlife, and Parks; P.O. Box 67, Kalispell, MT 59903; (406) 755-5505 (BPA Project Officer: Tom Vogel)

Effects of the Operation of Hungry Horse Dam on Kokanee in the Flathead River System - Pat Clancey

This study began in 1979 under U.S. Bureau of Reclamation (USBR) funding and continued in 1982 with funding provided by the Bonneville Power Administration (BPA). Research under USBR funding indicated significant mortality of kokanee eggs in the mainstem, Flathead River, where flows fluctuated seasonally and daily. These fluctuations were caused by the operation of Hungry Horse Dam, which is located on the South Fork of the Flathead River. Minimum and maximum flow recommendations were made for the Flathead River at Columbia Falls to prevent kokanee from spawning in areas which would later be left exposed by low river levels. Major emphasis since 1982 has been on fine tuning the flow recommendations in the mainstem Flathead River, monitoring their effect of kokanee reproduction, and recommending management strategies to enhance the mainstem kokanee fishery. The overall management goal for kokanee in the Flathead System is to provide a balance of size and numbers of fish for spawning escapement and angling, while maintaining a diversity of spawning areas.. Major objectives of the study are:

1. Continue to develop the stock recruitment relationship for kokanee in the river system begun in 1979.

2. Quantify effects of the amount and timing of controlled flows on distribution and reproductive success of kokanee in the re-regulated portion of the Flathead River. Determine the relative contributions of day and nighttime spawning.

3. Determine relative contributions of major river system spawning areas to the total kokanee population.

4. Identify timing and destination of successive runs of kokanee spawners in the Flathead River and their use by fishermen, and determine if timing is affected by discharge from Hungry Horse Dam.

Over 140,000 kokanee spawned in the Flathead River system in the fall of 1985. The peak count in McDonald Creek was 118,000 spawners. An estimated minimum of 20,000 kokanee spawned in the mainstem Flathead River, where high fall runoff and ice conditions prevented completion of spawner counts and probably rendered many redds unrecognizable.

An estimated annual average of 87,800 kokanee reached spawning grounds in the Flathead River system since 1979. An annual average of 69,700 (79 percent of total) spawned in McDonald Creek, an area not affected by hydro development. The mainstem Flathead averaged 11,000 (13 percent) spawners annually. Other river system spawning areas include the Whitefish River and the Middle and South Forks of the Flathead. Aerial counts of kokanee schools were valuable in estimating general trends of abundance and migration timing. Analyses of kokanee migration data indicated no significant relationship between aerial kokanee counts and 16 environmental variables. Preliminary estimates show nearly 15,000 kokanee harvested from the 1985 spawning run. Angler harvest in the river is limited to 10 percent of the total spawning run each year during population recovery.

Recovery of the mainstem kokanee population was projected using 20 percent egg to fry survival and a 2 percent fry to adult return rate. It is estimated that the maximum assigned level of 330,000 preharvest mainstem spawners will be reached by 2003. Fluctuations in natural reproductive rates in the river and in food conditions in Flathead Lake may affect the rate of population recovery. Survival of eggs to the eyed stage in the mainstem ranged from less than 40 percent in 1980 - 81 to 87 percent in 1984 - 85.

Recommended flows in the Flathead River of 3,500 - 4,500 cfs from October 15 - December 15, and 3,500 cfs minimum during the remainder of the year, should be continued 24 hours per day. Power peaking operations would significantly reduce spawning success.

A summary article regarding the study is in press in the North American Journal of Fisheries Management, and the final research report is near completion.

Impacts of Water Level Fluctuations on Kokanee Salmon Reproductive Success in Flathead Lake - Will Beattie

This study has investigated the effects of the operation of Kerr Dam on the reproductive success of kokanee salmon which spawn along the shores of Flathead Lake. Begun in 1981, this research has been funded by BPA. The principle goals of the study are to:

1) Determine the production potential of Flathead Lake shoreline areas for kokanee salmon.

2) Determine the effects of drawdown on egg and alevin mortality; describe changes in the groundwater regime in spawning areas associated with water level fluctuations.

3) Develop a recovery and mitigation plan for kokanee shoreline spawning in Flathead Lake.

Redd counts at shoreline spawning areas totalled 1,134 and 1,176 in 1984 and 1985, respectively. Excepting one westshore area, all natural spawning, for the past 5 years, has occurred at 12 areas along the east shore. Until 1985, redds have been distributed 60:40 above and below minimum pool (elevation 2,883 ft.). In 1985, 95 percent of redds were located above minimum pool. We estimate that 3,000 - 3,500 fish comprise this lakeshore run, which represents 3 - 4 percent of the spawning run in the Flathead system. The percentage of two and three year old fish in the lakeshore run has been increasing, while the percentage of fish maturing at four years has declined.

Spawning sites (redds) at all elevations were in gravel/cobble substrate where groundwater discharge varied from 0.1 to 0.4 cm3/cm2/h, and interstitial oxygen tension ranged from 6.0 to 9.0 ppm. Groundwater seeps and a shallow groundwater table keep some redds wetted through the incubation period, improving egg survival. Successful emergence of kokanee fry, however, only occurs from redds below minimum pool, or from exposed redds where groundwater discharge is high. Experiments showed that the ability of alevins to move through the substrate improves as substrate particle size increases.

An intensive ice fishery for kokanee has developed in Skidoo Bay, at the southeast end of the lake. Harvest of 50,000 fish has raised concern about over fishing the population. We recovered three and four year old fish tagged in Skidoo Bay in April during the summer fishery and during the spawning season. Marked fish were found at 11 areas in the Flathead River and its tributaries, Swan River, and two areas on the lake. Though the ice fishery was apparently composed of diverse stocks, the possibility remains that weak lakeshore stocks were being overharvested.

We sampled zooplankton monthly at one index station on Flathead Lake. The relative abundance of the four principle crustaceans which kokanee eat has varied little in five years. Based on this limited data, however, the density of the four species has declined. The decline in cladoceran density may be influenced by increasing grazing pressure form Mysis relictant, the oppossum shrimp.

The two seasons remaining in this study will be devoted to quantifying losses in spawning habitat attributable to the operation of Kerr Dam, and developing mitigation alternatives. Changes in the zooplankton community, and their effects in kokanee growth and survival may also require research effort.

DETERMINATION OF FISHERY LOSSES IN THE SOUTH FORK OF THE FLATHEAD RIVER AND TRIBUTARIES RESULTING FROM THE CONSTRUCTION OF HUNGRY HORSE DAM AND RESERVOIR (PROJECT NO. 85-23); Ray Zubik, Montana Department of Fish, Wildlife, and Parks; PO Box 67, Kalispell MT 59903; (406) 755-5505 (BPA Project Officer: Fred Holm)

Completion of Hungry Horse Dam and Reservoir in 1953 flooded approximately 57 kilometers (km) of the mainstem South Fork of the Flathead River and about 67 km of 50 tributary streams to the river. This inundation resulted in the complete loss of the resident riverine and tributary fishery. The dam also blocked access to approximately 40 percent of the drainage area available for spawning salmonids migrating upstream from Flathead Lake. Isolation of migratory salmonids was not mitigated by the creation of new lacustrine habitat in Hungry Horse Reservoir. The reservoir simply captured fish destined for Flathead Lake, yet produced no more recruitment to the Flathead Lake-River system. Spawning and juvenile trout rearing habitat in the flooded portions of the tributaries and the river was lost without replacement.

The major goals of this study are to (1) provide estimates of fishery losses in the South Fork of the Flathead River and its tributaries as a result of the filling of Hungry Horse Reservoir and (2) propose mitigation alternatives for enhancing the fishery. There are four major study objectives:

1) Assess the quality and quantity of fish habitat in the South Fork and tributaries flooded by the reservoir;

2) Estimate fish populations that inhabited the river and tributaries before the construction of Hungry Horse Reservoir;

3) Identify present fish passage problems, such as culverts between Hungry Horse Reservoir and its tributaries;

4) Evaluate alternatives to mitigate for lost fish production and determine the most desirable, cost effective measures.

The situation with adfluvial stocks migrating from Flathead lake is similar to that of anadromous fish in the lower Columbia River Basin where researchers have used two basic approaches to document lost production:

1) Habitat-based methods which rely on known relationships between habitat and production;

2) Biologically-based methods which rely on escapement.

We decided to use a habitat-based approach to estimate fishery losses because the Department has collected extensive habitat information and related it to westslope cutthroat trout and bull trout populations.

In order to calculate potential juvenile westslope cutthroat trout losses due to the construction of Hungry Horse Dam and Reservoir we will develop a predictive model using gradient and stream order. This relationship will be based on habitat and population estimates from 159 tributary reaches in the North, Middle and South forks of the Flathead River.

We will calculate the number of adult bull trout lost to the Flathead Lake River system using stream order and gradient. These predictions are based on a relationship developed for 94 North and Middle Fork reaches.

We sampled two sections of the South Fork above the reservoir to determine the numbers of westslope cutthroat trout lost due to inundation. We used three different techniques to estimate abundance: a hook-and-line-Petersen, a snorkel Petersen, and a snorkel expansion. Based on these estimates, we determined that about 22,000 WCT from 150 - 432 mm in total length were lost due to inundation of the South Fork of the Flathead River. We are presently developing and refining loss estimates for WCT and bull trout in the inundated portions of the tributaries and the entire South Fork river-tributary system above Hungry Horse Reservoir.

Finally, we will develop an array of mitigation alternatives and evaluate their cost effectiveness and ecological effects.

EVALUATION OF MANAGEMENT FOR WATER RELEASES FOR PAINTED ROCKS RESERVOIR BITTERROOT RIVER, MONTANA (PROJECT NO. 83-463); Mark Lere, Montana Department of Fish, Wildlife, and Parks (MDFWP) 3201 Spurgin Road, Missoula, MT, 59801;(406) 363-2439 (BPA Project Officer: Fred Holm)

Water shortages that occur in the Bitterroot River during July, August, and September have been a persistent problem for both irrigators and recreationalists. Demands for irrigation water from the river have often conflicted with the instream flow needs for trout and dewatering has commonly forced irrigators to dike or channelize the streambed to obtain needed flows. As called for under the Northwest Power Planning Council's Fish and Wildlife Program, the Montana Department of Fish, Wildlife, and Parks (MDFWP) has submitted a proposal for an annual purchase of 10,000 acre feet (AF) of water from Painted Rocks Reservoir to augment low summer flows in the Bitterroot River. This supplemental water potentially would enhance the fishery in the river and reduce the degradation of the channel due to diversion activities.

The present study is being funded by the Bonneville Power Administration and was undertaken to (1) develop an implementable water management plan for supplemental releases from Painted Rocks Reservoir which would provide optimum benefits to the river; (2) gather fisheries and habitat information that would be necessary to evaluate the effects of dewatering in the river; (3) obtain needed baseline information that would aid in determining the effectiveness of supplemental water releases in improving the fisheries resource. The study was initiated in July, 1983.

The water management plan was formulated by: (1) determining a minimum flow recommendation within the dewatered reach; (2) determining the frequency of need for supplemental water to maintain adequate flows; (3) developing a release scheduled for purchased water which would maximize the time adequate flows are met. A wetted perimeter/inflection point methodology was used as the primary approach in quantifying instream flow recommendations. Mathematical models are developed to determine the quantity and frequency that supplemental water would be needed to maintain these adequate flows. A minimum flow of 375 ft^3/sec was recommended for the dewatered reach of the river. Flows within this reach were estimated to exceed 375 ft^3/sec approximately 92, 28, and 26 percent of the time, respectively in late July, August, and September. Additional reservoir water (5,000 AF controlled by MDFWP and a 10,000 AF proposed purchase) was predicted to maintain or exceed 375 ft^3/sec flow within the dewatered reach for 53 percent of the time. About 63 and 99, percent respectively, of test releases conducted during 1984 (average water year) and 1985 (low water year) were lost before reaching a target site within the dewatered reach. A majority of these depletions were due to irrigation withdrawal. The release schedule designates supplemental water will not be released until flows within the dewatered reach become less than the minimum recommendation. The schedule designates a maximum release of 50, 112, and 110 ft^3/sec for July 16 - 31, August, and September, respectively.

Discharge patterns were determined by using water level recorders established at four stations on the river and at the heads of four major irrigation diversions. Two USGS stations also were used to evaluate discharge patterns.

Approximately 34 percent (29 miles) of the river becomes dewatered to some extent during the 16 July through 30 September irrigation season. Supplemental reservoir water (15,000 AF annually) was released during the 1983, 1984, and 1985 irrigation seasons to augment these low flow. Flows within the dewatered reach were maintained near or above the 375 ft^3/sec minimum recommendation during 1983 and 1984. During 1985, however, supplemental water releases could not maintain the minimum flow recommendation. Severe dewatering occurred for 20 days during July. The minimum flow recorded within the dewatered reach was 24 ft^3/sec on July 28 - 30.

Population estimates for trout were conducted on a control, dewatered and rewatered (from irrigation return) section of the river. Rainbow trout, brown trout and mountain whitefish were the predominant game fish in these three sections. Rainbow trout numbers in the control section have increased from 5ll/mile in 1982 to 1257/mile in 1985. In the dewatered section, rainbow trout numbers have increased from 182/mile in 1983 to433/mile in 1985. Rainbow trout numbered 324/mile in the rewatered section of the river during 1985. Brown trout numbers in the control section have not significantly changed between 1982 and 1985. Numbers have ranged from 225/mile to 296/mile during the four years of study. Brown trout numbers in the dewatered section have increased from 223/mile in 1983 to 362/mile in 1985. In the rewatered section, numbers of brown trout were too few for estimation during 1985. Supplemental releases of reservoir water appear to be enhancing the fisheries in the river, especially rainbow trout in the upstream (control) reach. The severe dewatering that occurred during 1985 did not appear to adversely affect adult trout populations in the river. It is unclear whether supplemental releases prevented the loss of trout numbers during the severe dewatering in 1985 or whether numbers of trout within the dewatered section have been depressed since the inception of the study. Further monitoring of populations within the dewatered reach will hopefully allow an assessment of the effects of supplemental water releases on the fishery.

Supplemental reservoir water (15,000 AF) again will be available for release during the 1986 irrigation season. The present study will continue data collection and the accomplishment of necessary tasks to evaluate the effectiveness of the water management plan and associated release schedule augmenting low summer flows and for enhancing the fishery in the Bitterroot River.

EFFECTS OF WATER LEVELS ON PRODUCTIVITY OF CANADA GEESE IN THE NORTHERN FLATHEAD VALLEY, MONTANA (PROJECT NO. 83-498); Daniel Casey and Marilyn Wood, Montana Department of Fish, Wildlife, and Parks; P.O. Box 67, Kalispell, MT 59903; (406) 755-5505 (BPA Project Officer: Jim Meyer)

The Fish and Wildlife Program of the Northwest Power Planning Council calls for wildlife mitigation at hydroelectric projects in the Columbia River Basin System. Operation of Hungry Horse Dam and Reservoir on the South Fork Flathead River causes sporadic water level fluctuations along the mainstem Flathead River. Seasonal water level fluctuations and substantial habitat losses have occurred as a result of construction and operation of Kerr Dam, which regulates Flathead Lake. These fluctuations may impact goose populations through flooding or erosion of nesting and brood-rearing habitats, and increased susceptibility of nests and young to predation. The Bonneville Power Administration has funded a 3-year study to evaluate these effects; the results of the second year's research efforts are summarized.

The number, location, and success of goose nests were determined through pair surveys and nest searches. Our 1985 pair count data indicated that 95-143 nests may have been present. An average of 151 indicated pairs were recorded in the study area; 108 nests were found in the same area. Fifty-seven of the nests were found on elevated sites; 25 were in nests built by other species, 12 were in natural snags, 5 on man-made structures, and 15 on weathered stumps in the remnant delta in the Flathead WPA. Fifty-one of the nests were ground nests. Hatching success for 1985 nests (55 percent) was low compared to long term averages for the region. Predation was the predominant cause of ground nest failure (25 nests), while we documented 2 nest failures due to flooding. As in 1984, 85 percent of all ground nests were located within 1 mile above or below the seasonal HWM. Ten of 15 stump nests at the Flathead Lake WPA were at or below full pool elevation (2,893 ft.). Most ground nests were located on the island landform in either the marsh, shrub, or forest cover type. Both the nest site and adjacent sites 5 m from the nest were found in open (25 percent) overstory canopy cover. Tree nests averaged 17.0 m in height in trees or snags averaging 20.0 m in height and 0.96 m in diameter. All tree nests were found in deciduous forest cover type and on the riparian bench land form. Twenty-eight percent of the tree nests were less than 2.0 m from the HWM and 52 percent were less than 5.0 m from the HWM. Stump nests found on the delta mudflats averaged 1.82 m in height and 3.73 m in circumference. The stump cavities averaged 32 cm x 47 cm at a depth of 38 cm.

The maximum gosling count in the study area for 1985 was 197. Total gosling production predicted by our nest total (108), hatching success (55 percent) and mean brood size (5.0), was 295 goslings for the study area. Six key brood-rearing areas were identified. Most (80 percent) sites were located in the herbaceous or pasture cover type and the riparian bench landform. All sites were less than 1.5 m. above the HWM and 70 percent were less than 10.0 m horizontal distance from the HWM. The WPA received the most use by broods throughout the brood-rearing period. Activity budget surveys conducted at the WPA indicated that broods spend the majority of their time (54 percent) feeding, primarily (37 percent) in the extensive mudflats along the north shore in areas classified as either unvegetated or short herbaceous cover types. Analysis of 316 observations of individual broods indicated no decline in mean brood size over time or age class, either for the WPA or for the study area as a whole.

Analysis of aerial photographs taken prior to construction of Kerr Dam documented the loss of 1,859 acres of habitat along the north shore of Flathead Lake. Losses were attributed to inundation and to continuing erosion due to operation of Kerr Dam.

Twenty-two geese were equipped with radio-collars during 1985 trapping efforts. Five radio-collared geese nested in the study area; Geese nesting on the river raised their broods on off-river sloughs. In three cases, geese traveled 19-37 km with their brood to the WPA.

Lake and river water level regimes were compared with the chronology of important periods in the nesting cycle. Fluctuations in the river levels during the earliest stages of egg-laying may disrupt some island ground nests. Low lake levels in May and early June coincide with the brood-rearing period. Mudflats are heavily used by broods, but their effect on survival must still be documented. Continued documentation of nesting and broodrearing habitat, nesting success, and gosling survival in relation to water level fluctuations will hopefully allow managers to optimize compatibility between water level regimes and goose production. Preliminary recommendations to protect and enhance Canada goose habitat and production are being developed.

IMPACTS OF WATER LEVELS ON BREEDING CANADA GEESE AND THE METHODOLOGY FOR MITIGATION AND ENHANCEMENT IN THE FLATHEAD DRAINAGE (PROJECT NO. 83-2);

William C. Matthews, Jr., Shari K. Gregory, Dennis L. Mackey, Confederated Salish and Kootenai Tribes, P.O. Box 98, Pablo, MT 59855. (406) 675-2700, ext. 570 (BPA Project Officer: Jim Meyer).

The Lower Flathead Canada Goose study began in 1983 on the Flathead River from Kerr dam to the confluence with the Clark Fork River, and in 1984 on the southern two-thirds of Flathead Lake.

Fluctuating water levels resulting from the operation of Kerr Dam can impact goose reproductive output in several ways. On the lake, access to preferred brood period by extensive mudflats. When water levels are low on the river, some nesting islands become attached to the mainland, promoting nest destruction by mammalian predators. In addition, nest flooding occurs on the river during periods of high water since many geese nest below the high water mark.

Objectives of the study include the following:

1. Document goose production and nest site selection and relate these to water level fluctuations.

2. Determine the effects of water level fluctuations on brood activity and habitat selection.

3. Identify a nest structure design and nesting material combination that is acceptable to geese and cost effective.

4. Develop a precise method of indexing the nesting population.

5. Formulate management recommendations to protect and enhance goose populations.

Six plane and three boat surveys were conducted on three island groups in Flathead Lake during 1985. All surveys were conducted in the morning. The mean number of pairs observed were not significantly different between boat and plane methods. The ratios of mean numbers of pairs observed to actual numbers of nests were slightly higher than similar ratios observed during 1984, but were still consistently lower than those observed on the river (plane ratio x = 0.73; boat ratio x = 0.81).

The total number of nests found on the nesting islands of Flathead Lake was 166 during 1985. This is very close to the number found last year (164) but the number that hatched was half that of last year (53 vs. 99) and the number predated was double last year (81 vs. 39). The major cause of nest loss on the lake was attributed to avian predation, primarily from ravens preying on eggs. In addition, a great-horned owl is suspected to have killed 6 adult geese on or near their nests on the Bird Islands.

Twenty-three nest structures were installed around the perimeter of Wild Horse Island. All were filled with soil and planted with vegetation to determine if growing media in nest structures is a feasible option compared to regularly replacing wind blown nesting material such as bark.

Three different methods of artificially establishing brood habitat were tried with wheat seed on the rocky beaches and mudflats of the lake. All methods of planting the seed resulted in some germination and evidence of use by goose broods was observed. The potential for larger scale plantings in appropriate areas looks promising as a way to create brood habitat on the barren mudflats.

Goose pair surveys on the river were conducted by boat and plane during mornings and afternoons. Results from pair surveys in 1985 were similar to those observed in 1984. There were no significant differences in the mean number of pairs observed between boat and plane surveys or between morning and afternoon surveys. Although not statistically significant differences in the mean number of pairs observed between boat and plane surveys or between morning and afternoon surveys. Although not statistically significant, the number of pairs observed during afternoon surveys was consistently less than during morning surveys. The ratio of the mean number of pairs observed to the actual number of nests found was 1.2 in 1985. As in 1984, morning boat or plane surveys appeared to give the best estimate of goose pairs on the river.

Fifty percent (26 of 52) of the artificial tree nest structures on the river were used in 1985. Use of structures has increased dramatically since 1983. Use of structures increased from 17 percent in 1983 to 50 percent in 1985. Sixty-five percent of the structures used contained bark nest material and 35 percent contained shale. Nesting success was 81 percent for geese using nest structures containing bark and 89 percent for those using shale. Geese appear to prefer using bark nest material, but will use shale, and are highly successful at hatching on both materials.

Seventy-one nests were found on the river in 1985. This is an increase of 15 nests from 1984. The increase in the nesting population was a result of an increase in use of nest structures in the northern half of the river where secure natural ground nest sites are limited. Nesting success on the river was low (53 percent) in 1985 as a result of high levels of mammalian predation on ground nesting geese. The mammalian predation rate increased from 6 percent in 1984 to 26 percent in 1985. Overall nesting success would have been much lower if nest structures were unavailable to nesting geese. Nesting success of geese using ground nests was only 26 percent while success of geese nesting in tree structures was 84 percent.

Nest structures on the river in 1985 appear to have resulted in more nests and a higher nesting success rate than would have been observed if structures were unavailable to nesting geese.

A riparian community type classification is currently being developed and will be used next year to map the study area. The results will be digitized for computer retrieval and data analysis.

Nest and random sites as well as general island characteristics were investigated and comparisons were made between areas used and areas available to nesting geese. Nearly all the 22 islands on the lake were used, while approximately half the 43 islands on the river were used by nesting geese. On the river, geese tended to use smaller, narrower islands, showed a preference for shrub habitats, and used herbaceous habitats less than expected. Visual cover was significantly greater at nest sites than random sites below 1 m height. Approximately 40 percent of the ground nests on the river were at or below the high water mark.

Two brood areas on the river were mapped at moderate and high water levels. One area was predominantly herbaceous habitat and cropland while the other was mostly coniferous forest and shrub habitat. Most of the area flooded at high water levels was herbaceous and shrub habitats.

Two brood areas on the lake were mapped at several water levels. The East Bay Brood Area showed the most dramatic impact of water level fluctuations with mudflats comprising 60 percent of the brood area at low water levels, while all the mudflats are flooded at full pool. Broods may submit themselves to a high risk of predation if they cross the mudflats to reach marsh or pasture areas.

URAL TWEED BIGHORN SHEEP - WILDLIFE MITIGATION (PROJECT NOS. 84-38 and 84-39);
Chris Yde, Montana Department of Fish, Wildlife, and Parks; PO Box 1020, Libby Montana 59923, (406) 293-3317; Louis Young, Kootenai National Forest, Rexford Ranger District, PO Box 666, Eureka Montana 59917, (406) 296-2536. (BPA Project Officer: Jim Meyer)

The Ural Tweed bighorn sheep project was designed to mitigate the impacts to the sheep population resulting from the construction of the Libby hydroelectric facility. The project is a cooperative effort between the Montana Department of Fish, Wildlife, and Parks (MDFWP) and the Kootenai National Forest. The primary objectives of the project are:

1. Develop preliminary designs for travel corridors to facilitate movement of bighorn sheep across Highway 37 to habitat improvement projects between the highway and Lake Koocanusa;

2. Cooperatively design habitat improvement projects to enhance the bighorn sheep seasonal habitats. The Kootenai National Forest has the responsibility to conduct the enhancement projects, while the Montana Department of Fish, Wildlife, and Parks has the responsibility to determine the effectiveness of the habitat improvement projects in enhancing bighorn sheep, other wildlife and their habitats; and

3. Outline a program to maintain a variable Ural Tweed bighorn sheep population.

The current contracting period was from September 1, 1984, to December 31, 1985. To date, habitat treatments have been initiated on 7 areas. The treatments include selective slash and burn, prescribed fore and fertilization. Inclement weather precluded the completion of the prescribed burns scheduled during the fall within the South Sheep Creek and Lower Stonehill units. Pretreatment vegetative information was collected from all units scheduled for habitat manipulations during 1985. Additionally, 10 future projects have been delineated for other areas frequented by bighorn sheep.

Eight adult bighorn sheep (4 ewes and 4 rams) were fitted with radio transmitters. Systematic aerial and ground surveys were utilized to monitor the movements and seasonal habitat preferences of the radio-collared sheep. Age and sex information was gathered whenever possible to aid in the development of a population simulation model. Monthly pellet group collections were initiated in May to provide samples for 2.6 diaminopimetic acid (DAPA), food habits and lungworm larvae analysis. The majority of the data analysis is ongoing and will be presented in later reports.

EFFECTS OF THE CABINET GORGE HATCHER ON WINTERING BALD EAGLES IN THE LOWER CLARK FORK RIVER AND LAKE PEND OREILLE (Project No. 86-14); John G. Crenshaw, Idaho Department of Fish and Game, Sagle, Idaho 83860; (208) 265-4185 (BPA Project Officer: Jim Meyer)

A P-year study of wintering bald eagles (Haliaeetus leucocephalus) along the lower 26 miles of the Clark Fork River and Lake Pend Orielle, Idaho was begun in early November 1985 to obtain baseline data on bald eagle use of the area. Important bald eagel habitat is being identified to allow future assessment of the effects to bald eagles resulting from the enhancement of the kokanee salmon (Onchorhynchus nerka) fishery through the operation of the Cabinet Gorge Hatchery, and to provide information from which management decisions can be based for the protection and/or enhancement of eagle habitat. Specific objectives include identifying changes in the number and distribution of bald eagles in the area, identifying perching, feeding, and roosting sites, determining daily behavioral activities of bald eagles, and identify perching, feeding, and roosting sites, determining daily behavioral activities of bald eagles, and identifying prey species.

Weekly fixed-wing aerial censuses of bald eagles in the study area conducted from 7 November 1985 to mid- January 1986 yeilded a maximum count of 269 on 9 January 1986. Adult bald eagles consistently out-numbered subadults in the censuses (x = 25 percent subadults, SD = 6.890, N = 7). Bald eagles favored the northern half of Lake Pend Oreille throughout this period, with most concentrated from Garfield Bay to Bottle Bay, and Warren and Pearl Islands. The Clark Fork River received more limited use (x = 11 percent of the total census, SD = 0.067).

Major roost sites were identified at Warren Island (maximum count 49 eagles) and east of Bottle Bay (maximum count = 22 eagles). Roosting eagles were also observed individually or in small groups near Garfield and Sunrise bays, and along the Clark Fork River.

Prey remains collected at sites of intense eagle activity. Field observations of foraging eagles provided a list of prey species used by bald eagles. These included Lake Superior whitefish (Coregonus clupeaformis), kokanee slamon, whitetail deer (Odocoileus virginianus), redhead ducks (Aythya americana), and American coots (Fulica americana).

WILDLIFE AND WILDLIFE HABITAT LOSS ASSESSMENTS FOR THE ANDERSON RANCH, BLACK CANYON, AND BOISE DIVERSION HYDROELECTRIC FACILITIES IN IDAHO (PROJECT NO. 85-l); G. Allyn Meuleman, Idaho Department of Fish and Game; 600 S. Walnut, Box 25, Boise, Idaho (208) 334-5057; (BPA Project Officer: Jim Meyer)

Abstract

We are currently assessing the effects resulting from the development and operation of the Anderson Ranch, Black Canyon, and Boise Diversion hydroelectric projects in Idaho. Both positive and negative effects to wildlife habitat and associated species are being addressed.

An interagency study team was developed for consultation, coordination, and the selection of target species. The Fish and Wildlife Services Habitat Evaluation Procedures are being used to assess the quality and quantity of the flooded cover types for the target species.

Pre-project photos are being used for Anderson Ranch to determine acreages of cover types flooded. Black Canyon and Boise Diversion do not have pre-project photos, so post-project photos, interviews and studies of upstream and downstream habitat were used to estimate acreages of cover types flooded.

We are currently in the process of determining these effects. The results from this study will give us the number of habitat units lost and gained due to hydroelectric development.

WILDLIFE PROTECTION, MITIGATION, AND ENHANCEMENT PLANNING FOR GRAND COULEE DAM (PROJECT NO. 86-74); Jack Howerton, Washington Department of Game
600 N. Capitol Way, Olympia, Washington 98504; (206) 753-2736
(BPA Project Manager: Jim Meyer)

Grand Coulee Mitigation Planning Project began in November of 1985. It followed completion of the Mitigation Status Review, (MSR), in which status of wildlife mitigation at all Columbia Basin hydroelectric projects was documented. Grand Coulee Project inundated 70,000 acres of wildlife habitat. No mitigation was implemented on this project.

Two consultation sessions were held before this effort began. The first led to the development of a proposal for a loss study as per Section 1004 (b) of the Columbia River Basin Fish and Wildlife Program (Program). Northwest Power Planning Council (Council), suggested we move directly to mitigation planning rather than conduct a loss study. A second consultation was then held in which conceptual mitigation goals were generally agreed upon.

The parties, U.S. Bureau of Reclamation (USBR), Colville Confederated Tribes (CCT), Spokane Tribe of Indians (STI), Washington Department of Game (WDG), and Fish and Wildlife Service (USFWS), subsequently met to draft the proposal and establish guidelines for the conduct of this effort. Pacific Northwest Utilities Conference Committee (PNUCC), was also invited to participate. The proposal developed at this meeting was the basis for the statement of work for our present contract. An Oversight Group for the effort was also established at this meeting to guide the effort and facilitate coordination and consultation.

Purpose of this project is to:

1. conduct a cursory review of losses;
2. identify and evaluate potential mitigation lands and habitats;
3. identify and evaluate habitat enhancement techniques;
4. review agency and tribal wildlife plans and policies; and
5. develop recommendations for protection, mitigation, and enhancement of wildlife for the Grand Coulee project.

To date, preproject aerial photos have been obtained and interpreted. Major habitat, (vegetation), types have been delineated, and wildlife species lists developed for each habitat. Indicator species have been selected as a preliminary to the selection of target species and for early planning purposes.

Project biologists are presently reviewing wildlife plans and identifying potential mitigation lands. Next habitats on the potential mitigation lands will be identified. Target species will then be selected and techniques for enhancing habitats for the target species reviewed and evaluate. All this will provide the basis for the protection, mitigation, and enhancement plan for Grand Coulee Project.

WILDLIFE AND WILDLIFE HABITAT LOSS ASSESSMENTS FOR THE WILLAMETTE RIVER BASIN FEDERAL HYDROELECTRIC FACILITIES (PROJECT NO. 84-36); Jim Noyes, Oregon Department of Fish and wildlife, P.O. Box 3503, Portland, Oregon 97208; (503) 229-5751; (BPA Project Officer: Jim Meyer)

Habitat based assessments were conducted of the U.S. Army Corps of Engineers' hydroelectric projects in the Willamette River Basin, Oregon, to determine losses or gains to wildlife and/or wildlife habitat resulting from the development and operation of the hydroelectric-related components of the facilities.

Preconstruction, postconstruction, and recent vegetation cover types at the project sites were mapped based on aerial photographs. Vegetation cover types were identified within the affected areas and acreages of each type at each period were determined. Wildlife target species were selected to represent a cross-section of species groups affected by the projects. An interagency team evaluated the suitability of the habitat to support the target species at each project for the quantity and quality of habitat was used to aid in assessing impacts resulting from the projects. The Willamette projects extensively altered or affected 33,407 acres of land and river in the McKenzie, Middle Fork Willamette, and Santiam river drainages. Impacts to wildlife centered around the loss of 5,184 acres of old-growth conifer forest, and 2,850 acres of riparian hardwood and shrub cover types. Impacts resulting from the Willamette projects included the loss of critical wither range for black-tailed deer and Roosevelt elk, and the loss of year-round habitat for deer, upland game birds, furbearers, spotted owls, pileatred woodpeckers, and many other wildlife species. Bald eagles and ospreys were benefitted by an increase in foraging habitat. The potential of the affected areas to support wildlife was greatly altered as a result of the Willamette projects. Losses or gains in the potential of the habitat to support wildlife will exist over the lives of the projects. Cumulative or system-wide impacts of the Willamette projects were not quantitatively assessed.

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BONNEVILLE POWER ADMINISTRATION
FISH AND WILDLIFE PROGRAM
REVIEW, COORDINATION, AND CONSULTATION

Resident Fish and Wildlife Projects

January 14 - 15, 1986
Holiday Inn
Spokane, Washington

Meeting Agenda

January 14, Tuesday

8:15 a.m.	Introduction
8:30 a.m.	Project No. 85-339, IDFG - Ed Bowles "Kokanee Stock Status in Lake Pend Oreille and Evaluation of the Cabinet Gorge Hatchery"
9:00 a.m.	Project No. 86-14, IDFG - Jay Crenshaw "Effects of the Cabinet Gorge Kokanee Hatchery on Wintering Bald Eagles in the Lower Clark Fork River and Lake Pend Oreille"
9:30 a.m.	Project No. 85-16, MDFWP - Brian Marotz "Kootenai River Tributaries Instream Flow Study"
10:00 a.m.	Break
10:30 a.m.	Project No. 83-467, MDFWP - Ian Chisholm "Quantification of Libby Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries"
	FLATHEAD RIVER BASIN
11:00 a.m.	Project No. 83-465, MDFWP - Bruce May "Quantification of Hungry Horse Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries"
11:30 a.m.	Lunch
12:30 p.m.	Introduction Canada Geese Projects in the Flathead Valley - Joe Ball
12:40 p.m.	Project No. 83-498, MDFWP - Dan Casey, Marilyn Wood "Effects of Water Levels on Productivity of Canada Geese in the Northern Flathead Valley"

1:30 p.m. Project No. 83-2, Salish/Kootenai Indian Tribe - Bill Matthews, Dennis Mackey, Shari Gregory
"Impacts of Water Levels on Breeding Canada Geese and the Methodology for Mitigation and Enhancement in the Flathead Drainage"

2:30 p.m. Break

2:45 p.m. Project No. 83-1, Salish/Kootenai Indian Tribe - Joe DOS Santos, Jim Darling
"Lower Flathead River Sys tern"

3:15 p.m. Project No. 81S-5, MDFWP - Pat Clancey, Will Beattie
"Effects of Operation of Kerr and Hungry Horse Dam on Reproductive Success of Kokanee in the Flathead System"

January 15, Wednesday

8:15 a.m. Project No. 85-23, MDFWP - Ray Zubik
"Determine Losses to Tributaries of South Fork Flathead River"

8:50 a.m. Other Wildlife Projects - Jim Claar, Gael Bissell
Bureau of Indian Affairs - MPC

9:30 a.m. Project No. 83-l (continued from l/14) - Paul Pajak, Bill Bradshaw
"Effects of Lake Level Fluctuations on Resident Fish in Flathead Lake"

1O:lO a.m. Break

l0:25 a.m. Fisheries Management of Flathead Lake, MDFWP - Dave Cross, John Fraley
Salish-Kootenai Tribes

1l:l0 a.m. Limnology of Flathead Lake and Modeling - Richard Hauer, Charlie Hall, Jon Jourdonnais

12:40 p.m. Lunch

1:40 p.m. Projects Nos. 84-39 (MDFWP) and 84-38 (USFS) - Chris Yde
"Ural-Tweed Bighorn Sheep - Wildlife Mitigation Project"

2:30 p.m. Project No. 83-463, MDFWP - Mark Lere
"Evaluation of Water Releases at Painted Rock Reservoir"

3:00 p.m.	Project No. 86-74, WDG - Jack Howerton "Wildlife Protection, Mitigation, and Enhancement Planning for Grand Coulee Dam"
3:15 p.m.	Project No. 85-1, IDFG - Allyn Meuleman "Wildlife and Wildlife Habitat Loss Assessments for the Anderson Ranch, Black Canyon, and Boise Diversion Hydroelectric Facilities in Idaho"
3:45 p.m.	Project No. 84-36, ODFW - Jim Noyes "Wildlife and Wildlife Habitat Loss Assessments for the Willamette River Basin Federal Hydroelectric Facilities"

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List of Attendees

January 14 and 15, 1986

Name	Agency	Phone
Joe Ball	UM	(406) 243-5372
Will Beattie	MDFWP	(406) 755-5505
Gael Bissell	MDFWP	(406) 755-5505 x-220
Sharon Blair	BPA	(503) 230-4982
Ed Bowles	IDFG	(208) 265-3111
Bill Bradshaw	CS&KT	(406) 675-2700
Robert Braund	MDFWP	(406) 755-5505
Margaret Brittingham	UCUT	(509) 359-2523
Ken Brooker	USCOE	(206) 764-3591
Chuck Brooks	USFS	(406) 293-6211
Dave Bunnell	USFS	(406) 755-5401
Daniel Casey	MDFWP	(406) 755-5505 x-242
Ian Chisholm	MDFWP	(406) 293-7639
Jim Claar	BIA	(406) 675-2700 x-259
Pat Clancey	MDFWP	(406) 755-5505
Jay Crenshaw	IDFG	(208) 265-4185
David Cross	CS&KT	(406) 675-2700 x-366
Jim Darling	CS&KT	(406) 675-2700
Joe Dos Santos	CS&KT	(406) 675-2700
Vern Ellis	IDFG	(208) 683-2886
John Fraley	MDFWP	(406) 755-5515
Mark Gaub	MDFWP	
David Geist	UCUT	(509) 359-2523
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