Draft

Pend Oreille Subbasin Summary

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Prepared for the
Northwest Power Planning Council

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Pend Oreille Subbasin Summary

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Background

The Pacific Northwest Electric Power Planning and Conservation Act (Act) of 1980 explicitly gives the Bonneville Power Administration (BPA) the authority and responsibility "to protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries in a manner consistent with . . . the program adopted by the Northwest Power Planning Council (NPPC) . . . and the purposes of this Act." The Act further requires BPA and the federal hydropower project operators and regulators to take the program into account to the fullest extent practicable at each relevant stage of their decision-making processes.

The NPPC is a planning, policy-making, and reviewing body. It develops and monitors implementation of the Columbia River Basin Fish and Wildlife Program (Program), which is implemented by BPA, the U.S. Army Corps of Engineers (USACOE), the U.S. Bureau of Reclamation, and the Federal Energy Regulatory Commission (FERC) and its licensees. The Program is not intended to address all fish and wildlife problems in the Columbia Basin from all sources. Rather, the Program is meant to accommodate the needs of other programs in the basin that affect fish and wildlife, and unify and coordinate a framework for fish and wildlife mitigation and recovery activities across the basin.

Section 4(h) of the Act establishes statutory guidelines that the NPPC must adhere to in the development of the Program. The NPPC ensures that the Program complements the existing and future activities of the federal and region's state fish and wildlife managers and appropriate Indian tribes and that they remain consistent with the legal rights of appropriate Indian tribes in the region (Section 4[h][6]). The NPPC also ensures this consistency by giving deference to the recommendations of the basin's fish and wildlife managers in all decision-making processes and that they remain consistent with the legal rights of the appropriate Indian tribes. There are various statutory standards within the Act that the NPPC must adhere to, including:

- §4(h)(6)(B) The Program will "be based on, and supported by, the best available scientific knowledge";

- §4(h)(8)(a) The Program shall, "in appropriate circumstances," include enhancement measures "as means of achieving offsite protection and mitigation with respect to compensation for losses arising from the development and operation of the hydroelectric facilities of the Columbia River and its tributaries";

- §4(h)(10)(A) Measures "to protect, mitigate and enhance fish and wildlife to the extent affected by the development and operation of the Federal Columbia River Power System (FCRPS)" will "be in addition to, and not in lieu of, other expenditures authorized or required from other entities under other agreements or provisions of law"; and

- §4(h)(7) "In the event recommendations received are inconsistent with each other, the NPPC, in consultation with appropriate entities, shall resolve such inconsistency in the Program giving due weight to the recommendations, expertise, and legal rights and

responsibilities of the federal and the region's state fish and wildlife agencies and appropriate Indian tribes."

Ultimately, the NPPC will amend into the Program specific subbasin plans that are consistent with the basin wide goals and objectives the Program sets forth. The NPPC relies on subbasin summaries to provide the context for the development of subbasin plans. The subbasin assessment and planning process will complete the Program at the subbasin level and provide the implementation plans out of which fish and wildlife projects are proposed for BPA funding to implement the Program. These subbasin summaries are an interim arrangement pending development of the new Program. Subbasin summaries are a documentation of existing assessments, plans, and other information available within each subbasin and are written by subbasin teams.

Fish and wildlife managers comprise the core members of subbasin teams. Core members of the Pend Oreille subbasin team which have the legal responsibility for fish and wildlife management are the Idaho Department of Fish and Game (IDFG), Washington Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service (USFWS), the Coeur d'Alene Tribe (CDAT) and the Kalispel Tribe of Indians (KT). These entities are responsible for coordinating fish and wildlife needs and management strategies; ensuring that subbasin summaries and plans have all of the elements necessary to protect, mitigate, and enhance fish and wildlife affected by the development, operation, and management of the FCRPS; and ensuring that the summaries are ready to submit to the NPPC. Other key members of the subbasin teams include 1) federal, state, and tribal land managers; 2) federal, state, and tribal water quality managers; and 3) private land and water owners. Their role in the subbasin team is to provide input on the status of habitat quality, ongoing monitoring efforts, and habitat strategies; recommend habitat actions to meet habitat quality objectives; and assure consistency with other planning efforts.

Introduction

The Pend Oreille subbasin (Figure 1) is located in northern Idaho, a northwestern Montana, and northeastern Washington. The Pend Oreille subbasin extends from Cabinet Gorge Dam downstream to the United States (U.S.) - Canadian border. The subbasin is divided into three areas: 1) all of Lake Pend Oreille and its tributaries from Cabinet Gorge Dam, located on the Clark Fork River, to Albeni Falls Dam which is located on the Pend Oreille River; 2) the Pend Oreille River and its tributaries between Albeni Falls Dam and the U.S. - Canadian border; and 3) the Priest River subbasin, including Upper Priest Lake, Priest Lake, and all tributaries up to the U.S.-Canadian border.

Figure 1. Location of the Pend Oreille subbasin

Area 1: Upper Pend Oreille

Subbasin Description

General Location

The Upper Pend Oreille subbasin encompasses all of Lake Pend Oreille and its tributaries, including 15 km of the Clark Fork River upstream to Cabinet Gorge Dam, and the Pend Oreille River and its tributaries down to Albeni Falls Dam (Figure 2). Lake Pend Oreille is located in the panhandle region of northern Idaho and lies primarily within Bonner County. Lake Pend Oreille inflow and outflow are regulated by two hydroelectric facilities. Inflow is controlled by Cabinet Gorge Dam, completed in 1952, and Noxon Rapids Dam, completed in 1959. Both of these projects are “power peaking” facilities owned and operated by Avista Corporation (Avista). Due to lack of storage capacity, the Cabinet Gorge project does not influence the seasonal hydrograph. The USACOE operates Albeni Falls Dam, which is located on the Pend Oreille River near the Washington border.

Figure 2. Location of the Upper Pend Oreille subbasin, Idaho

Drainage Area

Three major tributaries enter Lake Pend Oreille. The Clark Fork River enters the lake approximately 15 km from the Idaho - Montana border. The Pack River drains into the northeastern portion of the lake. Priest River drains into the Pend Oreille River an estimated 8 km upstream from Albeni Falls Dam.

Topography/geomorphology

The Selkirk Mountains to the west, the Cabinet Mountains to the north, and the Bitterroot Mountains to the east shape the Upper Pend Oreille subbasin. The subbasin was substantially altered by major glacial events in the late Pleistocene period. Glacial advances resulted in highly dissected watersheds with high stream density, shallow soils, and subsoil compaction of glacial tills. During the Precambrian period, shallow seas inundated northern Idaho. Sediments of clay, silt and sand settled out of brackish waters as seas retreated, subsequently metamorphosed, and began to fold and fault. Groundwater seeps and springs are prevalent in tributaries draining the Cabinet and Bitterroot Mountains to the north and east of Lake Pend Oreille.

Generally, streams on the northern and eastern sides of Lake Pend Oreille tend to be more productive and have much less fine sediment than streams draining the granitic soils of the Selkirk Mountains. Streams flowing from the Cabinet and Bitterroot Mountains are more likely to have bedload as a limiting habitat factor, whereas streams flowing from the granitic watersheds of the Selkirk Mountains may have fine sediment limiting habitat condition.

Migratory fish are precluded from several tributaries, or portions of tributaries due to natural waterfalls found throughout the basin.

Climate

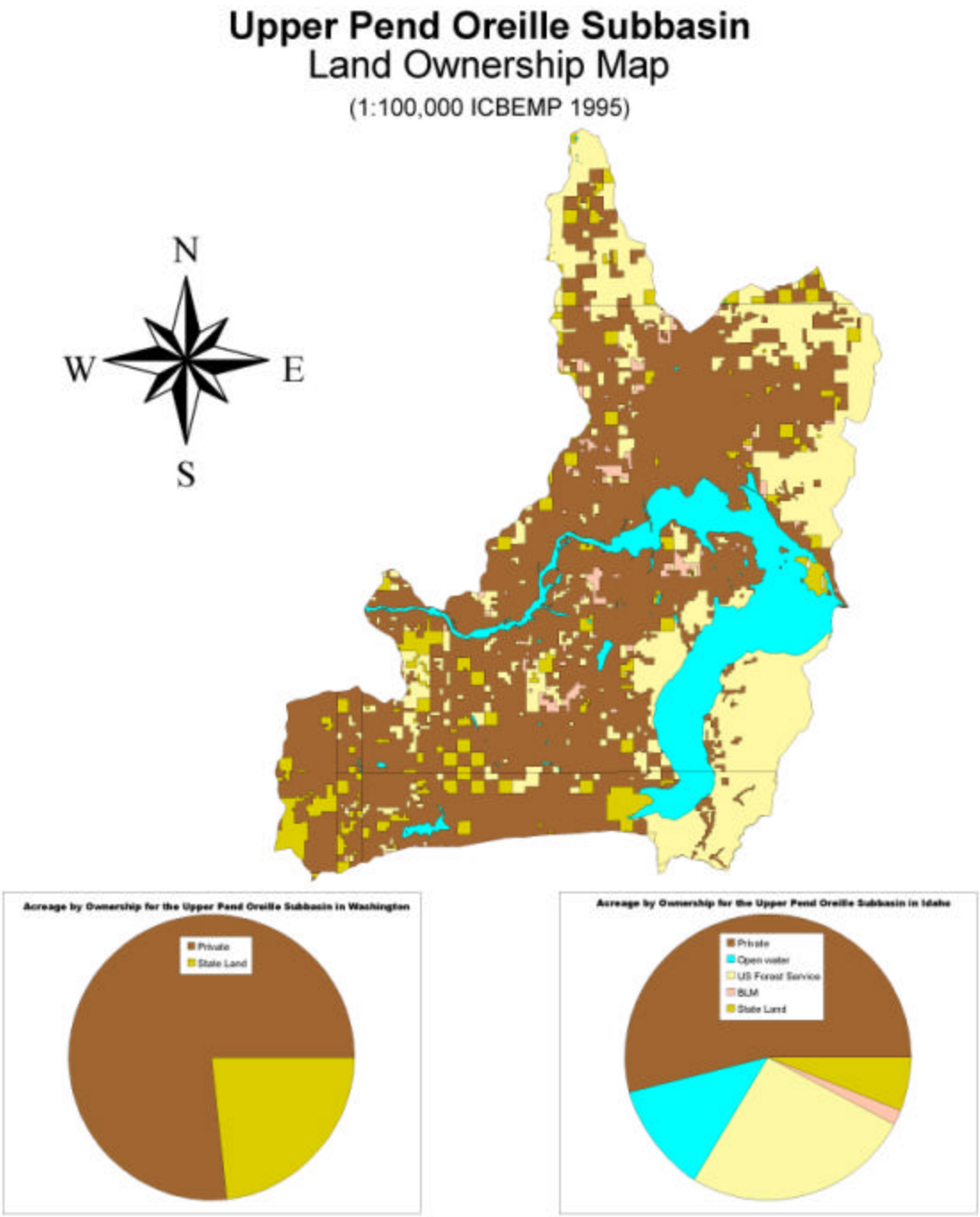
Continental and marine weather patterns influence climatic conditions in the Lake Pend Oreille subbasin. Winter storms pass over the area from November through March causing a noticeably wet climate. Mid-winter storms periodically bring warm air masses resulting in rain-on-snow events at middle elevations of 762 meters (m) mean sea level (msl) to 1,372m msl. Summer storms, however, generally pass farther north resulting in relatively dry seasonal conditions. Winds typically prevail from the southwest across Lake Pend Oreille.

Average monthly temperatures in the area range from –3° Celsius (C) to 18°C. Annual precipitation averages 84 centimeters (cm) in Sandpoint and exceeds 125 cm in the surrounding mountains (Weisel 1982). Precipitation falls mainly as snow in the winter months, averaging 224 cm per year.

The main body of Lake Pend Oreille seldom freezes in winter; however, shallow areas in the northern end of the lake form an ice cover in some years.

Major Land Uses

The majority of the Upper Pend Oreille subbasin is managed by the U.S. Forest Service (USFS) (Figure 3). Major land uses in the subbasin include agricultural and timber production and recreational development (Figure 4).



All Acreage by Ownership
1) Private - 430,273 acres
2) Open Water - 93,423 acres
3) US Forest Service - 194,146 acres
4) BLM - 12,689 acres
5) State Lands - 53,370 acres

Figure 3. Land ownership categories in the Upper Pend Orielle subbasin

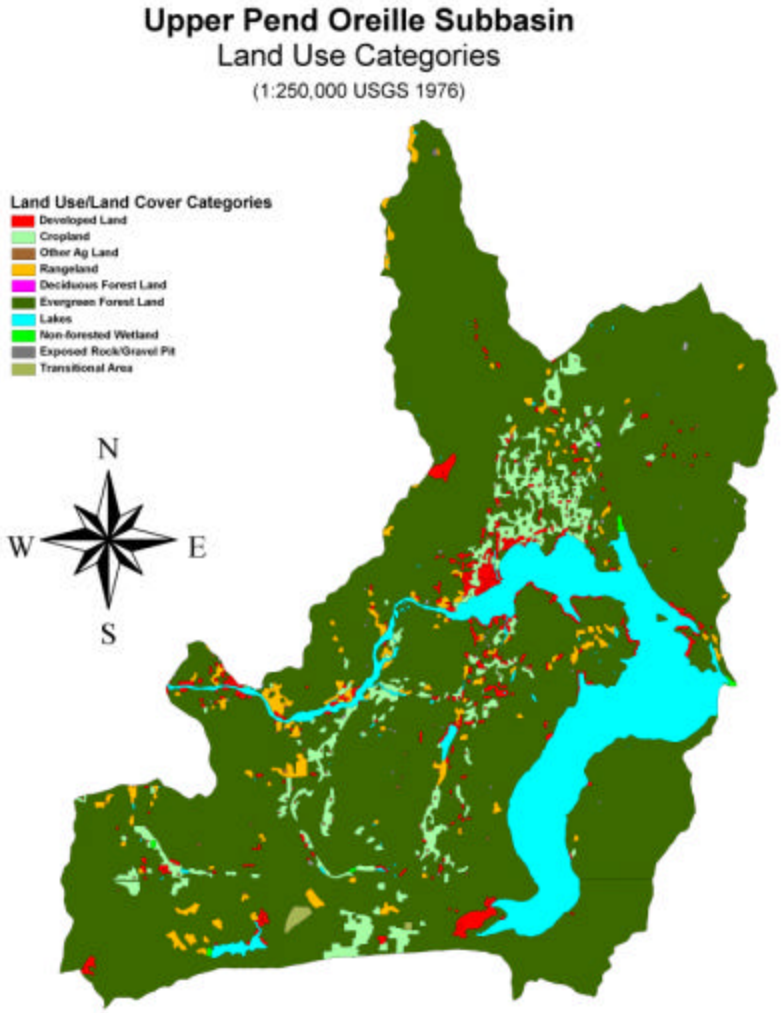


Figure 4. Land use categories for the Upper Pend Oreille subbasin

Hydrology

Lake Pend Oreille is the largest and deepest natural lake in Idaho, covering approximately 33,696 hectares (ha) prior to impoundment by Albeni Falls Dam in 1952. At full pool the lake now covers 38,362 ha (USFWS 1953, Hoelscher 1993). The lake has more than 282 km of shoreline and has a mean and maximum depth of 164 m and 351 m, respectively (Rieman and Falter 1976). An estimated 95% of the lake's volume is held in the large, southern-most basin, a glacially influenced portion of the Purcell Trench (Savage 1965) with a mean depth of 218 m.

The USACOE regulates the lake's elevation between a winter time low of 625.1m msl and a summer time high of 628.6m msl. Winter drawdown generally begins after Labor Day.

Minimum pool is normally reached between November 15 and December 1, with a target date of November 15 to facilitate kokanee salmon spawning.

The Clark Fork River is the largest tributary to Lake Pend Oreille. It drains the Clark Fork River watershed, an area of approximately 59,324 km^2 (Lee and Lunetta 1990). The river contributes approximately 92% of the annual inflow to the lake (Frenzel 1991) and most of the annual suspended sediment load. Tributaries to the Clark Fork below Cabinet Gorge Dam include Lightning Creek, Twin Creek, Mosquito Creek, and Johnson Creek. Pack River is the second largest tributary to the lake and is fed by a number of significant tributary watersheds, including Grouse Creek.

Annual runoff in the Clark Fork River is produced by melting snow, with peak flows typically occurring in May or June, but occasionally in April or July. Tributaries to the lake and Pend Oreille River may experience one or more run-off events. Mid-winter rain-on-snow events can result in rapid snowmelt, and in some years the peak flow from tributary watersheds occurs during these events. Lightning Creek and other tributaries draining the Cabinet and Bitterroot Mountains are particularly susceptible to rain-on-snow events due to high precipitation, their location in relation to the lake, prevailing winds, and the tendency for warm winter storms to pick up moisture from the lake. The Pend Oreille River is the only surface outflow from Lake Pend Oreille. The river flows for about 44 km from the lake's northwest corner near Sandpoint into Washington. Lake Pend Oreille is hydrologically connected to the Spokane Valley-Rathdrum Prairie aquifer at the lake's southernmost end, contributing about 44 million cubic meters (m^3) of water annually to the aquifer via subsurface flow (Hammond 1974, Drost and Seitz 1978).

Water Quality

Lake Pend Oreille is an oligotrophic (nutrient poor) lake. The lake's trophic status was determined in 1989 (Ryding and Rast 1989) using euphotic zone depth, annual mean total phosphorus concentrations, mean and maximum chlorophyll *a* concentrations, and mean and minimum secchi disc water transparency depths. Nutrient concentrations in shoreline areas and in the northern basin of the lake are considerably higher due to urbanization and suspended sediments in Clark Fork River inflow. Most of the annual phosphorus, and suspended sediment load enters the lake via the Clark Fork River (Hoelscher 1993). Studies of the pelagic zone (open water area) of Lake Pend Oreille indicated no major temporal changes in water quality variables such as secchi-disc readings, pH, alkalinity, dissolved oxygen, percent saturation, nutrients, chlorophyll-a, and trophic state (Woods 1991).

A number of stream segments within the Upper Pend Oreille subbasin are listed as water quality limited (IDEQ 1998). Granite Creek, Pend Oreille River, Pend Oreille Lake, North Fork of Grouse Creek, Caribou Creek, Fish Creek, Schweitzer Creek, Cocolalla Creek, and Hoodoo Creek are all listed for various "pollutants of concern" including sediment, flow, total dissolved gas (TDG), habitat alteration, and thermal modification. Sediment has also reduced the suitability for the production of native bull trout of a number of streams that are not listed, including Lightning Creek, its tributaries, and Twin Creek.

Vegetation

Historic vegetation patterns in the Upper Pend Oreille subbasin were largely influenced by wildfire. Early accounts and photographs of the subbasin indicate that old-growth stands of

western red cedar, *Thuja plicates*, and other species were common in riparian zones and floodplains. Large cedar stumps can still be found in many riparian areas along subbasin streams. Uplands were more typically dominated by seral species in various stages of succession, with age and composition dependent largely on fire cycles, elevation, slope, and aspect.

Euro-American settlement of the Clark Fork River Valley and Lake Pend Oreille was accompanied by forest clearing, agricultural development, logging, introduction of non-native pests, mining, railroad construction, hydroelectric projects, and general urbanization. Forest products are an important commodity in the subbasin. Forest fires have had a profound impact on vegetation within the Upper Pend Oreille subbasin during the last century. One fire ecologist speculated that riparian areas along the Clark Fork River and Lake Pend Oreille might have escaped the 1910 forest fire that burned an estimated 1.2 million ha in western Montana and northern Idaho (Peek 1983 as cited in MDFWP 1984). Other streams in the watershed were burned extensively by timber companies to remove understory vegetation following riparian and up-slope logging operations (USFS 1993). Low elevation riparian zones near tributary mouths include areas with and without tree canopy cover. Along stream corridors where tree overstory does not exist or is thin, vegetation includes shrubs and small trees such as thin-leaf alder, *Alnus sinuate;* willows, *Salix spp*.; snowberry, *Symphoricarpos albus;* mountain maple, *Acer glabrum;* red-osier dogwood, *Cornus stolonifera;* blue elderberry, *Sambucus cerulea;* and black hawthorn, *Crataegus douglasii.* Where tree canopy is present, tree species include black cottonwood, *Populus trichocarpa;* water birch, *Betula occidentalis;* quaking aspen, *Populus tremuloides;* and a mix of conifer species including western red cedar, western hemlock, *Tsuga heterophylla*; Douglas fir, *Psuedotsuga menziesi;* grand fir, *Abies grandis;* and western white pine, *Pinus monticola*.

Conifer forests in the subbasin consist of mixed stands, typified by stands of western red cedar/western hemlock; stands of co-dominant Douglas fir and ponderosa pine, *Pinus ponderosa;* stands of Douglas fir; western larch, *Larix occidentalis;* lodgepole pine, *Pinus contorta;* and western white pine. Dense stands of Douglas fir, larch, and lodgepole are characteristic of slopes with north and east aspects. Relatively open stands of Douglas fir and ponderosa pine are typical on the warmer, dryer south and west aspects.

Representative species of upland shrubs include western serviceberry, *Amelachier alnifolia;* mountain maple; snowberry; mountain balm, *Ceanothus velutinus;* mallow ninebark, *Physocarpus malvaceus;* huckleberry, *Vaccinium spp.;* and others.

Vegetation can strongly influence conditions in streams. Canopy cover adjacent to streams provides shade and helps to maintain cooler water temperatures during summer months. Conifers may also provide insulation during winter months, reducing freezing and formation of anchor ice. Large trees which fall into streams and floodplains help to shape channels, create pools, provide cover and shade, introduce and store nutrients, dissipate stream energy, and contribute to overall channel stability (Murphy and Meehan 1991). Riparian vegetation also plays an important role in providing stream bank stability through binding of soils by roots. The amount, type, and stage of vegetation in a watershed can also influence stream flows. Vegetation removal by fire or timber harvest can result in increased peak flows during storm events and increased summer flows (Harr 1981 and King 1989). Increased peak flows during winter months, when bull trout eggs are incubating, may reduce hatching success.

Vegetation patterns have a profound influence on distribution and abundance of wildlife species in upland habitats. Stand replacing wildfires periodically replaced older, mature stands of

timber, shifting wildlife species use from old-growth/mature forest dependent wildlife species, such as pileated woodpeckers and caribou, to species favoring early seral conditions, such as elk.

Fish and Wildlife Resources

Fish and Wildlife Status

The Upper Pend Oreille subbasin supports a significant complement of fish and wildlife species. Many are important to the region for economic, aesthetic, cultural, recreational, and ecological values.

Fisheries

Over 30 species of fish, including 12 native species, are found in the Upper Pend Oreille subbasin (Table 1).

Table 1. Fish species present in the Upper Pend Oreille subbasin.

Species	Origin	Location	Status
Bull trout (*Salvelinus confluentus*)	N	L,R,T	A/S-D
Westslope cutthroat trout (*Oncorhynchus clarki lewisi*)	N	L,R,T	C/S-D
Mountain whitefish (*Prosopium williamsoni*)	N	L,R,T	C/S-D
Pygmy whitefish (*Prosopium coulteri*)	N	L	U/U
Rainbow trout (*Oncorhynchus mykiss*)	E	L,R,T	A/S
Kokanee salmon (*Oncorhynchus nerka*)	E	L,R,T	C/D
Lake trout (*Salvelinus namaycush*)	E	L	C/I
Brook trout (*Salvelinus fontinalis*)	E	T	C/I
Brown trout (*Salmo trutta*)	E	L,R,T	C/S
Lake whitefish (*Coregonus clupeaformus*)	E	L	A/S
Longnose dace (*Rhinichthys cataractae*)	N	L,R,T	C/U
Redside shiner (*Richardsonius balteatus*)	N	L,R,T	C/U
Peamouth (*Mylocheilus caurinus*)	N	L,R	C/U
Tench (*Tinca tinca*)	E	L,R	C/I
Largescale sucker (*Catostomus catastomus*)	N	L,R,T	C/U
Longnose sucker (*Catostomus macrocheilus*)	N	L,R,T	C/U
Slimy sculpin (*Cottus cognatus*)	N	L,R,T	C/U
Torrent sculpin (*Cottus rhotheus*)	N	L,R,T	C/U
Burbot (*Lota lota)*	E	L,R	O/D
Northern pike (*Esox lucius*)	E	L	C/I
Tiger muskie (*Esox lucius x E. masquinogy*)	E	L	O/D
Yellow perch (*Perca flavescens*)	E	L,R	A/S
Walleye (*Stizostedion vitreum*)	E	L,R	O/D
Crappie (*Pomoxis spp*.)	E	L,R	C/S
Channel catfish (*Ictalurus punctatus*)	E	L,R	O/D
Brown bullhead (*Ameiurus nebulosis*)	E	L,R	C/S
Largemouth bass (*Micropterus salmoides*)	E	L,R	C/S-D
Smallmouth bass (*Micropterus dolomieui*)	E	L,R	C/S-D

Species	Origin	Location	Status
Pumpkinseed (*Lepomis gibbosus*)	E	L	C/S
Bluegill (*Lepomis macrochirus*)	E	L	O/I

E=Exotic, N=Native, L=Lake, R=River, T=Tributary, A=Abundant, C=Common, O=Occasional, U=Unknown, S=Stable, I=Increasing, D=Declining

Lake Pend Oreille supports a significant sport fishery. In 1991, anglers expended an estimated 465,000 hours fishing the lake with approximately 65% of the effort targeting trout and 35% of the effort targeting kokanee (Paragamian 1994). The world record bull trout, 14.5 kilograms (kg), and the world record rainbow trout, 16.8 kg, were taken from Lake Pend Oreille in 1949 and 1947, respectively. Currently, target species for management efforts in the lake are kokanee salmon, rainbow trout, bull trout, cutthroat trout, and lake trout. The kokanee fishery was closed to harvest, and harvest limits on lake trout and rainbow trout were relaxed in 2000 due to the steady declines in the kokanee population, which could be exacerbated by predation.

Prior to construction of Albeni Falls and Cabinet Gorge dams, the lower Clark Fork River supported important fisheries for migrating kokanee salmon, mountain whitefish, and bull trout. Westslope cutthroat trout were also present in the river and provided a fishery for fluvial and adfluvial fish. Currently, rainbow trout, brown trout, westslope cutthroat trout, and mountain whitefish are the principle sport fish in the lower Clark Fork River. Bull trout are also present and occasionally caught by anglers. Management direction is to improve habitat and recruitment to the river, with the fishery dependent on wild fish. Ecologically, restoring connectivity to the lower Clark Fork system is important as the Idaho portion currently serves as a sink for fish migrating downstream from Montana. Likewise, restoring access to the hundreds of miles of spawning and rearing habitat available in the Montana portion of the lower Clark Fork watershed provides an opportunity to bolster native populations of bull trout, westslope cutthroat trout, and mountain whitefish.

The Pend Oreille River, prior to the construction of Albeni Falls Dam, provided free flowing riverine habitat that supported a coldwater fishery for cutthroat trout, rainbow trout, mountain whitefish, and occasionally bull trout. Today, only a limited fishery for warmwater fish species and virtually no coldwater fish exist due to operational impacts of Albeni Falls Dam (Bennett and DuPont 1993). Management direction is to work with the USACOE on lake level management to improve conditions for warmwater species.

Bull Trout

Lake Pend Oreille and its tributaries have historically provided a highly regarded sport fishery for bull trout, including trophy specimens. Estimated harvest peaked in the 1950's, as the last of the fish produced from adfluvial runs to Montana tributaries became available to anglers. Legal harvest of bull trout was discontinued beginning in 1996 due to the pending Endangered Species Act (ESA) listing and declining spawning runs in several tributaries. Kokanee were recently documented to be the principle food item of bull trout over 406 millimeters (mm), comprising 66% of the diet (Vidergar 2000). The Pend Oreille bull trout population is comprised of a number of genetically distinct local populations, many of which have declined due to habitat loss. Despite local population declines in some tributary spawning stocks with an estimated total adult population between 8,000 and 16,000 fish (Vidergar 2000), the Pend Oreille bull trout

population is generally considered to be one of the strongest remaining populations in the U.S. Local citizens and agency representatives developed the *Idaho Bull Trout Conservation Plan* (Lake Pend Oreille Bull Trout Watershed Advisory Group 1999). The plan calls for restoring bull trout such that healthy local populations are well distributed around the Lake Pend Oreille subbasin and that a harvestable surplus of fish will be available. Bull trout restoration is also a primary emphasis of the Lower Clark Fork Settlement Agreement (Settlement Agreement) forged by Avista and local, state, and federal entities as part of the relicensing of Cabinet Gorge and Noxon Rapids dams. The Settlement Agreement includes provisions for restoring fish passage past Cabinet Gorge and Noxon Rapids dams.

Westslope Cutthroat Trout

Westslope cutthroat trout comprised an important part of the sport fishery up until the 1960's, but have since declined. Hatchery production was used through the 1990's to supplement wild stocks and provide a limited harvest fishery. Hybridization with rainbow trout, competition, and loss of habitat have contributed to declines of westslope cutthroat trout, but they are still widely distributed in tributary streams and are an important component of the lower Clark Fork River fishery. Harvest limits on westslope cutthroat trout were reduced in in 2000 in an effort to reduce harvest. Cutthroat trout restoration projects, including fish passage are a key component of the Native Salmonid Restoration Plan (NSRP) in the Settlement Agreement.

Kokanee

Since being introduced through emigration from Flathead Lake in the 1930's, kokanee have established themselves as a keystone species in Lake Pend Oreille. Kokanee provide forage for predatory bull, rainbow, lake trout, bald eagles, and a host of other wildlife species. The Lake Pend Oreille kokanee fishery was one of the most significant kokanee fisheries in the western U.S. and Canada. During the 1950's and 1960's, kokanee harvest averaged 1 million fish annually with a high of 1.3 million fish in 1953. This made Lake Pend Oreille the largest fishery in Idaho. Kokanee abundance began declining in 1966 concurrent with deeper drawdowns of the lake (Figure 5) (Maiolie and Elam 1993). Fishery was closed in 2000.

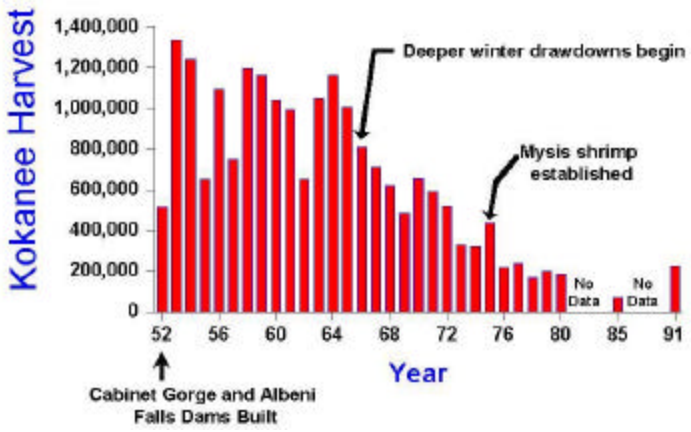


Figure 5. Harvest of kokanee from Lake Pend Oreille, Idaho

Kokanee salmon populations have declined precipitously since the 1960's (Figure 6). This decline has been largely attributed to the current operation of Albeni Falls Dam (Maiolie and Elam 1993; Paragamian and Ellis 1994). Historical population trends and harvest data indicate winter pool elevation effect kokanee abundance and harvest. Consistent annual drawdowns of the lake, below the elevation needed for flood control, exposed most of the shoreline gravel and limited kokanee spawning. Gravel surveys conducted in 1994 determined a 1.6-meter higher winter pool level would increase the amount of suitable kokanee spawning gravel by 560% (Fredericks *et al.* 1995).

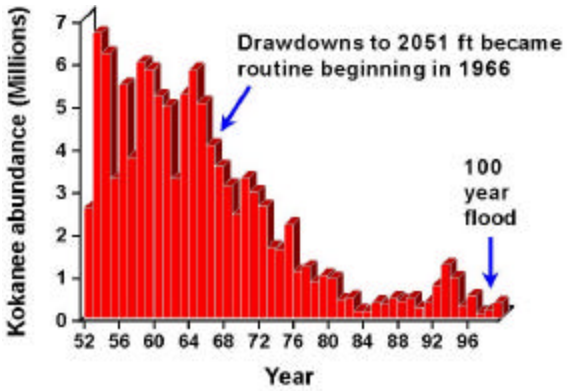


Figure 6. Estimates of kokanee abundance in Lake Pend Oreille, Idaho

The NPPC directed the USACOE to change the winter elevation of Lake Pend Oreille beginning in 1996. The lake was to be kept above an elevation of 626m msl for three winters. The IDFG investigated the effect of changed lake levels on kokanee production, the movements of shoreline gravel and sediment, and changes in the abundance of warmwater fish species in the Pend Oreille River. The higher winter lake level made an additional 167,225 m^2 of gravel available for kokanee (Fredericks *et al.* 1995). The survival rate for kokanee eggs to fry increased from 1.4% in 1995 to 9.6% in 1998 and 6.0% in 1999. This 500% increase in survival will be evaluated further. Additional studies were conducted on predation levels, the lake's energy budget, zooplankton, food availability for kokanee, opossum shrimp, and Eurasian watermilfoil, *Myriophyllum spicatum* (EWM).

Beginning in 2000, an emergency closure was imposed on kokanee harvest to maximize the number of spawners available to rebuild the population. The IDFG's management goals are to recover kokanee populations to a level where they can provide forage for trophy species and produce an annual harvest of 750,000 kokanee.

The kokanee population in the lake is monitored annually by mid-water trawling and hydroacoustics. The IDFG estimated kokanee abundance at 8.8 million fish in 1999, with a biomass of 240.4 metric tons, an annual production rate of 220.8 metric tons, and an annual yield to all sources of mortality of 235.8 metric tons (Maiolie 2000, in press). For comparison, total abundance was 13.7 million kokanee in 1996, with a biomass of 391.4 metric tons, an annual production rate of 299.3 metric tons, and an annual yield of 205 metric tons (IDFG files). These recent declines in kokanee abundance are considered very serious since even the higher abundance in 1996 was only at a one quarter of the population's recovery goal.

Rainbow Trout

Rainbow trout were first introduced into the Pend Oreille system in 1919, and the Gerrard strain rainbow trout, which are predaceous and grow to large sizes, were first introduced to the lake in 1941. Vidergar (2000) found that 77% of the diet of rainbow trout larger than 275 mm is kokanee. Trophy specimens exceeding 10 kg are caught every year and attract anglers from all over the country. Long-term management goals for the lake include continuing to provide a trophy rainbow trout fishery, utilizing kokanee salmon as a forage base. Bag limits, size restrictions, and season restrictions for rainbow trout were recently expanded to encourage angler harvest and reduce predation on the depressed kokanee population. These measures are intended to be short-term until the kokanee population shows signs of recovery as demonstrated by an increasing population trend. Resident rainbow trout contribute to the lower Clark Fork fishery, and rainbow trout are widely distributed in tributaries to Lake Pend Oreille and the lower Clark Fork River. Rainbow trout pose a threat of hybridization with westslope cutthroat trout, with hybrids being common in some portions of the subbasin.

Lake Trout

In 1925, the U.S. Fish Commission first introduced lake trout into Lake Pend Oreille. Lake trout dispersing from Flathead Lake, and possibly Upper Priest Lake and Priest Lake, likely contribute to the Lake Pend Oreille lake trout population. Lake trout are well established in Lake Pend Oreille and contribute to the sport fishery. They are considered to be a potentially significant threat to native fish and kokanee; therefore, the management emphasis is to reduce lake trout numbers through a year-round, no bag limit regulation. A mark-and-recapture population estimate of lake trout in 1999 was 1,792 fish with a 95% confidence interval of 1,054 to 5,982 (Vidergar 2000). Lake trout are thought to comprise 4% of the predator biomass and consume 2% of the kokanee production (Vidergar 2000).

Wildlife

The Upper Pend Oreille subbasin supports a diversity of wildlife species that provide important recreational opportunities for viewing, hunting, and trapping. Several species are federally listed under the ESA (Table 2).

Table 2. Wildlife species of the Upper Pend Oreille subbasin currently listed under the ESA

Species	Status
Grizzly bear (*Ursus arctos*)	Threatened
Woodland caribou (*Rangifer tarandus*)	Endangered
Gray wolf (*Canis lupus*)	Endangered
Lynx (*Lynx canadensis*)	Threatened
Bald eagle (*Halieeatus leucocephalus*)	Threatened

White-tailed deer, *Odocoileus virginianus*, are the most sought-after big game species, followed by elk, *Cervus elaphus*, black bear, *Ursus americanus*, and mountain lion, *Felis concolor*. Significant hunting activity is expended in pursuit of waterfowl, ruffed grouse, *Bonasa umbellus*, and wild turkeys.

Other big game species include mule deer, *O. hemionus;* moose, *Alces alces;* and mountain goat, *Oreamnos americanus*. Furbearers present include beaver, *Castor Canadensis;*

mink, *Mustela vison;* fisher, *Martes pennanti*, marten, *M. Americana;* river otter, *Lutra canadensis;* muskrat, *Ondatra zibethica;* and wolverine, *Gulo gulo*. Numerous small mammals are present.

Lake Pend Oreille, the lower Clark Fork River, and the Pend Oreille River have historically been important waterfowl migration and wintering areas. These areas provide important waterfowl nesting habitat as well. The Upper Pend Oreille subbasin supports 20% of all the wintering redhead ducks, *Aythya Americana,* in the Pacific flyway. Over 20 species of waterfowl using waters in the Upper Pend Oreille subbasin have been documented (Table 3).

Table 3. Waterfowl inhabiting the Upper Pend Oreille subbasin

Species
Mallard (*Anas platyrhynchos*)
Gadwall (*Anas strepera*)
Green-winged teal (*Anas crecca*)
Cinnamon teal (*Anas cyanoptera*)
Blue-winged teal (*Anas discors*)
American wigeon (*Anas americana*)
Pintail (*Anas acuta*)
Shoveler (*Anas clypeata*)
Ruddy duck (*Oxyura jamaicensis*)
Wood duck (*Aix sponsa*)
Redhead ducks (*Aythya americana*)
Canvasback (*Aythya valisineria*)
Ring-necked duck (*Aythya collaris*)
Lesser scaup (*Aythya affinis*)
Harlequin duck (*Histrionicus histrionicus*)
Bufflehead (*Bucephala albeola*)
Barrow's goldeneye (*Bucephala islandica*)
Common goldeneye *(Bucephala clangula*)
Common merganser (*Mergus merganser*)
Hooded merganser (*Lophodytes cucullatus*)
Canada goose (*Branta canadensis*)
Tundra swan (*Cygnus columbianus*)

Raptors using the area for nesting and/or as a migratory stop when food is plentiful include osprey, *Pandion haliaetus;* bald eagle; peregrine falcon, *Falco peregrinus;* and a variety of hawks and owls. Lake Pend Oreille supports one of the largest concentrations of nesting ospreys in the western U.S. and may support several hundred bald eagles during the winter migration period when spawned-out kokanee and wintering waterfowl are available as a food source (Martin *et al.* 1988). At least 10 pairs of bald eagles are known to nest along Lake Pend Oreille, the lower Clark Fork River, and the Pend Oreille River (C. Brengle, USACOE, personal communication).

Many species of songbirds, including year-round residents and neotropical migrants, are known to use the Upper Pend Oreille subbasin. At least two great blue heron, *Ardea herodias,*

rookeries are present along the Pend Oreille River and the Clark Fork River delta. Martin *et al.* (1988) completed an assessment of wildlife impacts associated with the construction and inundation of Albeni Falls Dam. Table 4 (Martin, *et al.* 1988) summarizes wildlife habitat losses for the target wildlife species. An interagency team of biologists used the Habitat Evaluation Procedure (HEP) to determine the quality and quantity of wildlife habitat impacted by the dam.

Table 4. Summary of Habitat Units (HUs) impacted by Albeni Falls Dam

Target species	Pre-construction HUs	Post-construction HUs	Net impact HUs
Mallard	10,995	4,970	-5,985
Canada goose	8,197	3,498	-4,699
Redhead	7,387	4,008	-3,379
Bald eagle (breeding)	7,730	3,222	-4,508
Bald eagle (wintering)	8,103	3,738	-4,365
Peregrine falcon	-	-	6,617 acres
Black-capped chickadee	3,157	871	-2,286
Yellow warbler	350	421	+71
White-tailed deer	2,686	1006	-1,680
Muskrat	3,722	2,016	-1,756

Habitat Areas and Quality

Fisheries

The Panhandle Bull Trout Technical Advisory Team (1998) assessed the condition of habitat and watershed condition for known and suspected bull trout waters within the Upper Pend Oreille subbasin (Appendix 1). Complete descriptions of these waters are provided in the *Lake Pend Oreille Bull Trout Key Watershed Problem Assessment* (Panhandle Bull Trout Technical Advisory Team 1998).

Fish habitat in tributary streams within the Upper Pend Oreille subbasin has been impaired through delivery of excess bedload sediment, fine sediment delivery, loss of large woody debris and riparian forest habitat, channelization, and isolation of streams from their floodplains (Panhandle Bull Trout Technical Advisory Team 1998). Man-made fish migration barriers and water diversions are scattered around the subbasin, resulting in loss of access to spawning and rearing habitat and loss of flow and migrating fish to diversions (Appendix 1).

During the summer and fall months, the lower 5.4 km of the Clark Fork River are flooded by backwater from Albeni Falls Dam, creating an unproductive environment for native and introduced salmonids. Riverine habitat is further compromised by Cabinet Gorge Dam and its operations, resulting in blocked fish passage, rapidly fluctuating river flows, and, during high water years, high levels of dissolved gas. The Settlement Agreement resulted in an increase in minimum flows released from Cabinet Gorge Dam from 85 cubic meters per second (cms) to 142 cms. The increased minimum flow results in an increase of over 4 ha of permanently wetted riffle habitat.

Cabinet Gorge Dam presents a complete migration block to fish migrating upstream from the Clark Fork River. Steps are underway to restore fish passage as part of the Settlement Agreement. There are high levels of TDG in the lower Clark Fork River, Lake Pend Oreille, and the Pend Oreille River as a result of river flows spilling over Cabinet Gorge Dam during periods

of high runoff. High TDG levels resulting from spill at Cabinet Gorge Dam may affect fish populations. Avista is working to reduce TDG as part of the Settlement Agreement. The effects of modified flow regimes in the lower Clark Fork River resulting from Hungry Horse Dam operations are unknown.

The Pend Oreille River provides good summer habitat for warmwater species including largemouth bass and yellow perch, but winter drawdown resulting from Albeni Falls Dam operations significantly compromises the ability of the river to support a healthy warmwater fishery. Riverine habitat in the Pend Oreille River below Albeni Falls is partially inundated by Box Canyon Dam and is an unproductive environment for both warmwater and coldwater sport fish. Consequently, only a marginal sport fishery exists in the Pend Oreille River in Idaho. It is not known what impact Albeni Falls Dam has on TDG. Albeni Falls Dam is a complete upstream migration block to fish.

In general, Lake Pend Oreille continues to provide good rearing habitat for coldwater fish species, but Albeni Falls Dam operations have resulted in impaired shoreline spawning habitat for kokanee salmon. Over 16 ha of high quality kokanee spawning habitat is estimated to be lost due to a 3.5-meter drawdown of Lake Pend Oreille during the winter months. Lowering of the lake to 625m msl each year has not allowed for shoreline gravel to be cleaned and resorted at a depth where it is available for kokanee spawning. Consequently, most kokanee spawning takes place at the south end of the lake where conditions are favorable. Studies are currently underway that address how dam operations may be changed to improve shoreline spawning. The effects of elevated TDG on lake fishes during periods of high runoff are currently not known but are under study by Avista.

Lake Pend Oreille's nutrient budget may also be affected by Albeni Falls Dam operations. Prior to impoundment, Lake Pend Oreille flooded well-vegetated shoreline areas during the spring, which likely resulted in an influx of nutrients to the lake at the onset of the summer growing season. Albeni Falls Dam operations inundated shoreline vegetation, resulting in an initial significant release of nutrients. Over time, that vegetation has been lost and higher elevation vegetation is only rarely flooded. Thus, it is possible that an important seasonal source of nutrients has been lost. Early summer nutrient releases would benefit plankton blooms and growth of kokanee salmon and other juvenile fish. Drawdown of the reservoir also results in an unproductive shoreline environment for production of aquatic invertebrates, potentially reducing a food source for shoreline feeding species such as cutthroat trout.

Wildlife

Upper Pend Oreille subbasin wildlife habitats range from sub-alpine areas of the Selkirk, Cabinet, and Coeur d'Alene Mountains to deepwater areas within Lake Pend Oreille. Habitats can be grossly divided into upland coniferous forest, and wetland/riparian/lake. The following discussion includes general descriptions of each of these divisions within the Upper Pend Oreille subbasin.

Upland Coniferous Forest

The moist, mild climate of the Pend Oreille subbasin contributes to the occurrence of richly diverse and productive forests dominated mainly by coniferous species. The diversity of the subbasin forest landscapes resulted from a complex interaction of elevation, aspect, climate, topography, geology, fire ecology, human influence, and soils. Perhaps the factors with the greatest effect are fire suppression, logging history, and white pine blister rust. These factors

resulted in disturbance and subsequent successional processes that are very different today than those that naturally occurred prior to Euro-American settlement. Early seral species such as ponderosa pine, western larch, and western white pine have declined in occurrence, while Douglas fir, grand fir, and western hemlock now dominate much of the forest landscape. The area occupied by old-growth forest has also been significantly reduced. Further, there are fewer large trees, snags, and downed woody debris within forest stands irrespective of successional stage. Generally, the Pend Oreille subbasin forests have lost diversity at a landscape scale.

Perhaps the most threatened forest type is low elevation ponderosa pine habitat where fire suppression and past logging resulted in replacement of widely spaced large trees, snags, and logs with dense, young Douglas fir and grand fir forests. These encroaching stands, compete with relic old trees for space and nutrients, eliminate ponderosa pine regeneration, and increase the potential for stand-replacing fire. It is estimated that greater than 75% of historic Interior Columbia Basin old-growth ponderosa pine ecosystems have been lost (USFS and BLM 1997). Noss *et al.* (1995) listed old-growth ponderosa pine forests as endangered (85 to 95% decline) in the northern Rocky Mountains, Intermountain West, and eastside Cascade Mountains. Henjum *et al.* (1994) recommended prohibiting logging of dominant or codominant ponderosa pine from forests in eastern Washington and Oregon, and Ritter (2000) identified dry ponderosa pine/Douglas fir/grand fir forests as a priority habitat for bird conservation in Idaho, with a goal of preventing additional loss of old-growth ponderosa pine forests. Low elevation old-growth ponderosa pine forests are especially important to flammulated owls, wintering ungulates, and animals such as black bears, grizzly bears, wolves, wolverine, fisher, lynx, cougar, and bald eagles that seek carrion associated with ungulate winter ranges.

An added impact to low elevation forests is recently accelerated subdivision and residential development. Impacts associated with residential development include removal of natural vegetation, which provides cover, forage, roosts, nest sites and dens, and increased human-related disturbances such as free-ranging dogs, snowmobiling, and cross-country skiing. In addition to direct mortality, harassment of wildlife by dogs during the winter stress period may predispose animals to other forms of mortality such as starvation. Habitat losses associated with rural residential development tend to be permanent. Consequently, impacts compound as development proceeds.

Some important conservation measures for upland forests in the Upper Pend Oreille subbasin include protection and restoration of low elevation ponderosa pine forests, and securing key low-elevation wildlife habitat from residential development.

Wetland/Riparian/Lake

Wetlands, riparian areas, and lakes within the Upper Pend Oreille subbasin were strongly influenced by past glaciation. Wetland areas in the subbasin can be separated into two divisions: wetlands associated with rivers, streams, and floodplains; and isolated glacial depressions and kettle lakes. Floodplain wetlands have greater hydrologic and nutrient dynamics and are more biologically productive, while glacial depressions have relatively stable water levels, and limited surface water and nutrient inputs. Due to anoxic conditions associated with continual saturation in wetlands associated with glacial depressions, organic material is incompletely decomposed. This results in organic material accumulation and peatland development. Peatlands, while naturally less biologically productive than floodplain wetlands, often support rare plants.

Most wetlands in the Upper Pend Oreille subbasin have undergone significant alteration or loss. Major influences include early beaver trapping, drainage for agricultural conversion, and

hydrologic alteration associated with Albeni Falls Dam. Fur trapping resulted in near complete removal of beaver during the 19th century in North America (Ringelman 1991). While largely undocumented, the effects of beaver removal on wetland extent must have been considerable in the Upper Pend Oreille subbasin. Beaver continue to re-occupy and restore wetlands across the subbasin today.

Most wetlands in the subbasin were at least partially drained for agricultural production by the 1930's. Agricultural production often included shrub removal and grazing, which continue to inhibit beaver re-occupancy and restoration. Floodplain wetlands were often the most completely drained and converted to agriculture due to the presence of productive soils and ease of drainage. Glacial depressions and kettle lakes were often only partially drained due to deep peat soils, deep kettle lakes, and lack of topographic outlet. Hoodoo Creek is a notable example due to the extensive floodplain wetlands, and the existence of a legal drainage district.

The greatest single impact to wetlands in the subbasin was construction and operation of Albeni Falls Dam. Pre-dam hydrology included steeply rising lake levels with spring run-off, peak lake levels in June, and receding lake levels through summer. This resulted in heavily vegetated, highly productive, seasonally flooded wetlands along the low gradient northern shorelines of Lake Pend Oreille, especially at the mouths of tributary creeks and rivers.

Following construction of Albeni Falls Dam, the water level of Lake Pend Oreille was regulated so that water levels were held above historic lake levels through the growing season. The lake is then drawn down in September. This regulated hydrology removed most vegetation from wetland areas so that drawdown, beginning in September, exposes poorly vegetated mudflats where productive, seasonally flooded wetlands formerly occurred. Martin *et al.* (1988) determined that 2,677 ha of former wetlands were converted to open water due to development and operation Albeni Falls Dam.

Potential nesting sites and cover for a diversity of wildlife species were removed due to a loss of vegetation and conversion of wetlands to open water. Wetland plant species that produce seeds, rootstocks, and vegetative parts selected by wildlife as food were eliminated from most former wetlands (USFWS 1960). Further, benthic invertebrates critical to ducks, shorebirds, bats, swallows, swifts, and many other insectivorous birds are significantly reduced in the drawdown zone (Bennett and DuPont 1993). These impairments resulted in an indicated 50% reduction in duck production from brood counts conducted in 1949, 1958, and 1960 (USFWS 1960).

Some of the most productive wetlands associated with Lake Pend Oreille occur at the mouths of streams and rivers where loose alluvial soils accumulated in deltas. Vegetation loss associated with operation of Albeni Falls Dam exposes loose alluvial soils to wave action and undercutting at high water, followed by sloughing upon annual fall drawdown. Erosion of important wildlife habitat in these locations has been significant and is ongoing. Martin *et al.* (1988) estimated the annual erosion rate due to operation of Albeni Falls Dam at 12 ha per year. Sites where ongoing losses are of special concern include the Clark Fork River delta, Pack River delta, Strong's Island, and the mouths of Priest River, Hoodoo Creek, Hornby Creek, and Carr Creek. Due to the historic productivity of these areas to fish and wildlife, they often support important cultural resources. Sandberg noted apparent island erosion of 3.35 m at the base of the shoreline, and 2.4 m at the top of the shoreline slope during 1989 (P. Cole, IDFG, personal communication).

Habitat losses in the Clark Fork River delta merit special description because they represent the largest contiguous floodplain wetland complex in the Upper Pend Oreille subbasin, and impacts are further compounded by the influence of Cabinet Gorge and Noxon Rapids dams.

Following glacial recession, ancient Lake Missoula was permanently drained, and the Clark Fork River carved channels into the stiff lacustrine deposits forming the Clark Fork River delta at the mouth of the lower Clark Fork River at Lake Pend Oreille. These channels, with alluvial landforms and historic lakeside beaches created by sediment transported down the Clark Fork River, formed a rich and diverse complex of old wetland river channels, active river channels, islands, and floodplain wetlands. It can be noted from historic photographs that the area was heavily forested by a mixture of cottonwoods and conifers. Included in the approximately 1,214 ha of the Clark Fork River delta were stands of old-growth western red cedar

Early logging removed much of the old-growth western red cedar in the Clark Fork River delta. However, large-scale habitat degradation occurred due to operation of Cabinet Gorge, Noxon Rapids, and Albeni Falls dams. Upstream dams impeded sediment transport to the delta, prohibiting development of delta landforms, and the protective lakeside beach. Widely fluctuating flows associated with dam operations continue to erode delta shorelines that would naturally be protected by armored streambeds during low fall/winter flows. Compounding these impacts is an unnaturally elevated lake level during the growing season due to operation of Albeni Falls Dam. This elevated lake level removed protective vegetation due to deep inundation in areas that were formerly seasonally flooded. Elevated lake levels and lack of protective vegetation and lakeside beach exposed the delta to accelerated erosion associated with a long wind fetch across Lake Pend Oreille. Further, following growing season inundation, poorly vegetated banks slough during drawdown in late summer and early fall. The result has been the loss of roughly 50% of functional delta wildlife habitat and ongoing losses estimated at 3.2 to 4.8 ha per year (Parametrix 1998).

Important wetland/riparian/lake conservation measures would include wetland protection and restoration, and erosion control in sites affected by the operation of Albeni Falls Dam. Ideally, eroded habitats due to dam operations would also be restored.

Watershed Assessment

Several recent reports describe the Upper Pend Oreille subbasin and its fish and wildlife resources. These documents include the *Lake Pend Oreille Key Watershed Bull Trout Problem Assessment* (Panhandle TAT 1998), the *Lake Pend Oreille Key Watershed Bull Trout Conservation Plan* (Lake Pend Oreille Bull Trout WAG), the *Albeni Falls Wildlife Protection, Mitigation, and Enhancement Plan* (Martin *et al.* 1988), and the *Idaho Department of Fish and Game Five Year Fish Management Plan* (IDFG 1996). Many IDFG annual reports, funded by either Dingell-Johnson or the BPA, have focused on the Lake Pend Oreille kokanee fishery. Master's theses from the University of Idaho and Eastern Washington University have described conditions in the lake, the Pend Oreille River, and tributary streams. Descriptions of specific portions of the subbasin are also provided in USFS National Environmental Protection Act (NEPA) documents, Cumulative Watershed Effects (CWE) analyses performed by the Idaho Department of Lands (IDL) and a significant number of studies conducted by Avista. Recent studies by the USFS Rocky Mountain Research Station and the University of Montana describe the genetic structure of bull trout populations in Lake Pend Oreille and lower Clark Fork River tributary streams.

Major Limiting Factors

The two primary limiting factors for fish, wildlife, and associated habitats in the Upper Pend Oreille subbasin are habitat loss and non-native species competition. Habitat loss can be described in a variety of ways, but is generally referred to as the loss of connectivity, quality, quantity, and diversity. Many environmental and managed factors can contribute to these limiting factors. Several of these key factors are described further in more detail.

Fisheries

Key factors limiting fish populations in the Upper Pend Oreille subbasin are described in *Resident Fish Planning: Dworshak Reservoir, Lake Roosevelt, and Lake Pend Oreille* (Fickeisen and Geist 1993), the *Lake Pend Oreille Key Watershed Bull Trout Problem Assessment* (1998), IDFG reports, and Master's theses from the University of Idaho. Limiting factors can result from either human activities or natural events, acting separately or cumulatively.

In the Upper Pend Oreille subbasin, limiting factors for fish include lake and stream habitat conditions; outside influences on the species including competition, hybridization, prey availability, and predation (including human predation); and biological constraints inherent to the species (Panhandle Bull Trout Technical Advisory Team 1998). Limiting factors are not equally distributed across the basin and different species may have different limiting factors.

Limiting factors in the lake for kokanee have been well documented. Stock-recruitment curves for kokanee declined from the early 1950's (Bowler 1980) to the 1990's (Fredericks *et al.* 1995) and put the entire population at risk of collapse. Equilibrium points on the curves were approximately 5 million adult kokanee between 1952 and 1965, 3 million kokanee between 1965 and 1975, and 1 million kokanee between 1977 and 1994. Declines in the stock-recruitment curves are due to declines in habitat. The mechanism for the declines is rather straightforward. Wave action sorts the gravel on the shorelines creating silt-free areas for kokanee spawning. Drawdowns in the fall drop the water level below the wave-washed zone, which limits the availability of spawning habitat. Also, lowering the lake to 625m msl each year prevents the creation of spawning areas at 1 to 1.6 m below the surface where they would be useful for kokanee spawning. Fredericks *et al.* (1995) estimated only 35,370 m^2 of gravel below 625 m elevation, but 197,685 m^2 of spawning gravels below the 626.4 m elevation. Limitations in the spawning area are thought to limit the kokanee population to a low level. Experimentally keeping the lake higher in the winter (which puts more gravel in the water) has met with promising results. Survival of kokanee eggs increased four to seven fold during two of three test years (Maiolie *et al.* 2000, Maiolie *et al.* in press). Further work is needed to reduce the confounding effects of floods and declining kokanee abundance but results point to spawning habitat as a limiting factor. It has been hypothesized that opossum shrimp may limit kokanee abundance. Studies are continuing, but to date no limitations due to shrimp were found (Clarke 1999). Growth and survival of newly emerged kokanee fry does not show adverse effects due to shrimp. Historically, the kokanee population declined concurrently with changes in water level management and nearly a decade before shrimp became established in the lake, which points to spawning habitat as a limiting factor.

The Pend Oreille River fluctuates between a cold flowing river during the winter months and a warm slackwater reservoir during the summer months. Lack of suitable overwintering habitat limits the warmwater fishery, and warm water during the summer precludes a coldwater fishery. Higher winter pool levels could result in a seven-fold increase in largemouth bass overwintering area and a viable fishery (Bennet and DuPont 1990).

The lower 5 km of the Clark Fork River support a seasonal coldwater fishery during the winter months, but some of the most diverse and productive riverine habitat in the lower Clark Fork is compromised by the summer pool flooding otherwise productive riffle habitats. Peaking operations at Cabinet Gorge Dam lower the productivity of the Clark Fork River, but a good trout fishery is present year-round in free flowing reaches.

Instream habitat conditions that influence bull trout and westslope cutthroat trout distribution and abundance include flow, water temperature, cover, connectivity, and habitat complexity. Living space for these species has been reduced in some streams through loss of flow; excess bedload filling in pools; widening of stream channels resulting in water too shallow to support fish; loss of large woody debris recruitment needed to create pools and cover; fine sediment covering spawning gravels; or filling in the spaces between rocks where juvenile bull fish hide. Shifting bedload in unstable streams may reduce incubation success by physically damaging eggs of fall spawning fish such as bull trout. Shifting bedload in unstable streams is believed to be a significant limiting factor in streams on the northern and eastern tributaries to Lake Pend Oreille, and is primarily associated with significant levels of timber management and road construction (Panhandle Bull Trout Technical Advisory Team 1998). Fine sediment can reduce the flow of oxygenated water into redds, reducing hatching success, and is a problem in upper Pack River tributaries (Panhandle Bull Trout Technical Advisory Team 1998). Water temperature can be influenced by streamside vegetation management or land management practices that alter groundwater inflow. Loss of shade or groundwater inflow can result in temperature conditions that are unsuitable for bull trout and other salmonids. Limiting factors for each of the bull trout supporting tributaries are thoroughly discussed in the *Lake Pend Oreille Key Watershed Bull Trout Problem Assessment* (1998).

Dam construction on the Clark Fork River, beginning in 1913 with construction of Thompson Falls Dam, cut off hundreds of kilometers of spawning and rearing habitat for migratory species such as bull trout, westslope cutthroat trout, and mountain whitefish. After 1913, the accessible watershed available to Lake Pend Oreille fish upstream of Albeni Falls Dam consisted of the Pend Oreille River and its tributaries, Lake Pend Oreille and its tributaries, and the Clark Fork River and its tributaries upstream to Thompson Falls Dam. After construction of Cabinet Gorge Dam blocked the Clark Fork River in September 1951, the total watershed area available to bull trout, excluding the Priest River subbasin and the Lower Pend Oreille subbasin, was further reduced by about 43% (Panhandle Bull Trout Technical Advisory Team 1998). Overall, it is estimated that less than 10% of the historic range of bull trout in the Upper Pend Oreille subbasin is accessible to bull trout as a result of dam construction (Panhandle Bull Trout Technical Advisory Team 1998). Restoration of fish passage at Cabinet Gorge and Noxon Rapids dams is currently underway as an adaptive management program under the Settlement Agreement. If this program is successful, it will restore fish passage back to conditions found between 1913 and 1952.

Biological constraints inherent to fish include reproductive potential, existing genetic diversity within populations, and behavioral attributes. Reproductive potential can be influenced by factors that select for fish size, such as angling, because larger females produce more eggs than smaller females. Factors that increase mortality on juvenile and sub-adult fish can influence reproductive potential for species such as bull trout, which typically mature at older ages than some other fish species. Genetic diversity can be influenced by introductions of non-native fish into populations, shrinking population size, and fragmentation of populations through migration barriers. Behavioral changes can occur through selective breeding in a hatchery environment or

introductions of new genetic material but would be a function of genetic changes. To increase the likelihood of a population persisting through time, fish populations with genetic material that is adapted to local conditions must be maintained. In addition, population sizes must be large enough that a full range of genetic diversity is retained, providing a greater probability of a population withstanding environmental changes or disturbances. Temporary behavioral changes may result from stress brought on through competition or other factors; the genetic integrity of a population can determine how well the population responds to stress.

Reproductive potential of a bull trout population can be significantly impacted by hybridization with brook trout. The sharp decline in the kokanee population will result in lost forage for top predators such as bull trout and rainbow trout, and it is anticipated that this will eventually limit predator populations if not reversed (Mailolie 1999). Competition for spawning areas with other species, such as between bull trout and brown trout, can directly reduce reproductive success if competition results in redd superimposition. Competition for food or habitat that is in limited supply or predation can limit populations by reducing survival to spawning age. Lake trout pose this threat to bull trout, cutthroat trout, and kokanee in Lake Pend Oreille, but lake trout on their own are not currently believed to be limiting fish populations due to their relatively low numbers. The combined presence of lake trout, rainbow trout, and bull trout may act to further limit the kokanee population.

Illegal harvest of some species, particularly bull trout, has been cited as a limiting factor in some spawning streams (Panhandle Bull Trout Technical Advisory Team 1998).

Wildlife

The presence, distribution, and abundance of a number of wildlife species in the Upper Pend Oreille subbasin have been affected by habitat losses due to hydropower development, agricultural development, urbanization, timber harvest, road construction, legal and illegal wildlife harvest, and natural and human-caused events. These factors continue to limit wildlife populations. Current operation of the hydropower system and, in particular, lake level management have affected the availability of aquatic macrophytes to some species of waterfowl, resulting in apparent changes in distribution and use patterns of waterfowl. Ongoing habitat loss due to dam operations, particularly the loss of unique habitat types such as those found in the Clark Fork River delta, result in an ever-shrinking habitat base for several species of waterfowl, furbearers, songbirds, shorebirds, big game, and raptors. Productive wetland habitats have been converted to mudflats due to inundation by Albeni Falls Dam. Operation of Albeni Falls dam has resulted in an estimated loss of 12 ha per year of delta, island, and shoreline habitats around Lake Pend Oreille, the lower Clark Fork River, and the Pend Oreille River (Martin *et al.* 1988). Peaking operations and trapping of river sediments by Cabinet Gorge Dam are also responsible for the loss of approximately one hectare per year of Clark Fork River delta habitat (Parametrix 1988).

Loss of old-growth habitat types due to logging, fire, development, and dam operations limit the ability of old-growth dependent species to thrive in the Upper Pend Oreille subbasin. Woodland caribou are considered to be one of the most endangered mammals in the United States; logging and fires resulting from human and natural causes have largely impacted their old-growth and mature forest habitat.

An extensive forest road network and the presence of major highways and rail lines have resulted in the loss of security habitat and fragmentation of habitat, particularly for wide ranging species such as grizzly bear, elk, and moose. Extensive road networks contribute to increased

poaching losses. Highway 95 and the Burlington Northern Santa Fe rail line, which travel north/south between the Cabinet and Selkirk Mountains, are responsible for a considerable amount of wildlife loss annually and are believed to have a significant impact on habitat connectivity.

Changes in fish communities have likely resulted in fewer migratory fish available to species such as bears and otters, particularly in tributary streams that no longer support large runs of bull trout, cutthroat trout, or mountain whitefish.

Development of wildlife habitats for residential and commercial purposes is ongoing and increasing as the area's population grows. Shoreline habitat has been modified by development, resulting in changes in vegetation communities, loss of wetlands, and human disturbance.

The Selkirk Mountains woodland caribou population ranges across the Lower Pend Oreille, Priest River, Upper Pend Oreille, and Kootenai subbasins. Adjacent habitat in British Columbia is integral to the existence of this population (W. Wakkinen, IDFG, personal communication). During the 1980's, poaching and collisions with vehicles were believed to limit the Selkirk caribou population (USFWS 1994). Programs instituted in the Selkirks to reduce the effect of these factors were largely successful but populations did not improve substantially, even with translocations of 103 caribou into the range from 1987 through 1998 (Wakkinen and Johnson 2000). Predation is believed to be limiting for woodland caribou in general (Bergerud 1978, Caughley and Sinclair 1994) and the Selkirk population in particular (Bergerud 1978). It has been hypothesized that large, long-term changes in habitat and other factors may have led to increases in predator numbers, thereby increasing predation on caribou (Wakkinen and Hayden, IDFG, personal communication).

The range of grizzlies outside of Canada and Alaska is now confined to six recovery zones located within the states of Montana, Wyoming, Idaho, and Washington. One recovery zone, the Selkirk Zone, includes portions of the Lower Pend Oreille, Priest River, Upper Pend Oreille, and Kootenai subbasins. This zone is adjacent to important grizzly bear range within British Columbia, Canada. The current population of grizzly bears within the Selkirk Zone is increasing slowly, but is far from meeting ESA de-listing criteria (Wakkinen and Johnson 2000). Human caused mortality, especially of females, by illegal shooting or killing bears in self-defense is apparently the limiting factor in the recovery of the Selkirk grizzly bear population (Knick and Kasworm 1989, McLellan *et al.* 1999).

The amount and quality of lynx foraging habitat is primarily a result of post timber harvest regeneration, wildfires, and to a lesser extent controlled burns. Livestock grazing also has the potential to impact lynx by removing herbaceous forage that snowshoe hares use during the summer. Ruediger *et al.* (2000) suggest that cattle grazing is also a factor in the decline of aspen stand regeneration in Rocky Mountain subalpine areas, and probably degrades snowshoe hare habitat in riparian willow areas as well. In contrast, wind throw, insects, and disease aid in creating lynx denning habitat. Lynx are relatively tolerant of human activity; however, urban development and roads with high traffic volumes may affect lynx movements (Stinson 2000). Lynx are limited by the availability of a winter prey base, primarily snowshoe hare, as well as environmental/anthropogenic factors including forest management practices, habitat fragmentation, wildfires, fire suppression, insect epidemics, and lynx harvest management (Stinson 2000).

Development is likely the greatest threat to waterfowl, upland game, and furbearers in the subbasin. The abundance and quality of suitable nesting, brood rearing, and foraging habitat is assumed to be limiting for waterfowl and upland game. Aquatic furbearers are likely limited by

development along watercourses, while furbearers such as pine marten may be limited by a lack of old-growth habitat.

Artificial Production

Fish stocking during the past 100 years has influenced fish populations in Lake Pend Oreille. Lake Superior whitefish were the first known non-native species stocked in Lake Pend Oreille during the late 1890's to feed a growing population of white settlers. Many of the warmwater species found in lowland lakes and some of the non-native salmonids like brook trout were stocked in the early 1900's. In 1925, the U.S. Fish Commission stocked lake trout into Lake Pend Oreille.

Kokanee salmon emigrated naturally into Lake Pend Oreille from Flathead Lake, Montana during the winter flood of 1933. This species provided the largest fisheries in the state of Idaho through the 1960's. The population started a long-term decline in 1966 and is currently on the brink of collapse. Kokanee have been stocked in Lake Pend Oreille for many years, with increasing numbers since 1986 (Table 5). In 1985, the Cabinet Gorge Kokanee Hatchery was built with funding from BPA and Avista to mitigate for dam related losses. Hatchery stocked kokanee have helped prevent a total kokanee collapse, but population recovery and meeting the harvest goal of 750,000 kokanee annually will depend on restoration of the wild portion of the kokanee population.

After kokanee salmon were well established, the IDFG, in cooperation with the Bonner County Sportsmen Association, introduced Kamloops rainbow trout into Lake Pend Oreille in 1941 and 1942. These fish came from Kootenay Lake British Columbia and they soon created a world-class fishery with the existing world record 16.8 kg rainbow caught in 1947. The IDFG supplemented the rainbow trout population with a locally developed Kamloops rainbow broodstock during the 1960's through the 1970's. Fingerlings stocked during the 1980's until 1992 were derived from a local non-captive broodstock collected in the Clark Fork River and from fry received from Kootenay Lake (Table 5). All rainbow trout stocking was discontinued in 1992 due to the concern over predator population expansion.

Table 5. History of kokanee, cutthroat trout, rainbow trout, and bull trout stocking in Lake Pend Oreille, Idaho, 1986 through 1999.

Year Class (KL/KE only)	KL eggs collected	Kokanee adults trapped	Year kok re-lease	KL	KE	CT	Predators	
				Fry released	Fry released	Fingerling released	Species released	Number released
1985	10,661,104	76,245	1986	5,010,248	None	10,058	KM	3,864
1986	9,102,142	59,181	1987	5,861,050	"	10,125	KM	6,930
1987	17,255,051	88,064	1988	13,027,000	"	None	KM	11,638
							K2	4,875
1988	14,155,998	69,163	1989	11,743,000	"	"	KM	13,351
							K2	22,172
							BU	2,000
1989	9,579,772	81,991	1990	7,758,000	"	"	K2	22,600
							BU	3,338
1990	6,038,108	61,913	1991	5,184,101	"	109,051	None	

Year Class (KL/KE only)	KL eggs collected	Kokanee adults trapped	Year kok re-lease	KL	KE	CT	Predators	
				Fry released	Fry released	Fingerling released	Species released	Number released
1991	6,591,608	91,426	1992	5,515,190	“	101,368	K2 BU	9,344 5,055
1992	7,498,513	106,876	1993	561,146	“	72,855	None	
1993	11,097,143	179,419	1994	9,902,543	“	86,160	“	
1994	16,613,806	160,321	1995	14,050,457	“	100,039	“	
1995	12,893,131	136,586	1996	10,661,003	100,000	88,995	“	
1996	4,496,439	56,113	1997	3,720,697	None	92,227	“	
1997	601,661	16,204	1998	2,483,740	“	94,200	“	
1998	8,955,972	91,996	1999	7,127,261	1,121,059	109,475	“	
1999	22,383,530	225,540	2000	17,710,513	None		“	
Total	157,923,978	1,501,038		120,315,949	1,221,059	874,553	KM K2 BU	35,783 58,991 10,393

BU - LPO bull trout, KE - early spawning kokanee, KL - late spawning kokanee, KM - LPO stock rainbow fingerlings, K2 - Kootenay L. BC rainbow

Limited numbers of bull trout were stocked during 1989, 1990, and 1992 (Table 5). These fish came from Trestle Creek and Gold Creek, and the Clark Fork spawning channel adjacent to the Cabinet Gorge Hatchery. The IDFG was experimenting with bull trout spawning and rearing techniques at the time, and all fish released were clipped with an adipose fin clip.

The limited wild population of westslope cutthroat trout in Lake Pend Oreille was supplemented with hatchery stocking primarily during the 1990’s. The IDFG experimented with a kokanee net pen rearing program, but limited funding did now allow for an evaluation of the potential benefits. The presence of IPN, infectious pancreatic necrosis, a viral disease affecting young cutthroat trout, at the Clark Fork Hatchery caused the IDFG to terminate the cutthroat trout stocking program in Lake Pend Oreille. A new broodstock is being developed at the Hayspur Hatchery, but it will likely be several years before production fish are again available for stocking.Current and planned fisheries management direction in Lake Pend Oreille emphasizes kokanee as a keystone species with bull trout and rainbow trout managed for a trophy fishery. Westslope cutthroat trout will be managed primarily as a wild trout fishery with restrictive regulations. Lake trout are being actively managed against to reduce their potential negative interactions with the preferred species. The only planned supplemental stocking is with kokanee fry, depending on their availability (N. Horner, IDFG, personal communication).

Existing and Past Efforts

Efforts Funded by BPA through the Columbia Basin Fish and Wildlife Program

Lake Pend Oreille Fishery Recovery Project

Two fishery research programs funded by BPA have been conducted on Lake Pend Oreille between 1985 and 1992, and between 1996 and the present. The earlier research focused on defining the best ways to stock kokanee into the lake to get the best returns. Results indicated that stocking larger fry (50 mm) improved the survival during stocking and that stocking location did not significantly influence hatchery fry survival (Paragamian 1994). The Cabinet Gorge Hatchery has produced kokanee for Lake Pend Oreille since 1985. It was designed to produce enough fish that the lake could reach its recovery goal of 750,000 kokanee in the harvest. To date, supplemental stocking has not improved the kokanee population sufficient to meet this goal.

The more recent research looked at several aspects of the lake including understanding kokanee population dynamics; gaining an understanding of limiting factors for kokanee; assessing the effects of a modified lake level management regime on kokanee spawning and recruitment; examining the effects of the introduction of opossum shrimp; determining whether or not food is limited for planktivorous species; and identifying the effect of the hatchery program on the kokanee population. Research has also been conducted on estimating population size and relative abundance of predator species, limnology, and assessing the effects of lake level management on the Pend Oreille River fishery.

This recent work on Lake Pend Oreille was specified in the NPPC's 1995 Program, Resident Fish and Wildlife Amendments. Sections 10.6E, 10.6E1, to E4 listed the studies to be done, told the USACOE where to hold the lake levels, and requested BPA funding. Section 10.5A.5 specified that investigations be conducted on the life history, habitat needs and threats to persistence of bull trout in Lake Pend Oreille. Some of this work has been completed although most remain unfunded. Section 5.4D.7 required changes in Lake Pend Oreille elevation to benefit kokanee and provide additional water for Columbia River salmon flows for a period of three years.

Cabinet Gorge Hatchery

Cabinet Gorge hatchery was constructed in 1986 as a cost-share project between BPA, IDFG, and Avista. It is operated with IDFG funds. The hatchery has a production capacity of 17 million kokanee fry, but in most years this capacity has not been met.

The hatchery was constructed to mitigate for losses of kokanee spawning due to Albeni Falls and Cabinet Gorge Dam operations. While in some years hatchery reared kokanee appear to make up a significant proportion of the kokanee population in Lake Pend Oreille, the hatchery has not kept the kokanee population from continuing to decline. Prior to construction of the dams in the early 1950's, annual kokanee fry production in the lake and tributaries was estimated at approximately 200 million.

Albeni Falls Wildlife Mitigation Project

The Albeni Falls Wildlife Mitigation Project (Project) was developed to protect, enhance, and maintain the long-term quality of wetland and riparian wildlife habitat in the Lake Pend Oreille vicinity as on-going mitigation for construction of Albeni Falls Dam. The Project was amended into the NPPC's Program in 1995 (measures 11.2D.1, 11.2E.1, 11.3D.4 and 11.3D.5). The

Project has received annual implementation funding from BPA since 1995. The long-term conservation potential for the Project is primarily the protection of existing high quality wetland habitat, but also includes protection of habitat with high restoration potential. The Albeni Falls Interagency Work Group (Work Group) members include the IDFG, the KT, the CDAT, the Kootenai Tribe of Idaho, the USFWS, the USACOE, the NRCS, and the USFS. The Work Group established priority mitigation focus areas by taking into consideration in-place/in-kind opportunities, the threat to wetland plant communties in the primary areas of impact, juxtaposition to other management areas, and availability of protection opportunities. The Work Group implements the Albeni Falls Wildlife Mitigation Project by way of formal agreement, and implements projects in the Upper Pend Oreille, Lower Pend Oreille, Priest River, Kootenai, and Coeur d'Alene subbasins. The purpose of the *Albeni Falls Interagency Work Group Operating Guidelines and Guiding Principles for Mitigation Implementation* (1998) is to establish membership roles and responsibilities as well as a decision-making and dispute resolution process for implementing projects. According to the guidelines, mitigation implementation shall occur in the following areas: 1) the upper Pend Oreille subbasin: lands adjacent to or below 631m msl; 2) areas with a hydrologic connection to Lake Pend Oreille from Cabinet Gorge Dam to Box Canyon Dam; and 3) the Kootenai River and Coeur d'Alene subbasins in Idaho.

Using BPA funds, the IDFG, in coordination with the Work Group, developed *the Albeni Falls Wildlife Protection, Mitigation, and Enhancement Plan* (Martin *et al.* 1988). The plan not only identifies the wildlife habitat benefits and impacts associated with the construction and operation of Albeni Falls Dam, but it also identifies potential areas in which to mitigate wildlife habitat losses. The BPA completed the *Albeni Falls Wildlife Management Plan Environmental Assessment* in 1996. The plan is a programmatic guide to the development of wildlife mitigation projects in the Upper Pend Oreille, Lower Pend Oreille, Priest River, Kootenai, and Coeur d'Alene subbasins.

Efforts Funded Outside of the Columbia Basin Fish and Wildlife Program

Fisheries

A substantial number of "on-the-ground" projects have been undertaken to improve the watershed conditions that sustain fish populations, directly improve habitat, or provide protection for fish through education and increased law enforcement. The projects listed below are in addition to regular management and enforcement activities conducted by the IDFG.

Lake Pend Oreille:

1998	Avista, Trout Unlimited (TU), and IDFG developed and implemented an ongoing project to increase education and enforcement efforts directed at protecting bull trout. Results are ongoing, but angler awareness of regulations and fish identification skills has improved.
1997-1999	USACOE held lake levels up during the winter months to improve kokanee spawning. Results: Survival of young of the year kokanee improved by 500% in 1998 and 1999.
1994	IDFG, in cooperation with the Lake Pend Oreille Idaho Club (LPOIC) initiated an ongoing program to encourage harvest of lake trout (limits removed in 2000). Results: Lake trout populations have remained low, and anglers harvest a high percentage of lake trout caught.
1997	IDFG and LPOIC developed and distributed a color fish identification guide. Results: Improved angler fish identification skills.
1997	IDFG, USFS, and Idaho Chapter of the American Fisheries Society published and distributed a fish information pamphlet. Results: Increased public awareness of fish habitat needs.
1996	IDFG closed the lake to harvest of bull trout. Results: Redd counts have increased in several tributaries.
1998	Natural Resources and Conservation Service (NRCS) stabilized eroding lakeshore at Ponder Point. Results: Reduced fine sediment delivery to the lake and halting loss of shoreline habitat.

Trestle Creek:

1994-1996	USFS completed a drainage-wide watershed restoration project, including road obliteration, culvert removal and replacements, riparian zone re-planting, and placement of 800 pieces of large woody debris. Results: 32 km of problem roads obliterated; bull trout redd counts remain high, average 263 per year since project completion; and security has improved for grizzly bears and elk.
1996	Trestle Creek Local Working Committee and IDL adopted site specific Best Management Practices (BMPs) for timber harvest, requiring harvest plans, buffer strips, and other measures. Results: Logging activity is more tightly regulated, particularly in the riparian areas, resulting in increased protection for bull trout, cutthroat trout, and cavity nesting species.
2000	As part of the Settlement Agreement, easements were acquired on over 300 m of creek frontage to protect habitat. Results: Long term protection for bull trout, cutthroat trout, and other species dependent on riparian forest.

South Gold Creek:

1997	Lakeview Local Working Committee (LLWC) and IDL adopted site-specific best management practices for timber harvest. Results: Logging activity is more tightly regulated, particularly in the riparian areas, resulting in increased protection for bull trout, cutthroat trout, and cavity nesting species.
1998	Avista restricted vehicle access to Gold Creek with a gate to protect spawning habitat. Results: Use of recreational vehicles in the stream channel has been stopped, protecting bull trout redds.
1996	USFS replaced culverts, places large woody debris, and completed channel restoration on two miles of creek. Results: Channel stability is improved, reducing the threat to bull trout redds from mid-winter floods.
1998	IDFG hand excavated channel through drawdown zone to allow adult bull trout to migrate back to Lake Pend Oreille. Results: Post-spawning bull trout survival has improved.

North Gold Creek:

1997	LLWC and IDL adopted site-specific best management practices for timber harvest. Results: Logging activity is more tightly regulated, particularly in the riparian areas, resulting in increased protection for bull trout, cutthroat trout, and cavity nesting species.
1998-1999	USFS conducted watershed restoration work including woody debris placement, headwater channel stabilization, riparian plantings, and road removal. Results: Problem roads have been obliterated; bull trout redd counts remain high; conditions have improved for harlequin ducks; and security has improved for elk.

Granite Creek:

1997	LLWC and IDL adopted site-specific best management practices for timber harvest. Results: Logging activity is more tightly regulated, particularly in the riparian areas, resulting in increased protection for bull trout, cutthroat trout, and cavity nesting species.
1957-2000	IDFG, with assistance from LPOIC, TU, and Avista, operated and maintained a kokanee spawning channel and egg taking facility in Sullivan Springs. Results: The egg take and wild production of fish from Sullivan Springs has forestalled the collapse of the kokanee fishery.
1996-1999	IDFG placed cleaned gravel, removed fines, and redesigned kokanee trap to improve conditions for bull trout in Sullivan Springs. Results: Increased use of the spawning channel by bull trout and kokanee, reduced impact to bull trout redds and outmigrants from trapping operations.
1998	IDFG transported 40 bull trout spawners around intermittent reach of Granite Creek. Results: Increased egg deposition by bull trout.

1997	IDFG transported over 90 bull trout spawners around intermittent reach of Granite Creek. Results: Increased egg deposition by bull trout.
1994-1997	USFS completed watershed restoration work, including channel stabilization, culvert removal, woody debris replacement, and placement of a fish ladder in a culvert. Results: Channel stability is improved, reducing the threat to bull trout redds from mid-winter floods, fish passage to approximately 1 km of habitat restored.
2000	Over 24 ha of private land was purchased for IDFG management in a cooperative project between Avista, LPOIC, and IDFG. Results: Mature riparian forest habitat, floodplain, spawning channel, and bull trout rearing habitat are permanently protected from development.

Lightning Creek Complex:

1995	USFS relocated approximately 1 km of floodplain road. Results: Riparian forest habitat has been restored, floodplain habitat and channel conditions improved, and sediment input has been reduced in Lightning Creek.
1997	USFS recontoured road segments in the headwaters of Lightning Creek. Results: Improved watershed stability, increased security for grizzly bears and elk.

Grouse Creek:

1996	Pack River LLWC and IDL adopted site-specific best management practices for timber harvest. Results: Logging activity is more tightly regulated, particularly in the riparian areas, resulting in increased protection for bull trout, cutthroat trout, and cavity nesting species.
1990	USFS, LPOIC, and TU created 21 pools and 35 boulder clusters in Grouse Creek. Results: Increased rearing habitat for Gerrard rainbow trout.
1997	USFS and TU placed 62 cover structures in NF Grouse Creek and 56 boulder clusters in Grouse Creek. Results: Increased rearing habitat for bull trout and Gerrard rainbow trout.
1996	USFS and Coldwater Creek Company planted riparian areas in Grouse Creek. Results: Improved bank stability, increased habitat for riparian wildlife species.
1996-1997	USFS and CedaPine Veneer completed stream improvement work on four miles of stream in Grouse Creek. Results: Increased rearing habitat for Gerrard rainbow trout.
1995-1997	USFS, with assistance from TU and IDFG, obliterated roads, removed culverts, and restored fish passage in Grouse Creek tributaries. Results: Increased security for big game and grizzly bears, restore passage to over 5 km of spawning and rearing habitat for bull trout, improved conditions for harlequin ducks.

Johnson Creek:

1997	USFS added 8 pool-and-cover structures in lower Johnson Creek and recontoured roads in the headwaters. Results: Improved rearing habitat for bull trout and increased watershed stability and big game security.

Pack River:

1996	Pack River Local Working Committee and IDL adopted site-specific best management practices for timber harvest. Results: Logging activity is more tightly regulated, particularly in the riparian areas, resulting in increased protection for bull trout, cutthroat trout, and cavity nesting species.
1997	IDL closed 2.6 km of unstable road. Results: Reduced fine sediments into spawning and rearing habitat for bull trout, increased wildlife security.
1996-1997	USFS relocated and recontoured roads, removed culverts, planted riparian areas, and completed in-channel work to improve watershed conditions in upper Pack River and tributaries. Results: Reduced fine sediments into spawning and rearing habitat for bull trout and increased big game and grizzly bear security.
1999	NRCS conducted bank stabilization projects on lower Pack River. Results: Reduced fine sediment delivery to Pack River and improved riparian habitat.

Twin Creek:

1998-2000	IDFG, the USFWS, Avista, TU, Ruen Family Trust, Bonner County, and Crown Pacific planned, designed, and began reconstruction of over 2 km of previously channelized stream to improve conditions for bull trout spawning and rearing. Results: Channel length increased by approximately 300 meters, channel complexity increased, width to depth ratio was reduced, and floodplain and riparian function were restored.
1997	USFS removed culvert from North Fork Twin Creek. Results: Reduced risk of culvert failure and impacts to downstream spawning and rearing habitat.

Clark Fork River:

1999	Through the Settlement Agreement, Avista increased minimum flow release from Cabinet Gorge Dam from 85 cms to 142 cms. Results: Over 4 ha of productive riffle habitat were restored and improved density of trout.
1999-2000	Avista, USFWS, IDFG, and Montana Department of Fish Wildlife and Parks (MDFWP) initiated bull trout passage project for Cabinet Gorge Dam using an adaptive management approach. Results: The project was recently initiated, but several juvenile bull trout were safely transported downstream past Cabinet Gorge Dam from Montana tributaries.

1998 IDFG, Avista, and Idaho Department of Environmental Quality (IDEQ) changed timing of Federal Energy Regulatory Commission (FERC) inspection at Cabinet Gorge to protect bull trout redds. Results: No more de-watering of bull trout redds in the Clark Fork spawning channel.

1965 Avista constructed spawning area for bull trout in spring-fed section of river. Results: Annual spawning by bull trout, averaging approximately 5 redds per year.

1999 Through the FERC relicensing process, Avista and stakeholders (local, state, and federal agencies; non-government organizations, and tribes) agreed to the Settlement Agreement. The 45-year program includes over $950,000 annually to fund a native fish restoration project focused on providing fish passage; $400,000 annually for tributary restoration in Idaho; $475,000 annually for tributary restoration work in Montana; minimum flows in the lower Clark Fork River; recreational fish enhancements; habitat enhancement in the lower Clark Fork River in Idaho; and fisheries management assistance funding ($35,000 annually in Idaho). Results: Funded the Twin Creek, Granite Creek, and Trestle Creek projects in 2000; reconnected Lake Pend Oreille with upstream habitats in Montana; restored habitats in Montana and Idaho.

Strong Creek:

1994 IDFG and TU placed fish ladder in previously impassable flume. Results: Access restored to over 0.5 km of spawning and rearing habitat for cutthroat trout and bull trout.

Rapid Lightning Creek:

1997 USFS removed culvert and repaired stream crossing. Results: Reduced sediment delivery to stream.

1998 NRCS and landowner implemented streambank stabilization project. Results: Reduced sediment delivery to stream.

Trout Creek:

1996 USFS pulled culverts, improved cross drainage, and improved stream crossings. Results: Reduced sediment delivery to stream.

Hoodoo Creek:

1998 NRCS and landowners installed riparian buffers. Results: Improved habitat for fish, songbirds, waterfowl, and furbearers.

Cocolalla Creek:

1996-2000 Cocolalla Lake Association, Bonner County Soil and Water Conservation District, NRCS, Soil Conservation Commission, IDL, IDEQ, and IDFG implemented projects including an incentive program for improved management of riparian areas on private lands, restored fish passage, and improved water

quality in the lake. Results: Improved water quality and improved trout fishery in the lake.

Wildlife

The IDFG, USFWS, and the USFS have undertaken a number of habitat improvement projects and other measures to benefit wildlife. Since the early 1990's, the USFWS has provided funding for an IDFG conservation officer to establish patrols to protect grizzly bears and caribou and to perform the function of community educator. In the past two years, the USFS has conducted several elk winter range improvement burns. The IDFG manages a number of Wildlife Management Areas (WMAs) in the subbasin. These WMAs are located at Shepherd Lake, the Pend Oreille River, the Clark Fork delta, Farragut, and Sunnyside.

Results and Accomplishments:

The Albeni Falls Wildlife Mitigation Project

The IDFG has protected several thousand acres of wetland habitat in the Upper Pend Oreille subbasin (Table 6). Trespass grazing has been eliminated on 301 ha as a result of site protection and fence construction. Although limited monitoring and evaluation has been completed to date, visual inspection of emergent wetland plant communities indicates that the elimination of grazing has resulted in increased plant cover as non-woody plants have slowly become re-established. It is likely, therefore, that waterfowl and aquatic furbearers, such as muskrat, are provided with an increase in essential food resources. Wetland vegetation has become more mature and increasingly dense resulting in increased deer browse availability.

Table 6. IDFG wildlife mitigation acquisitions in Idaho, 1997 - 1999

Year	Property Name	Location	Acres	HUs
1997	Henderson Ranch	Clark Fork	240	373.27
1997	Carter's Island	Clark Fork Delta	96	311.82
1997	Denton Slough	Hope	16	41.44
1998	Pack River	Pack River	110	187.02
1999	Boundary Creek	Boundary Creek	1,405	287.40
1999	The Hunter Ranch	Pack River	216	Pending
1999	Pack River	Pack River	30	Pending
1999	Cocolalla Lake	Cocolalla Lake	98	Pending
1999	Albeni Cove	Pend Oreille River	39	Pending
1999	Albeni Cove	Pend Oreille River	31	Pending
1999	Westmond Lake	Westmond Lake	65	Pending
	Total		2,346	

Lake Pend Oreille Fishery Recovery Project

To date, the project has successfully monitored the impacts to spawning habitat from lake level management. Results indicate that bars of suitable-sized spawning gravel quickly formed at the lake's low pool elevation. Gravel areas that were 0.3 to 1.3 m below the low pool elevation were found to decline in spawning quality as the amount of silt and gravel declined and the amount of cobble increased over the course of four years. In two of the three test years, egg-to-fry survival greatly improved during years with reduced drawdown (Maiolie *et al.* in press). In the other year, flows through the lake were at a 100-year record high, and survival did not improve. The research also found that zooplankton abundance was high enough to support good kokanee growth and survival in 1998 (Clarke 2000). Work on predators found that their abundance was too high for the currently reduced kokanee population (Vidergar 2000, Maiolie in press). Regulation changes went into effect in 2000 to reduce rainbow and lake trout abundance. Riparian vegetation did not change concurrent with the reduced drawdowns (Maiolie *et al.* 2000). Research has also shown that the lake's shrimp population has been stable in spite of recent declines in kokanee. The bull trout population was estimated and their food habits studied. Project information was used in the USFWS Biological Opinion for Lake Pend Oreille. This document will likely make future changes in the operation of Albeni Falls Dam to benefit kokanee and thereby improve conditions for bull trout.

Efforts Funded Outside of the Columbia Basin Fish and Wildlife Program

Many projects have been implemented to directly improve fish and wildlife habitat and watershed conditions that sustain fish populations. The results of these efforts are summarized in the "Existing and Past Efforts" section, subtitled "Fisheries."

Subbasin Management

Existing Plans, Policies, and Guidelines

Several planning documents, policies, and management guidelines for fish and wildlife habitat protection in the Upper Pend Oreille subbasin are briefly described below. Various state and federal agencies and tribes within the subbasin have developed fish and wildlife habitat protection plans with extensive input from local watershed groups and technical teams. Currently, the most effective plans are those that have been collaboratively developed and are well funded.

The Albeni Falls Interagency Work Group

Section 11.3E.1 of the NPPC 1995 Program directed the states and tribes to form long-term agreements within three years following the adoption of the program for all wildlife mitigation. **I**n response, the IDFG, the KT, the CDAT, the Kootenai Tribe of Idaho, the USFWS, the USACOE, the NRCS, and the USFS formalized the Work Group and signed an agreement. The *Albeni Falls Interagency Work Group Operating Guidelines and Guiding Principles for Mitigation Implementation* (1998) guides the implementation of wildlife mitigation projects. The impetus for the agreement was provided not only by the members' desire to meet the Program directive, but more importantly, the members wanted to implement the Program at a local level by providing the mechanism for non-profit organizations, watershed groups, and other members of the public to propose projects directly to the fish and wildlife managers.

Federal

Idaho Panhandle National Forests

The USFS manages over half of the Upper Pend Oreille subbasin as part of the Idaho Panhandle National Forests (IPNF). The 1987 IPNF Forest Plan is the primary document that guides Federal forest management in the subbasin. The Inland Native Fish (INFISH) interim strategy was adopted in 1996 by the IPNF to protect habitat for bull trout, westslope cutthroat trout, and other species associated with streams and riparian areas. All projects on the IPNF are required to be in compliance with INFISH guidelines, which include mandatory setbacks from streams unless site-specific management criteria for improving these habitats are met.

Federal Energy Regulatory Commission

In 2000, the FERC issued Avista a new license to operate Cabinet Gorge and Noxon Rapids Dams. The collaborative Settlement Agreement includes specific protection, mitigation, and enhancement (PM&E) measures for fish and wildlife (Avista 1999). The PM&E measures include increasing the minimum flow release at Cabinet Gorge Dam from 82 cms to 145 cms and funding to complete projects that directly or indirectly benefit fish and wildlife. A management committee, comprised of representatives from state and federal agencies, tribes, and other interested stakeholders, provides project oversight and review, with implementation provided by Avista, IDFG, MDFWP, the USFWS, and other stakeholders. Unused dollars roll into interest bearing accounts and are available for future projects. Funds can also be borrowed from out-years to complete larger projects earlier in the license period.

U.S. Army Corps of Engineers

The USACOE, Seattle District, manages Albeni Falls Dam and Lake Pend Oreille as a multi-purpose project for hydropower production, flood control, recreation, fish and wildlife conservation, and navigation. Land allocation, management standards, and guidelines are outlined in the *Albeni Falls Project Master Plan* (1981). Management of USACOE lands and waters is guided by Federal and state legislation, Army and USACOE policies, and local policy. Within the subbasin, the USACOE manages approximately 1,716 ha of land and water in fee-title interest. Of this total, 1,626 ha are licensed to IDFG for the purpose of development, conservation, and management of wildlife resources. The remaining acreage is managed by the USACOE as developed recreation sites, natural areas, or operations areas designated for authorized purposes other than recreation or wildlife management. Additionally, the USACOE Regulatory Branch, Walla Walla District, administers activities within the Idaho portion of the subbasin subject to Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act.

Bureau of Land Management

The Bureau of Land Management (BLM) administers several small, isolated tracts in northern Idaho, and management emphasis is directed at water-based recreation.

U.S. Fish and Wildlife Service

The USFWS administers the ESA. The USFWS is developing bull trout and lynx recovery plans that include the Upper Pend Oreille subbasin. Recovery plans for grizzly bears, caribou, and bald

eagles are in effect. The USFWS provides funding for habitat restoration projects and is the lead agency for administering the NSRP. The NSRP is an adaptive management approach to restoring fish passage and connectivity between the Idaho and Montana portions of the Lower Clark Fork and Pend Oreille subbasins. The NSRP also has provisions for improving habitat and other measures to benefit native fish.

Natural Resources Conservation Service

The NRCS provides technical support to landowners and assists with funding projects designed to reduce soil erosion and provide streambank protection. The U.S. Environmental Protection Agency (EPA) is responsible for implementing the Clean Water Act, including ensuring that Total Maximum Daily Load (TMDL) plans are developed and implemented.

Tribal Government

Kalispel Tribe

The Kalispel Natural Resource Department (KNRD) *Fish and Wildlife Management Plan* (Plan) is a comprehensive accumulation of present and future KNRD resource direction based upon the KT's management authorities within its ceded lands. These authorities are based on federal law, tribal resolution, and agreements between the KT and other resource management agencies. The Plan identifies resource mission statements that are supported by specific goals and objectives. The Plan directs each division’s development of annual work plans. Strategies are developed annually and drive each division’s on-the-ground activities to achieve its stated mission. It is important for the KT to actively manage resources within its ceded lands and provide management recommendations to attain resource improvement goals. The KNRD's approach is to manage sustainable native populations and habitats using watershed management principles. Non-native populations and/or artificial habitat management will be addressed based upon population health, habitat condition, and feasibility.

Coeur d'Alene Tribe

Traditionally, the Coeur d’Alene people occupied the territory extending roughly from Lake Pend Oreille to the Clearwater River, and from the Bitterroot Mountains to the Channel Scablands (Sprague 1996, Cd’A Tribe EAP 1999 Draft). Subsequently, a significant portion of the Pend Oreille subbasin lies within the usual and accustomed and ceded lands of the CDAT. This area includes the portion of the subbasin from the north shore of Lake Pend Oreille south to the crest of the Coeur d'Alene Mountains and east to the crest of the Bitterroot Range. Cultural and traditional resources are abundant throughout the area and tribal members continue to depend upon this area as a means of providing subsistence, recreational, and traditional resources for their families as their ancestors had for thousands of years. This includes such resources as elk, deer, bear, moose, fish, and camas.

The CDAT's Natural Resources Department (Department) is dedicated to the management of all natural resources within the historical and cultural territories of the CDAT. The Department is comprised of fisheries, wildlife, water resources, forestry, fire management, land services, and environmental planning programs, each dedicated to management of lands and resources and enforcement of tribal regulations. Tribal fish and wildlife programs operate under a mission to restore, protect, expand, and reestablish native fish and wildlife populations to sustainable levels to provide harvest opportunities.

The CDAT is a fish and wildlife co-manager within the subbasin. The CDAT is responsible for the management and enforcement of all tribal harvest within the subbasin, including the establishment of all seasons, bag limits, and harvest techniques. The CDAT serves as a core member of the Albeni Falls Interagency Work Group and uses this forum to mitigate Albeni Falls wildlife habitat losses. This includes the mitigation of the existing construction and inundation losses, operational losses, and secondary losses.

State Government

Idaho Department of Fish and Game

The IDFG is charged with "preserving, protecting, and perpetuating" Idaho's fish and wildlife resources for present and future generations, and is responsible for managing fish and wildlife populations in the Upper Pend Oreille subbasin. Idaho Department of Fish and Game management plans and policies relevant to fish and wildlife and their habitat in the subbasin include the *Idaho Department of Fish and Game Five Year Fish Management Plan: 2001-2005.* Generally, IDFG's fisheries management policies emphasize providing diverse sport fishing opportunities while conserving wild, native fish stocks.

In 1996, the State of Idaho completed its bull trout conservation plan. Lake Pend Oreille and its tributaries were designated a bull trout key watershed. The plan identified problem assessments and conservation plans be developed for each of the key watersheds. A bull trout Technical Advisory Team (TAT), consisting of state, tribal, federal, and private industry scientists, in 1998 completed the *Lake Pend Oreille Key Watershed Bull Trout Problem Assessment*. In 1999, the Pend Oreille Bull Trout Watershed Advisory Group, comprised of members of the TAT and area citizens, completed the *Lake Pend Oreille Bull Trout Conservation Plan*. The plan identified specific, prioritized actions that will benefit bull trout. The plan established two restoration targets for bull trout: 1) ensure the Lake Pend Oreille Basin bull trout population is not vulnerable to extinction, and 2) provide for an overall bull trout population sufficient to produce an annual harvestable surplus. The Settlement Agreement, state and federal programs, and private grants fund implementation of the plan.

The *Northern Idaho Wildlife Mitigation Agreement* (1997) between BPA and the State of Idaho, through IDFG and the Idaho Fish and Game Commission, identifies the obligations of both BPA and the State of Idaho in mitigating wildlife impacts associated with construction and inundation of Albeni Falls Dam. The underlying purpose of the Memorandum of Agreement is to protect, mitigate, and enhance wildlife and wildlife habitat permanently, through the acquisition, protection, and management of lands.

Idaho Department of Lands

The IDL manages several thousand acres of timberland in the Upper Pend Oreille subbasin and administers the Idaho Forest Practices Act. The IDL assists private landowners with the development of timber management plans so that they comply with site-specific best management practices in several tributary watersheds. The IDL is responsible for administering mining laws and the state's lake protection act, and holds regulatory authority for lake shoreline developments.

Idaho Department of Environmental Quality

The IDEQ is responsible for implementing the 1972 Federal Clean Water Act and enforcing state water quality standards for protection of aquatic life and other beneficial uses. The IDEQ developed a non-binding water quality management plan for Pend Oreille Lake in 1994 and is in the process of developing a TMDL. The IDEQ and IDFG were the lead agencies in implementing the State of Idaho Bull Trout Conservation Plan.

Idaho Department of Parks and Recreation

The Idaho Department of Parks and Recreation (IDPR) manages two state parks in the Lake Pend Oreille subbasin.

Idaho Water Resources Board

The Idaho Water Resources Board has identified and adopted stream maintenance flows for Grouse Creek, Granite Creek, Sullivan Springs, Lightning Creek, and Pack River. The Idaho Department of Water Resources is responsible for managing Idaho's water rights program and the Stream Channel Protection Act, which requires permits for in-channel work or developments.

Idaho Department of Environmental Quality

The Idaho Department of Environmental Quality administers several programs designed to monitor, protect, and restore water quality and aquatic life uses. These include BURP monitoring; 305(b) water quality assessments; 303(d) reports of impaired waters and pollutants; TMDL assessments, pollutant reduction allocations, and implementation plans; Bull trout recovery planning; 319 nonpoint source pollution management; Antidegradation policy; Water quality certifications; Municipal wastewater grants and loans; NPDES inspections; Water quality standards promulgation and enforcement; General ground water monitoring and protection; Source water assessments; and specific watershed management plans identified by the legislature. The Idaho Board of Environmental Quality oversees direction of the agency to meet responsibilities mandated through Idaho Code, Executive Orders, court orders, and agreements with other parties.

Local Government

Bonner and Kootenai counties have adopted comprehensive plans to guide growth and development on county administered lands. Bonner County’s plan has been under revision for the past three years. Kootenai County adopted a site disturbance ordinance in 1999 that was designed to protect water quality.

The Cocolalla Lake Association and Bonner County Soil and Water Conservation District developed a plan for improving water quality in the Cocolalla Creek watershed, which is a tributary to the Pend Oreille River.

Goals, Objectives, Strategies, and Recommended Actions

The Upper Pend Oreille subbasin provides diverse fish and wildlife populations and habitats that are significant ecologically, aesthetically, and economically to the citizens of Idaho and the Northwest. The Upper Pend Oreille subbasin also has special cultural significance to the KT, the Kootenai Tribe of Idaho, and the CDAT. The overall goal is to provide for healthy, sustainable populations of fish and wildlife that will provide ecological, economic, cultural, recreational, and

aesthetic benefits to the region. This goal will likely be reached by maintaining the functions and attributes of healthy portions of the ecosystem, and working with modified aspects of the ecosystem to either restore lost ecological components or replace them with other components that produce desirable outputs.

Fisheries

Goal 1: To minimize and mitigate the impacts of the federal hydropower system on the kokanee population and sport fishery in Lake Pend Oreille.

Status: Kokanee are an introduced species that migrated downstream from Flathead Lake in the 1930's. They established a self-sustaining population with a harvestable surplus in excess of 1 million fish annually and became a major forage species for bull trout, rainbow trout, and lake trout. Current population is at record low numbers and in danger of collapse.

Limiting Factors:

The kokanee population is currently limited by spawning areas. The population has declined precipitously since the 1960's largely due to the operation of Albeni Falls Dam (Maiolie and Elam 1993; Paragamian and Ellis 1994). Historical population trends and harvest data indicated winter pool elevation affects kokanee abundance and harvest. Consistent annual drawdowns of the lake, below the elevation needed for flood control, exposed shoreline gravel and limited kokanee spawning habitat. Gravel surveys conducted in 1994 determined a 1.6 meter higher winter pool level would increase the amount of suitable kokanee spawning gravel by 560 percent (Fredericks *et al.* 1995). The survival rate for kokanee eggs to fry increased from 1.4 percent in 1995 (full drawdown) to 9.6 percent in 1998 and 6.0 percent in 1999 (partial drawdown in these years)(Maiolie 2000 in press). These data indicate that changes in lake level management are needed to create suitable spawning areas for kokanee.

Spawning habitat in the Clark Fork River has declined as a result of Cabinet Gorge dam blocking migration, peaking flow releases, and reducing gravel recruitment due to trapping behind the dam. Although Cabinet Gorge Dam blocked kokanee from potential spawning areas, the population remained productive until 1966 when deeper drawdowns of the lake by Albeni Falls Dam further reduced spawning sites.

A second limiting factor, which has only appeared recently, is predation. In 1997, the kokanee population was already low. Then severe flooding resulted in significant declines in survival of all age classes of kokanee (Maiolie 2000). A predatory bottleneck appears to have developed in the population and kokanee have not rebounded since 1997. The low kokanee population is currently below what is needed to sustain the lakes predatory species. If changes do not occur, further declines in kokanee abundance are expected.

Opossum shrimp, *Mysis relicta*, have been implicated as a cause for decline of some kokanee populations, but recent studies have failed to show that shrimp affect kokanee abundance in Lake Pend Oreille (Clarke 1999). Experiments showed that newly emerged kokanee had good growth and survival even with the shrimp population in the lake. Also based on past history we know that the lake supported much higher

kokanee populations even with higher shrimp densities in the mid-1970's. Shrimp at this time do not appear to be limiting the kokanee population.

Objective 1: By 2015 restore kokanee populations in Lake Pend Oreille to three quarters of their abundance prior to impacts of Albeni Falls Dam (3.75 million adult fish with a harvest of 750,000 fish/year).

Strategies 1: This strategy is to improve shoreline spawning areas for kokanee. Lake level changes should be designed which will improve spawning conditions for kokanee and further our understanding of the dynamics of shoreline gravel and its effects on the kokanee population.

Recommended Actions:

- One action is to work with the Northwest Power Planning Council and the Fish and Wildlife Service to develop changes in lake level management that are consistent with the current operating rule curves for Albeni Falls Dam. Then it is important to see that these changes are incorporated into operation of the dam. (The newly released Fish and Wildlife Service's Draft Biological Opinion recommended lake level changes to enhance kokanee spawning for the benefit of bull trout forage. Likely, some form of these changes will go into effect in 2000.)
- Continue the annual fish monitoring program that was developed under BPA funding. Program should continue to include: standardized mid-water trawling of the lake using methods similar to those in use since 1977; hydroacoustic assessment of the pelagic fish stocks to include large predators; stratified-random fry netting to assess survival and composition of young-of-the-year kokanee; and spawner counts on standard reaches of shorelines. This monitoring will enable researchers to evaluate changes in lake level management on the survival of kokanee year classes.
- Monitor the quality and location of shoreline gravels. Substrate samples should be collected in known and historical spawning areas and analyzed for quality. Gravel sizes and silt content should be compared to previously collected data (Maiolie and Elam, 1993). These data should be used to define lake level management strategies which benefit shoreline spawning areas.
- Evaluate kokanee survival and physical changes in spawning areas and make new recommendations on future lake level changes. The Draft Fish and Wildlife Service Biological Opinion includes an annual review of lake level management.
- Restore /protect/maintain spawning and rearing habitat in tributary streams to improve survival of stream spawning kokanee. Also, determine the potential benefits of improving other tributary streams to provide more spawning habitat for kokanee. If significant improvements can be made, work with public and private entities to acquire land or easements and to protect tributary habitat.
- Initiate research to assess whether following a more naturally fluctuating pool level will benefit kokanee and other species in Lake Pend Oreille. Studies should include determining whether natural pool elevations would improve migration conditions for kokanee and other salmonids at tributary mouths by allowing depositional areas to become vegetated and establish defined channels. Studies should also determine the benefits of improved riparian vegetation on bank stability and lake productivity.

Researchers should then work with USACOE, NWPPC, and other entities to propose new rule curves and implement a more natural pool level if significant benefits are demonstrated.

- Conduct basic limnological monitoring of the lake. Parameters such as temperature, dissolved oxygen, secchi transparency, and nutrient status (total dissolved phosphorus) should be monitored and related to fish and shrimp populations. Monitoring would serve as baseline data to explain changes in kokanee survival.
- Investigate the potential for enhancing kokanee reproduction by artificially building spawning areas at selected locations on an experimental basis.

Strategy 2: Evaluate the contribution of Cabinet Gorge Hatchery to the fishery recovery effort. To date the hatchery has not been successful at recovering the kokanee population.

Recommended Actions:

- Mark all hatchery kokanee entering the lake. Age kokanee collected by fry netting and trawling during annual surveys. Calculate and compare survival rates. Determine if one-year class is the bottleneck for hatchery fish or whether a chronic problem is occurring.
- Compare survival of hatchery kokanee stocked into Spirit Lake to those stocked into Lake Pend Oreille. This would help to determine if poor survival is due to the lake or the fish.
- Determine the percent return of hatchery kokanee to the egg collection station at Sullivan Springs Creek and compare return rate to kokanee that spawned naturally above the weir. If natural spawners show good returns, then investigate potential to increase natural spawning.
- Determine if the stocking of hatchery kokanee is negatively impacting wild kokanee. Data collection should continue to correlate number of kokanee stocked versus wild fry survival for the next five years to determine any statistical or biological significance.

Objective 2: Balance predator and prey populations in Lake Pend Oreille to a 1:10 biomass ratio within the next 3 years. Reassess predator abundance as the kokanee population recovers.

Strategy : Annually monitor both predator (bull trout, lake trout, and rainbow trout) abundance and kokanee abundance. Keep predator and prey ratio within previously defined guidelines for the lake

Recommended Actions:

- Develop a hydroacoustic method to determine pelagic predator abundance. Research is needed on the diurnal and seasonal distribution of rainbows, lake trout, and bull trout in Lake Pend Oreille. This may be possible with the recent development of recording depth-sensitive tags. Knowing predator distribution may enable researchers to assess predator abundance using hydroacoustic techniques. Monitoring predator populations is essential in determining the effects of recovery efforts and balancing predator and prey.

- Kokanee survival rates in Lake Pend Oreille should be estimated to determine the maximum level of predation that is occurring. Survival rates will be compared to other lakes where predation is thought to be a problem and to lakes with few predators. Strategies should be implemented to balance predator and prey, if needed.
- If re-balancing is needed, implement changes in fishing regulations or conduct active removal of predators.

Goal 2: Protect, enhance, and restore native fish populations to maintain stable, viable levels, to ensure they are not vulnerable to extinction, and to provide ecological and sociological benefits.

Goal 3: Protect, enhance, and restore the sport fisheries on Lake Pend Oreille, the lower Clark Fork River, the Pend Oreille River, and tributary waters in the Pend Oreille subbasin.

Objective 1: By 2015, restore bull trout populations to a level where adult escapement is well distributed and at any one time at least six of the spawning tributaries support healthy spawning populations defined as having a stable or increasing trend, with an estimated probability of persistence of 95% or better over the next 100 years - probability of persistence is determined using the model described by Dennis and others (1991).

Objective 2: By 2015, provide for an overall bull trout population sufficient to produce an annual harvestable surplus of over 2,000 fish in Lake Pend Oreille.

Objective 3: By 2010 restore kokanee salmon populations in Lake Pend Oreille to a level that provides for a sustainable harvest of 750,000 fish and allows for the expansion of the trophy trout and char fishery.

a. Increase egg to fry survival to greater than 3% based on hydroacoutics and fry netting by 2005. This should result in an improvement in abundance to greater than 400 fish/ha of all age classes.
b. Determine if the incorporation of the lake levels in the USFWS Biological Opinion creates quality spawning areas for kokanee with 50% gravel and less than 30% fine material.
c. Equilibrate predator and prey populations in Lake Pend Oreille to a 10:1 biomass ratio within the next 3 years.
d. Determine if hatchery produced kokanee have the same annual survival rate as wild kokanee of the same year class (40% for age 1-2, 80% for age 2-3, 60% for age 3-4). If not, explain why and recommend solutions.
e. Maintain a kokanee egg take at Sullivan Springs Creek of 20 million eggs until the kokanee population in the lake recovers.

Objective 4: By 2010, restore the trophy rainbow trout fishery in Lake Pend Oreille to include a harvest of 2500 fish larger than five pounds each and at least 30 fish larger than 11.3 kg each.

Objective 5: By 2015, protect and restore remaining stocks of genetically pure westslope cutthroat trout to ensure their continued existence in the basin, and to provide catch rates of over 0.5 fish per hour in the Clark Fork River, and an annual catch of over 1,000 fish in Lake Pend Oreille.

Objective 6: By 2010, provide a warmwater sport fishery in the Pend Oreille River with catch rates exceeding 0.5 fish per hour.

Objective 7: Minimize lake trout-bull trout competition by keeping the lake trout population below 2,000 adult fish.

Objective 8: Inventory fish species composition within the deep basin of Lake Pend Oreille to determine uniqueness of fish the fish community in 1,609 m of water.

Strategy: Restore/protect/maintain spawning and rearing habitat in tributary streams to improve survival of stream spawning salmonids, with emphasis on bull trout, cutthroat trout, kokanee salmon, and rainbow trout.

Objective 9: Restore Cold Water Biota and Salmonid Spawning beneficial uses to Full Support throughout the subbasin.

Strategy: Effectuate actions identified in TMDL Implementation Plans to restore aquatic life beneficial uses.

Recommended Actions:

- Complete water quality Subbasin Assessments and necessary TMDLs for impaired water bodies.
- Complete development of TMDL implementation plans within 18 months of TMDL approval through coordination with appropriate agencies, advisory groups, and interested parties.
- Seek funding for projects identified in TMDL Implementation Plan

Recommended Actions:

- Identify and pursue land acquisition and/or conservation easements with willing private landowners to secure and/or prevent stream and floodplain damage, and to protect tributary habitat.
- Work with the USFS and other timberland owners and managers to identify and remove failing roads and correct other problems that are negatively impacting stream habitat, floodplain function, and watershed condition (Lightning Creek and Pack River watersheds are high priority).
- Provide technical assistance and cost sharing on streambank stabilization, flood control, and stream crossing projects to ensure landowners and road maintenance agencies do projects that are either benign or beneficial to target fish species.
- Work with Idaho Transportation Department and Montana Rail Link to improve stream crossings on Lightning Creek and Trestle Creek, to alleviate impacts to fish migration corridors due to bridge-caused bedload deposition.

- Artificially recruit large woody debris to stream channels and maintain shade in Gold Creek, North Gold Creek, Cedar Creek, Twin Creek, Johnson Creek, and Granite Creek where BPA and Avista powerline maintenance results in removal of riparian tree species.
- Inventory fish passage through stream crossings, diversions, or other man-made obstructions and restore fish passage where needed.
- Work with federal and state agencies, and responsible parties, to remove and/or stabilize mine tailings and waste rock deposited in stream channels and floodplains in the South Gold Creek watershed.
- Investigate potential for stream channel restoration work in channelized reaches of Hoodoo and Cocolalla creeks.
- Develop and implement an educational program about stream habitat and its importance to the Lake Pend Oreille fishery, targeting landowners, land managers, and local governments.

Strategy 2: Improve habitat for kokanee salmon, bull trout, westslope cutthroat trout, rainbow trout, and other sport fish in Lake Pend Oreille, the lower Clark Fork River, and the upper Pend Oreille River by modifying dam operations.

Recommended Actions:

- Continue the existing kokanee research project to assess whether winter lake levels modified for the Fish and Wildlife Service's Biological Opinion improve kokanee fry recruitment.
  a. Compare years of high winter pool level to years of lower winter pool level to define effect. All hatchery fry stocked into the lake will be marked by "coding" the otoliths while they are in the hatchery. (This method involves changing the temperature of the water the fry are reared in to form a series of dark rings on the otoliths.) Determine kokanee biomass annually. Population estimates of wild and hatchery kokanee will be kept separate. Growth and survival of wild kokanee fry will be compared to determine benefits of lake levels.
  b. Monitor the quality and location of shoreline gravels. Eighty substrate samples (20 at each of four sites) will be collected in known and historical spawning areas and analyzed for quality. Samples will be collected using SCUBA or snorkeling techniques. Gravel sizes and silt content will be compared to previously collected data (Maiolie and Elam, 1993).
  c. Kokanee survival rates in Lake Pend Oreille will be estimated to determine the maximum level of predation that is occurring. Survival rates will be compared to other lakes where predation is thought to be a problem and to lakes with few predators.
- Continue the existing warmwater fish research project to assess whether higher winter lake levels improve recruitment of largemouth bass and other spiny ray species in the Pend Oreille River. Use this research to identify and implement dam operations that will allow goals to be met.
- Initiate research to assess whether lake level management prescribed by the US Fish and Wildlife Service Biological Opinion for bull trout significantly impacts the quality of coldwater fish habitat (including bull trout habitat) in the lower Clark Fork River, and if so, to what extent. Quantify impacts and develop and implement a mitigation plan.

- Initiate research to assess whether lower summer pool levels will benefit bull trout, westslope cutthroat trout, rainbow trout, mountain whitefish, and other species making up the fishery in the lower Clark Fork River and whether lower summer pool levels will benefit target species (bull trout, kokanee, rainbow trout) in Lake Pend Oreille. Investigate whether lowering the summer pool will improve migration conditions for bull trout and other salmonids at tributary mouths by allowing depositional areas to become vegetated and establish defined channels. Work with the USACOE and other entities to implement lower summer pool levels if benefits are demonstrated.
- Investigate the potential for restoring fish passage at mainstem dams, and implement if expected benefits include strengthening stocks of listed and native salmonids.

Strategy 3: Improve conditions for native and desirable non-native fish species through fisheries management actions.

Recommended Actions:

- Investigate the potential for using commercial-type fishing gear to control lake trout numbers, and implement if biologically, economically, and socially feasible and acceptable.
- Conduct research on predator-prey relationships in the aquatic community to provide a basis for management decisions. Balance ratio by increasing prey or decreasing predators, if needed.
- Conduct research to assess relationships between bull trout and other top predators to provide a basis for management decisions. Determine the habitat overlap between bull trout, lake trout, and rainbow trout using recording tags.
- Continue the recently started angler education project to improve anglers' fish identification and fish releasing skills.
- Conduct research to assess the importance of native and introduced fishes to the overall ecological community of the subbasin.
- Set gillnets and traps in the deep basin of Lake Pend Oreille. Classify any native species collected and conduct genetic analysis if warranted.

Strategy 4: Evaluate the contribution of Cabinet Gorge Hatchery to the fishery recovery effort. To date the hatchery has not been successful at recovering the kokanee population.

Recommended Actions:

- Mark all hatchery kokanee entering the lake. Age kokanee collected by fry netting and trawling during annual surveys. Calculate and compare survival rates. Determine if one year class is the bottleneck for hatchery fish or whether a chronic problem is occurring.
- Compare survival of hatchery kokanee stocked into Spirit Lake to those stocked into Lake Pend Oreille. This would help to determine if poor survival is due to the lake or the fish.
- Determine the percent return of hatchery kokanee to the egg collection station at Sullivan Springs Creek and compare return rate to kokanee that spawned naturally above the weir. If natural spawners show good returns, then investigate potential to increase natural spawning.

- Determine if the stocking of hatchery kokanee is correlated in a statistically and biologically significant amount with a decline in wild kokanee survival. Correlate number of kokanee stocked to wild fry survival for the last five years and the next 3 years.

Wildlife

Goal 1: Protect, restore, enhance, and sustain populations of wildlife for aesthetic, cultural, ecological, and recreational values.

Objective 1: Increase the Selkirk woodland caribou herd to 75 animals or more by 2010, with the intent to meet ESA de-listing criteria by 2020.

Status: Endangered (Federal, Idaho, Washington)

Limiting Factors: Predation, poaching, and collisions with vehicles (Bergerud 1978; Caughley and Sinclair 1994; USFWS 1994).

Strategies:
- Reduce predator impacts to caribou through habitat manipulation, where feasible.
- Secure adequate habitat and prevent human-caused mortality.
- Continue monitoring radio-collared caribou to determine population dynamics, seasonal habitat use, and population survival and document population trends.
- Implement herd augmentation whenever the caribou population is documented at less than 50 animals.

Objective 2: Maintain bald eagle populations at or above present levels.

Status: Endangered (Idaho); Threatened (Federal, Washington)

Limiting Factors: Loss of nesting and winter roost sites and disturbance from development and other anthropogenic activities (USFWS 1986).

Strategies:
- Protect bald eagle nesting and winter roost sites by securing existing and potential nesting/roosting areas (including a 400 m to 800 m radius buffer around nests).
- Identify and map winter roosting habitats.
- Monitor and/or research water quality, and prey abundance and production.
- Maintain high quality fish and waterfowl habitat for prey species.

Objective 3: Restore a self-sustaining population of grizzly bears in the Selkirk Recovery Zone that meets the *Grizzly Bear Recovery Plan* goals (USFWS objective) (Table 7).

Table 7. Grizzly Bear Recovery Plan goals

Criterion	Targets (achieved for three consecutive years)

Females with cubs	At least 6 females with young observed per year
Mortality Limit	Maximum of 0.50 bears killed per year
Female Mortality Limit	Maximum of 0.15 female bears killed per year
Distribution of females with young	Females with young observed in at least 7 of 10 Bear Management Units

Status: Endangered (Washington); Threatened (Federal, Idaho)

Limiting Factors: The illegal shooting or killing of bears in self defense (Knick and Kasworm 1989, McLellan *et al.* 1999).

Strategies:

- Cooperate and coordinate with the Interagency Grizzly Bear Committee (IGBC 1995).
- Assess distribution of grizzlies in the subbasin though trapping, radio-marking and hair-snagging surveys.
- Monitor bear populations to determine progress towards ESA de-listing criteria.
- Secure funding for information and education patrols to make contacts with people, especially hunters, recreating in grizzly bear habitat within the subbasin.
- Expand information and education efforts to improve grizzly bear survival through completion and distribution of bear identification, clean camping brochures and video, and through funding brochures, signs, and other informational materials.
- Augment efforts to de-commission or close roads to meet access criteria to improve grizzly bear survival.
- Develop a strategic conservation plan that includes provisions for grizzly bear population monitoring and an information and education program that emphasizes the needs of grizzly bears by ensuring that increased demands for human recreation within the Selkirk Zone are compatible with grizzly bear recovery.
- Develop habitat parameters for recovery and incorporate those parameters in forest and land use plans.
- Provide enforcement to deter and pursue grizzly bear poaching and provide a preventative presence in the subbasin.
- Pursue protection of important seasonal grizzly bear range within the Selkirk Grizzly Bear Recovery Zone, particularly low-elevation spring range, through conservation easement or fee-title acquisition.
- Investigate protection of grizzly bear movement corridors through conservation easement or fee-title acquisition.

Objective 4: Restore and maintain viable lynx populations in the subbasin.

Status: Threatened (Federal, Washington); Species of Special Concern (Idaho).

Limiting Factors: Winter prey base, forest management practices, habitat fragmentation, wildfires, fire suppression, insect epidemics, and lynx harvest management (Stinson 2000).

Strategies:

- Determine distribution abundance, population trend, and limiting factors for lynx in the subbasin based on reviews of literature, habitat modeling, and direct investigation.
- Coordinate survey, monitoring, and management activities with affected land management agencies to assist in lynx recovery.
- Conduct intensive telemetry studies of lynx populations to better evaluate limiting factors.
- Conduct prey species research (snowshoe hare and red squirrels) to evaluate prey base limitations on lynx populations.
- Investigate lynx habitat use and travel patterns in relation to snowmobile, cross-country and downhill ski trails, and other anthropogenic activities.
- Conduct investigations of potential competition between lynx and other carnivores and the possible role of anthropogenic-induced habitat changes.

Objective 5: Restore and sustain state and tribal species of special concern, federal candidate species, BLM sensitive species, and USFS indicator species, including the following: wolverine, fisher, otter, northern flying squirrels, northern bog lemmings, pygmy shrew, Townsend's big-eared bat, common loons, pygmy nuthatch, flammulated owls, boreal owls, black-backed owls, great grayowls, northern pygmy owls, three-toed woodpeckers, upland sandpipers, northern alligator lizard, ring-necked snake, rough-skinned newts, wood frog, and Coeur d'Alene salamanders.

Limiting Factors: Unknown

Strategies:

- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Address limiting factors through appropriate methods.

Objective 6: Protect, restore, enhance, and sustain populations of big game species such as black bear, elk, mountain goat, moose, mountain lion, mule deer, and white-tailed deer.

Limiting Factors: The lack of low elevation stands of old-growth forest is likely limiting for white-tailed deer in the Priest River subbasin (Secord 1994). Predation is an important factor in the population dynamics of white-tailed deer in the subbasin (Hayden and Spicer 1995) and is possibly limiting. Wildlife habitat is threatened by development of summer and year-round homes at low elevations, by extensive thinning and removal of closed-canopy, low-elevation winter ranges, fire suppression in middle and upper elevations, recreation on key winter ranges, and other land-use practices.

Strategies:

- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.

- Identify priority zones for habitat protection, restoration, and enhancement activities with a priority on areas affected by development.
- Protect, enhance, and maintain critical habitats from development and other land use threats.
- Enhance an average of 400 ha annually through habitat burns or other forest management practices.
- Protect, enhance, and maintain winter range with an emphasis on maintaining blocks of low-elevation, closed canopy forest cover.
- Determine how predators, hunting, and inter-specific competition from sympatric species impact ungulate populations in the subbasin by 2010.
- Encourage management of mid- and upper-elevation portions of the forest toward the more natural, open mature stands that favor moose and mule deer.
- Secure funds to develop fire plans and implement activities on high elevation habitats controlled by the USFS and/or owned by private individuals/timber companies.
- Ensure linkage between mountain ranges are protected, and allow for large and small animal movement.
- Reduce impacts of highways and railways on wildlife.
- Restore a population of 195 mountain goats in the Selkirk Mountain Range through augmentation of 10 goats to be released by 2005 and burning of habitat adjacent to cliff complexes occupied by mountain goats.

Objective 7: Protect, restore, enhance, and sustain populations of waterfowl, upland game, and furbearers under traditional levels of recreational and subsistence use.

Limiting Factors: Unknown

Strategies:

- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Address limiting factors through appropriate methods.
- Coordinate subbasin activities with appropriate agencies and organizations in adjacent subbasins, including the British Columbia Ministry of the Environment.
- Identify priority zones for habitat protection, restoration, and enhancement activities with a priority on areas affected by development.
- Protect, enhance, and maintain critical habitats from development and other land use threats.

Objective 8: Maintain or enhance neo-tropical migrant bird populations at current levels within present use areas and identify limiting factors for these populations within the subbasin.

Limiting Factors: Unknown

Strategies:

- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Identify limiting factors associated with different neo-tropical bird species.
- Identify priority zones, such as riparian, wetlands, and grasslands, for neo-tropical bird habitat protection, restoration, and enhancement activities.
- Protect, enhance, and maintain neo-tropical bird habitats.
- Augment existing broad-scale efforts to establish and analyze trends of neo-tropical birds through a system of breeding bird surveys.

Objective 9: Maintain or enhance amphibian and reptiles populations at current levels within present use areas and identify limiting factors within the subbasin.

Limiting Factors: Unknown

Strategies:
- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Identify priority zones, such as riparian, wetlands, and grasslands, for amphibian and reptile habitat protection, restoration and enhancement activities.
- Protect, enhance, and maintain key amphibian and reptile habitats.

Objective 10: Maintain or enhance invertebrate populations at current levels within present use areas and identify limiting factors for these populations within the subbasin.

Limiting Factors: Unknown

Strategies:
- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Identify and address limiting factors for invertebrates.

Goal 2: Protect, enhance, and restore native wildlife habitat function and performance to establish ecological security for native wildlife populations.

Objective 1: Restore the diversity, block size, and spatial arrangement of habitat types needed to sustain wildlife populations at ecologically sound levels.

Limiting Factors: Unknown. Major influences include hydropower operations, dike construction for flood control, agricultural draining, human development, livestock grazing, recreational activities, and forest management practices**.**

Strategies:
- Develop a consolidated habitat map for the subbasin, with special emphasis on wetland, riparian, old-growth, ponderosa pine, aspen, and white-bark pine communities. This may require canvassing existing databases, content, and researching knowledge gaps.

- Investigate and analyze historic losses of key habitat type, biological functions, and performance associated with changes in habitat diversity, block size, and spatial arrangement.
- Protect habitat through conservation easements, fee-title acquisition, and long-term agreements.
- Coordinate efforts to develop comprehensive plans for protection, restoration, and enhancement of key habitat types in the subbasin.
- Coordinate efforts to restore natural disturbance regimes in key habitats in the subbasin.
- Identify and address human impacts to key habitats and use adaptive management techniques to address those impacts.
- Reverse the loss of island and associated wetland habitat in the Clark Fork and Pack River deltas, and along the Pend Oreille River by managing water levels, providing island stabilization and building features.

Recommended Actions:

- Conduct research on the use of modified lake level management (including both summer and winter pool levels) as a means to reduce erosion and stimulate restoration of island and shoreline habitat.
- Implement modifications to lake level management as warranted, and coordinate with fisheries managers.
- Research the use of structural means, such as barrier reef and jetty construction, bioengineering, or rock bank stabilization, to prevent further island loss and stimulate island rebuilding. Implement those measures that have a good probability of success.

Objective 3: Restore the connectivity of habitat types needed to sustain wildlife populations at the landscape level.

Limiting Factors: Unknown. Major influences include human development, particularly adjacent to waterways; highway and railway activity, inundation of land, recreational activities, and forest management practices.

Strategies:

- Identify existing large-scale wildlife travel corridors in the subbasin and between subbasins.
- Secure management rights to travel corridors between blocks of habitat and across highways and railways.
- Construct overpasses, drift fences, and other structures to assist wildlife in crossing highway and railway obstacles.
- Secure management rights through conservation easements or fee-title acquisition to enhance habitat connectivity.

Objective 2: By 2050, fully mitigate wildlife habitat losses associated with the construction and inundation of Albeni Falls Dam.

Limiting Factors: Willing sellers and habitat availability.

Strategies:

- Protect habitat through fee-title acquisition, conservation easement, or long-term lease agreement in coordination with the Albeni Falls Interagency Work Group and the *Albeni Falls Interagency Work Group Operating Guidelines and Guiding Principles for Mitigation Implementation* (1998).
- Complete site-specific management plans.
- Enhance and restore habitat through peer-accepted methodologies for the target habitat cover types.
- Implement habitat enhancement and restoration activities.
- Implement Operations and Maintenance plans.
- Maintain, monitor, and evaluate habitat through peer-accepted methodologies for the target habitat cover types in perpetuity.
- Implement monitoring plans and evaluate project success and contribution to meeting goals.
- Implement adaptive management to meet project goals.

Recommended Actions:

- Continue funding the Albeni Falls Wildlife Mitigation Project at a level of $5 million annually. Losses for Albeni Falls Dam are located in the NPPC Program, Table 11-4.

Research, Monitoring and Evaluation Activities

BPA-funded Research, Monitoring and Evaluation Activities

Lake Pend Oreille Fishery Recovery Project

BPA-funded fishery research activities on Lake Pend Oreille are limited to the IDFG's Lake Pend Oreille Fishery Recovery Project. The goal of this project is recover fisheries that were directly impacted by the federal hydropower system. The research covers activities as diverse as predation, competition, Mysis shrimp interactions, lake level effects, and recovery efforts in the Pend Oreille River above Albeni Falls Dam.

Currently BPA is funding several monitoring activities as part of the research project. Every year since 1977, mid-water trawling was used to assess the kokanee population. Data on kokanee abundance and survival is obtained. Basic limnology, including temperature, oxygen, and secchi transparency is collected monthly, throughout the spring, summer, and fall, on the lake. Time-series data has also been collected on Mysis shrimp during most years dating back to the early 1970's. Since 1995, BPA has sponsored annual hydroacoustic surveys of the lake to provide a second, less bias, estimate of kokanee abundance as well as an estimate of the open water predators of the lake. Sampling throughout the lake with a large fry net has also become a standard monitoring activity when information on kokanee fry abundance is needed. This has been done for the last two years. The substrate at five major spawning areas in the lake is also monitored annually. These data are related to lake levels to determine the effect of changes on the quality of spawning areas. Counts of kokanee spawning in tributary streams and on the shoreline of the lake are one of the longest running data sets. Each year since 1972 these spawning fish were counted as an index of the adult kokanee population.

Evaluation of lake level changes is part of the ongoing research. For three years the USACOE held the lake higher during winter while IDFG documented changes to the habitat and

fish community in the lake and river. Other topics being evaluated include: carrying capacity for kokanee, predation within the lake, and the lake energy budgets.

The Albeni Falls Wildlife Mitigation Project

The IDFG is currently completing wildlife management plans for many of the habitat areas recently protected with BPA funds. A complete monitoring and evaluation plan is being developed and will include some of the following:

- Neo-tropical migratory bird monitoring on wildlife mitigation lands associated with the Pend Oreille WMA.
- Waterfowl monitoring on wildlife mitigation lands associated with the Pend Oreille WMA.
- 5-year habitat monitoring assessments using HEP on wildlife mitigation lands associated with the Pend Oreille WMA.
- Restoration and enhancement success monitoring wildlife mitigation lands associated with the Pend Oreille WMA.

Non BPA-funded Research, Monitoring and Evaluation Activities

IDFG License and Federal Aid to Fish Restoration Program

The IDFG has been involved with research, monitoring, and evaluation activities in the Lake Pend Oreille subbasin since the 1950's. The IDFG is currently conducting a year-long creel survey on Lake Pend Oreille and the lower Clark Fork River to assess angler use, catch rates, harvest, catch composition, and angler preferences. This survey was established to assess the response of the fishery to recent closure to kokanee harvest and liberalization of the harvest limits on rainbow trout and lake trout. The data will also be used to assess trends in the fishery by comparison with long-term data sets.

The IDFG regional fisheries staff assists Avista with bull trout redd counts, and IDFG houses 18 years of the long-term trend data on Lake Pend Oreille bull trout redd counts. The IDFG also works with local sportsmen groups to monitor participation, catch, and harvest in biannual fishing derbies.

Clark Fork Settlement Agreement

As part of the Settlement Agreement, Avista funds a full-time fisheries biologist for IDFG, the USFWS, and MDFWP in addition to having hired their own biologist. All four biologists work cooperatively as the Aquatic Implementation Team to implement projects in the Lake Pend Oreille and lower Clark Fork subbasins.

The Idaho biologist is responsible for implementing, monitoring, and evaluating the Idaho Tributary Habitat Acquisition and Fishery Enhancement Program. To date, this program has resulted in the acquisition of floodplain and riparian habitat on Granite Creek and Trestle Creek. Funds were also used to implement a 2 km stream channel restoration project in Twin Creek. Operational changes at Cabinet Gorge Dam have resulted in an increase in the minimum flow from 85 cms to 142 cms. Current monitoring activities include screw trapping of outmigrating fish in Trestle Creek and Twin Creek, cooperating with the USFS Rocky Mountain Research Station in estimating adult bull trout abundance in tributaries prior to spawning, annual redd counts of all known bull trout spawning areas, and spring and fall electrofishing on the Clark Fork River to estimate fish population size and community structure for comparison with

pre-Settlement Agreement information. Research is being conducted to assess the influence of watershed condition on bull trout recruitment. Current population studies on Twin Creek will allow for comparisons between habitat conditions and fish population responses to the channel restoration project. The *Lake Pend Oreille Bull Trout Conservation Plan* (Lake Pend Oreille Bull Trout Watershed Advisory Group 1999) is the primary document guiding implementation of the Tributary Habitat Acquisition and Fishery Enhancement Program.

The USFWS biologist is responsible for implementing, monitoring, and evaluating the NSRP, developed as part of the Settlement Agreement. Projects in the Upper Pend Oreille subbasin include trapping and radio tagging adult bull trout to assess their movements in the Clark Fork River below Cabinet Gorge Dam to identify the best potential locations for a permanent trap site or fish ladder entrance. The project has also resulted in a description of the genetics of bull trout populations in tributaries to Lake Pend Oreille, and the lower Clark Fork River in Idaho and Montana, and in the trap and haul of juvenile bull trout downstream from Montana tributaries to the lower Clark Fork River in Idaho.

The Avista biologist is responsible for monitoring the effects on the downstream aquatic community of high TDG levels produced by spill at Cabinet Gorge Dam. Monitoring was contracted out to a consultant and includes collecting fish during spill events to assess the level of gas bubble disease (GBD), monitoring the health of penned fish in the Clark Fork River and Lake Pend Oreille, and assessing fish distribution during spill events. Research is ongoing, with preliminary results indicating some fish afflicted with GBD, and high TDG extending down the Clark Fork River, across the north arm of Lake Pend Oreille, and into the Pend Oreille River during large runoff events. Avista is also investigating engineering solutions to reduce entrainment of atmospheric gas at Cabinet Gorge Dam and will have preliminary proposals by the end of 2000.

Montana biologists are implementing a tributary restoration and enhancement program upstream from Cabinet Gorge Dam similar to the Idaho project. If fish passage efforts are successful, improved conditions in the Montana tributaries should increase recruitment of bull trout and westslope cutthroat trout to Lake Pend Oreille. Trapping and tagging programs in the Montana tributaries will be used to monitor success of the restoration efforts.

Avista funded projects provide annual reports to the Management Committee, which oversees Settlement Agreement implementation.

U.S. Forest Service

The USFS Sandpoint Ranger District annually monitors watershed and fish habitat conditions for tributary streams on USFS lands. Results are published in an annual monitoring report distributed by the IPNF Supervisor's Office.

The Rocky Mountain Research Station in Boise, Idaho has conducted a significant amount of research on bull trout populations in the Upper Pend Oreille subbasin. Studies have included assessing the validity of redd counts, determining timing of migration and spawning, comparison of stock sizes, estimation of mortality, estimating age of adults, monitoring for repeat spawning, estimating of persistence, and, in cooperation with the University of Montana, assessing the genetic structure of tributary bull trout populations. These studies have resulted in several publications, including Rieman and McIntyre 1993, Rieman and Myers 1997, and others.

U.S. Geological Survey

As part of a larger study encompassing watersheds in the northern Rocky Mountains, the U.S. Geological Survey (USGS) is currently conducting fish and water quality assessments in the Lower Clark Fork subbasin. The project is due to be completed next year.

Idaho Department of Environmental Quality

The IDEQ periodically monitors water quality in the Upper Pend Oreille subbasin, assessing such attributes as temperature, sediment, heavy metals, and nutrients.

The Idaho Department of Environmental Quality (DEQ) is responsible for assessing waters of the state. The Clean Water Act and EPA regulations direct that the state monitor and assess the physical, chemical, and biological integrity of water bodies. To accomplish this, DEQ has developed the Beneficial Use Reconnaissance Project (BURP), and the Water Body Assessment Guidance (WBAG) program. Waters identified as potentially impaired also undergo a more rigorous water quality Sub-basin Assessment that incorporates all available information and focuses on the cause and extent of impairments for development of a Total Maximum Daily Load (TMDL) if necessary.

The purpose of the BURP program is to consistently provide the physical, chemical, and biological data necessary to assess the integrity and quality of waters. It relies heavily on macroinvertebrate sampling, habitat evaluation and measurement, bacterial sampling, and fish sampling. The BURP protocol closely follows EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* (Plafkin et al. 1989). BURP data also documents existing uses, which must then be designated and protected under Idaho's water quality standards. It is the goal of the state to re-monitor water bodies on a rolling five year schedule.

The WBAG was designed to use BURP data to answer questions about stream integrity, water quality, and beneficial use support status. It originally consisted of multi-metric indexes for macroinvertibrates and habitat, qualitative and quantitative fisheries assessments, and evaluation of criteria exceedances. Assessments of BURP data collected from 1993 through 1996 were conducted to generate the 1998 list of impaired waters required under section 303(d) of the CWA. Revisions to the assessment methodology are currently underway that would allow the use of more types of data, revise the macroinvertebrate and habitat indexes, add a multi-metric fish index, revise the salmonid spawning beneficial use assessment, and add an interpretation of criteria exceedances in the assessments. The revised water body assessment methodology is expected to be completed in 2001 for use in the next 303(d) and 305(b) reporting cycles, and in ongoing TMDL sub-basin assessments.

Fisheries

Objective: Restore Cold Water Biota and Salmonid Spawning beneficial uses to Full Support throughout the subbasin.

Strategy: Effectuate actions identified in TMDL Implementation Plans to restore aquatic life beneficial uses.

Recommended Actions:

- Complete water quality Subbasin Assessments and necessary TMDLs for impaired water bodies.

- Complete development of TMDL implementation plans within 18 months of TMDL approval through coordination with appropriate agencies, advisory groups, and interested parties.
- Seek funding for projects identified in TMDL Implementation Plan

Statement of Fish and Wildlife Needs

Fisheries

- Restore the kokanee population and the fishery dependent on it through Albeni Falls Dam operational changes. Research work to date has attributed impacts to the Lake Pend Oreille kokanee population to the current operation of Albeni Falls Dam. Continue making changes in the operation of the dam to benefit fish populations, and the continued monitoring to document the effects. Currently, three test years have been monitored. For statistical reliability more years are needed. Previous annual reviews by the ISRP have stated a similar finding: that lake level changes should continue over the next 10 years.

- Fund projects identified in the *Lake Pend Oreille Bull Trout Conservation Plan*. This plan is scientifically based and was developed by the local community.

- Determine the habitat overlap between rainbow trout and bull trout, and the degree of hybridization with westslope cutthroat trout. With a depressed kokanee population, management actions will continue to limit rainbow trout abundance. These issues need to be addressed to remove uncertainty about whether or not a recovered rainbow trout population would impact bull trout and/or westslope cutthroat trout.

- Survey public attitudes regarding the implementation direction of BPA-funded programs. Such human dimensions work is important to direct management priorities to achieve public acceptance and support.

- Construct a detailed GIS-based fish and wildlife habitat map for the entire subbasin. Include providing personnel and equipment to search available databases for existing coverages, digitizing existing fish and wildlife information currently not available GIS data layers, and identifying key habitat areas. Existing GIS databases such as the one developed by Bonner County could be used as a starting point.

- Assess the ecological impacts of the modified lake hydrograph on fish and wildlife populations and communities, and investigate modifying operations to benefit fish and wildlife while minimizing socio-political impacts.

- Research broad ecological relationships and identify limiting factors for focal species within the subbasin. For example, identify the role of migratory fish in the ecosystem in terms of providing nutrients to headwater areas and their role in the food web.

- Assess the status of native species that have received little attention to date. In particular, westslope cutthroat trout, mountain whitefish, and pygmy whitefish appear to be well

below historic population levels. Assess status and causative factors for current population conditions.

- Assess the genetic structure and purity of westslope cutthroat trout.

- Conduct a fisheries habitat assessment to determine construction, inundation, and operational impacts resulting from Albeni Falls Dam.

- Survey the Lake Pend Oreille fish community that exists in the deep basin (300m), and analyze the genetic makeup of that community. Although it is doubtful that a new endemic species would be found, there may well be strains of the native species that have become adapted to life in the depths and spend at least part of their life history there. U.S. Navy video from their test site at the bottom of the lake recorded fish on several occasions.

Wildlife

- Conduct a wildlife habitat assessment to determine operational impacts resulting from Albeni Falls Dam.

- Construct a detailed, GIS-based wildlife habitat map for the entire subbasin. This would include providing personnel and equipment to search available databases for existing coverages, digitizing existing wildlife information currently not available as data layers, and identifying key habitat areas.

- Survey public attitudes regarding the implementation direction of BPA-funded programs. Such human dimensions work is important to direct management priorities to achieve public acceptance and support.

- Research broad ecological relationships and to identify limiting factors for focal species within the subbasin. Assess fluctuating water levels on aquatic-dependent wildlife such as waterfowl and otter.

- Fund the establishment of techniques, surveys, and programs to assess the health and trend of wildlife and wildlife habitat in the subbasin. Existing wildlife management surveys are inadequate to assess distribution, establish abundance, or evaluate trends for most species at the subbasin level to allow BPA to evaluate progress towards goals stated in this summary.
    - Survey the subbasin to map waterfowl use areas and winter distribution of ungulates.
    - Initiate a system of breeding bird surveys across the subbasin.
    - Initiate assessment of listed species or those likely to become listed as threatened or endangered by federal, state, or tribal governments.
    - Assess grizzly bear distribution and habitat use in the south Selkirk and west Cabinet Mountains is suggested for initial efforts.

- Protect known key habitats, such as the McArthur Lake Wildlife Travel Corridor, through conservation easement or fee-title acquisition, and implement enhancement activities such as burning transitional habitat for ungulates.

- Conduct a complete aerial survey during mid-winter to assess distribution of large mammals and concurrently establish population densities for elk, moose, mountain goats, and caribou.

- Conduct periodic aerial surveys to assess population trends of elk, moose, mountain goats, and caribou.

- Conduct periodic capture-recapture programs to evaluate populations of grizzly bear, black bear, and mountain lion.

- Use GIS analysis to map potential winter range, possibly based on characteristics obtained during the complete survey.

- Initiate and permanently incorporate sufficient breeding bird surveys to monitor trends in bird species diversity.

- Conduct a system of "hair-grabbing" surveys to allow DNA analysis to determine distribution for grizzly bears, lynx, fisher, and wolverine.

- Investigate furbearer distribution and abundance, particularly of fish predators and forest carnivores.

- Investigate distribution and limiting factors of freshwater mussels.

- Determine and address limiting factors for caribou, mule deer, and mountain goats.

References

Bennett, D. H., and J. M. DuPont. 1993. Fish habitat associations of the Pend Oreille River, Idaho. University of Idaho, Project F-73-R-15, Prepared for: Idaho Department of Fish and Game, Boise.

Bergerud. 1978.

Bowler, B., B.E. Rieman, and V.L. Ellis. 1980. Pend Oreille Lake fisheries investigations. Idaho Department of Fish and Game, Job Performance Report, Project F-73-R-2, Boise.

Cacek, C. C. 1989.The relationship of mass wasting to timber harvest activities in the Lightning Creek Basin, Idaho and Montana. Eastern Washington University, Master's Thesis.

Caughley and Sinclair. 1994.

Clarke, L. 1999. Juvenile kokanee diet and growth, and zooplankton community dynamics in Lake Pend Oreille, Idaho. Masters Thesis, University of Idaho.

Davis, J. D., L. Nelson, and N. Horner. 2000. Regional Fisheries Management Investigations. Idaho Department of Fish and Game, 1994 Job Performance Report, F-71-R-19, Boise.

Dennis, B., P. L. Munholland and J. M. Scott. 1991. Estimation of growth and extinction parameters for endangered species. Ecological Monographs. 6:115-143.

Donald, D. B. and D. J. Alger.1992 Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Canadian journal of Zoology. 71:238-277.

Drost, B. W. and H. R. Seitz. 1978. Spokane Valley-Rathdrum Prairie Aquifer, Washington and Idaho. U.S. Geological Survey Open File Report 77-829. Reston, Virginia.

Fickeisen, D. H., and D. R. Geist. 1993. Resident fish planning: Dworshak Reservoir, Lake Roosevelt, and Lake Pend Oreille. Project 93-026, Pacific Northwest Laboratory, Prepared for: United States Department of Energy, Bonneville Power Administration, Portland, Oregon.

Fredenberg, W. 2000. Draft bull trout recovery plan for the Priest River basin. U. S. Fish and Wildlife Service, Kalispell, Montana.

Fredericks, J., M.A. Maiolie and S. Elam. 1995. Kokanee impacts assessment and monitoring on Lake Pend Oreille, Idaho. Idaho Department of Fish and Game, Annual Progress Report to Bonneville Power Administration, Contract 94BI12917, Project 94-035, Portland, Oregon.

Fredericks, J., J. Davis, N. Horner, and C. Corsi. 1997. Regional Fisheries Management Investigations. Idaho Department of Fish and Game, 1996 Job Performance Report, F-71-R-21, Boise.

Fredericks, J., M. Liter, N. Horner, and C. Corsi. 2000. Regional Fisheries Management Investigations. Idaho Department of Fish and Game, 1998 Job Performance Report, F-71-R-23, Boise (In Progress).

Frenzel, S.A. 1991. Hydrolgic budgets, Pend Oreille Lake, Idaho, 1989-90. U.S. Geological Survey. Boise, Idaho.

Guth, A. R. and S. B. Cohen. 1991. Northern Region. A pictorial of the U.S. Forest Service 1891-1945. Pictorial Histories Publishing Co., Inc. Missoula, MT.

Hammond, R. E. 1974. Groundwater occurrence and movement in the Athol area and the northern Rathdrum Prairie, northern Idaho. U. S. Geological Survey. Boise, ID.

Harr, R. D. 1981. Some characteristics of and consequences of snowmelt during rainfall in western Oregon. Journal of Hydrology. 53:277-304.

Henjum *et al.* 1994.

Hoelscher, B. 1993. Pend Oreille Lake Fishery assessment. Bonner and Kootenai Counties, Idaho. 1951-1989. Water Quality Status Report No. 102. Idaho Department of Health and Welfare Division of Environmental Quality.

Idaho Department of Environmental Quality. 1998.

Idaho Department of Fish and Game. 1996. Fisheries Management Plan, 1996-2000. Boise.

King. 1989.

Knick and Kasworm. 1989.

Lee, K. H. and R. S. Lunetta. 1990 Watershed characterization of using Landsat Thematic mapper satellite imagery, Lake Pend Oreille, Idaho. US EPA Environmental Systems Monitoring Lab. Las Vegas, Nevada.

Maiolie, M. A., and S. Elam. 1993. Dworshak Dam impacts assessment and fisheries investigations. Annual report, Project number 87-99, Idaho Department of Fish and Game, Prepared for: United States Department of Energy, Bonneville Power Administration, Portland Oregon.

Maiolie, M. A., B. Harryman, and B. Ament. 1999. Lake Pend Oreille fishery recovery project. Idaho Department of Fish and Game, Annual Report to Bonneville Power Administration, Contract 94BI12917, Portland Oregon.

Maiolie, M.A., B. Harryman, and W. J. Ament. 2000. Lake Pend Oreille fishery recovery project. Idaho Department of Fish and Game, Annual Report to Bonneville Power Administration, Contract 94BI12917, Portland, Oregon. In press.

Martin *et al.* 1988.

McLellan *et al.* 1999.

Merriam W. B. 1975. Pend Oreille, the story of an inland sea. W. B. Merriam, Pullman Washington.

Murphy and Meehan. 1991.

Noss *et al.* 1995.

Panhandle Bull Trout Technical Advisory Team. 1998. Lake Pend Oreille key watershed: bull trout problem assessment (June 1998 draft). Lake Pend Oreille Watershed Advisory Group and Idaho Division of Environmental Quality, Boise, Idaho.

Paragamian. 1994.

Paragamian, V. L., and V.L. Ellis. 1994. Kokanee stock status and contribution of Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho. Idaho Department of Fish and Game, Annual Report to Bonneville Power Administration, Project 85-339, Portland Oregon.

Peek. 1983.

Rieman, B. E. and C. M. Falter. 1976. Lake Pend Oreille limnological studies. Idaho Department of Fish and Game, Federal Aid to Fish and Wildlife Restoration, Project F-53-R-10. Job Performance Report. Boise, ID.

Rieman and McIntyre. 1993.

Rieman and Myers. 1997.

Ringelman. 1991.

Ritter. 2000.

Ruediger *et al*. 2000.

Ryding and Rast. 1989.

Savage, C. N. 1965. Geologic history of Pend Oreille Lake region in north Idaho. Pamphlet 134, Idaho Bureau of Mines and Geology, Moscow.

Stinson. 2000.

U.S. Army Corps of Engineers. 1981. Albeni Falls project master plan.

U.S. Fish and Wildlife Service. 1953.

_____. 1960

_____. 1993. Grizzly bear recovery plan. Missoula, MT. 181 pp.

_____. 1994. Recovery plan for woodland caribou in the Selkirk Mountains. Portland, OR. 59 pp.

U.S. Forest Service. 1993. Trestle Creek watershed improvement environmental assessment. Idaho Panhandle National Forest, Sandpoint RD, Sandpoint, Idaho.

U.S. Forest Service and BLM. 1997.

Vidergar, D. 2000. Population estimates, food habits, and estimates of consumption of selected predatory fishes in Lake Pend Oreille, Idaho. Masters Thesis, University of Idaho.

Wakkinen and Johnson. 2000.

Weisel. 1982.

Woods, P.F. 1991. Limnology of the pelagic zone, Pend Oreille Lake, Idaho, 1989-1990. in Phase I Diagnostic and Feasibility Analysis: A strategy for Managing the Water Quality of Pend Oreille Lake, Idaho Division of Environmental Quality.

Woods, P. F. 1991. Limnology of the pelagic zone, Pend Oreille Lake, Idaho 1989-90. USGS, Boise, ID.

Area 2: Lower Pend Oreille

Subbasin Description

General Location

The Lower Pend Oreille subbasin is located in northeastern Washington approximately 80 km north of Spokane. The subbasin lies primarily in Pend Oreille County. The Lower Pend Oreille subbasin begins in Idaho at Albeni Falls Dam and travels northerly along the Pend Oreille River corridor to the Canadian border. The subbasin is divided by the Selkirk Mountains on either side (Figure 7).

Figure 7. Location of the Lower Pend Oreille subbasin

Drainage Area

The drainage area of the Pend Oreille River between Albeni Falls Dam and the U.S. - Canadian border is approximately 65,300 km^2. The largest tributary to the Pend Oreille River in the U.S. is Sullivan Creek, which drains a basin approximately 227 km^2. Other large tributaries include Calispell Creek, Tacoma Creek, Ruby Creek, LeClerc Creek, Lost Creek, Slate Creek, and Skookum Creek.

Topography/geomorphology

The Pend Oreille subbasin lies between the Selkirk Mountians to the east and the Chewelah Mountains to the west. These mountains are not more than 2,072 m above sea level. The southern portion of the subbasin is mostly rural with large areas of forested mountains and valleys of open pasture. The surrounding topography of the northern portion of the subbasin is relatively abrupt, and the mountains are steep and rugged.

Most of the subbasin is underlain by metamorphic or igneous bedrock. The geologic basement rocks, or bedrock, found within the Lower Pend Oreille subbasin are comprised of metamorphosed sedimentary rocks, quartzite, in the southern portion of the subbasin. Highly metamorphosed volcanics and marine sediments including carbonates, conglomerates and quartzite in the northern portion of the subbasin, and intrusive igneous granite and granodiorites are in the central portion of the subbasin. The bedrock outcrops at the surface in the high montain ranges and is encountered at depths greater than 30 m in the valleys.

Climate

The climate of the Pend Oreille subbasin combines characteristics of a typical mountain/continental climate, which predominates in the Rocky Mountains, and a maritime climate. Average annual precipitation at lower elevations near Newport, Washington is 63.5 cm. At higher elevations, the average annual precipitation ranges from 89 to 140 cm. Monthly precipitation patterns show that the majority of precipitation falls in the winter and spring, with the highest totals occurring from November through January. Peak rainfall also occurs in May and June, particularly in the northern portions of the Pend Oreille subbasin. Total annual snowfall averages 127 to 152 cm in the Pend Oreille River valley. Total annual snowfall represents approximately 20% of the average annual precipitation.

Major Land Uses

Much of the land within the Lower Pend Oreille subbasin lies within the Colville National Forest. State, tribal, and private land holdings make up the majority of the remaining ownership within the subbasin. Rangeland and agricultural land are located adjacent to the Pend Oreille River corridor. Agricultural uses include cultivated crops, grazing, and animal husbandry. The city of Newport is located on the Washington - Idaho border and is the largest urban area in the subbasin. Other developed areas include Cusick, Metaline, Ione, and Usk. Past and current land use practices have not changed significantly; timber production continues to be the predominant land use (Figure 8).

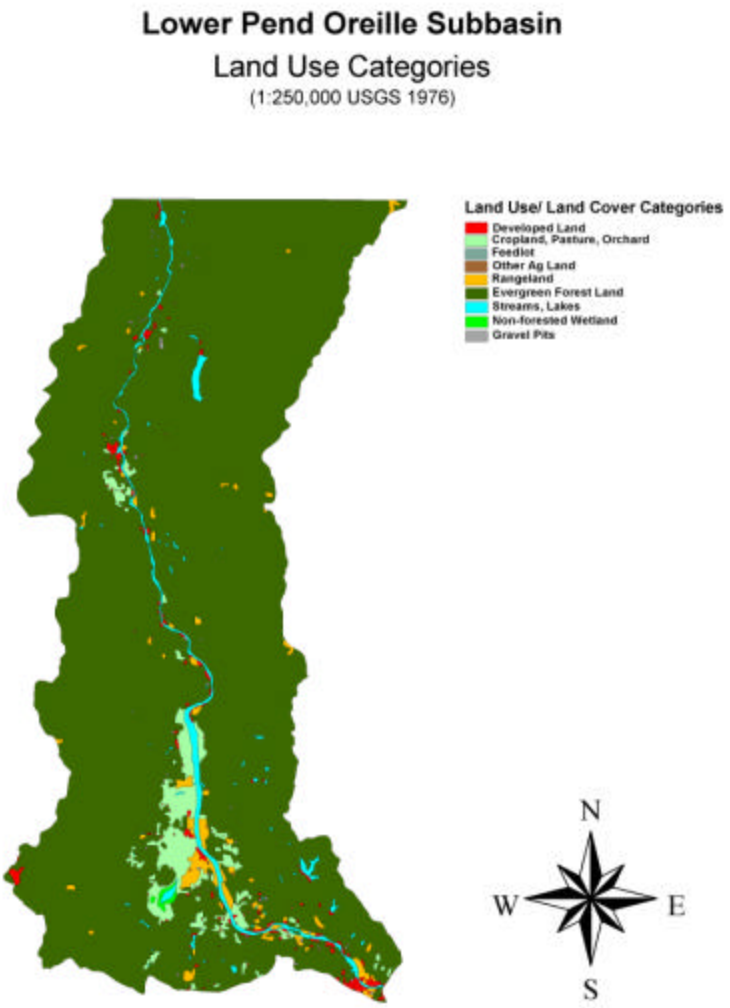


Figure 8. Land use categories for the Lower Pend Oreille subbasin

Hydrology

The Pend Oreille River, the second largest river in Washington, flows for 249 km in a northwesterly direction from its headwaters at Lake Pend Oreille to the Columbia River in British Columbia, Canada. The Pend Oreille River is impounded by several hydroelectric projects. Albeni Falls Dam is located in Idaho approximately 3.5 km upstream from Newport, Washington. Box Canyon Dam, owned and operated by Pend Oreille County Public Utility District (PUD) Number 1, is located on the Pend Oreille River and forms a 2,983 ha reservoir. Box Canyon Reservoir extends 89.8 km from Albeni Falls Dam downstream to Box Canyon Dam. Boundary Dam, owned by Seattle City Light, is also located on the Pend Oreille River about 1.6 km upstream from the U.S. - Canadian border. This reservoir is 28.1 km long and has a

surface area of about 664 ha at full pool. Box Canyon Dam and Albeni Falls Dam are run-of-river projects while Boundary Dam is operated for peaking generations. Two additional hydroelectric projects, Waneta and Sevenmile, are located downriver from Boundary Dam in Canada and are owned and operated by B.C. Hydro. Major lakes within the subbasin include Sullivan Lake, Bead Lake, Marshall Lake, and Calispell Lake.

Hydrologic records are maintained by the USGS with data published yearly. Gaging stations in Box Canyon Reservoir are located at the town of Newport (station no. 12395500), the town of Cusick, below Box Canyon Dam (station no. 12396500), downstream of Box Canyon Dam (station no. 12396500), and the Pend Oreille River at the international boundary (station no. 12398600). There is also a USGS gage on Calispell Creek (station no. 12396000). Information sources on water rights, claims, and water use are available from the Washington Department of Ecology (WDOE) (WDOE 1994, 1995a, 1995b). Geiger *et al.* (1993) provides an annotated bibliography describing data and studies of surface and groundwater quantity on the Kalispel Indian Reservation.

Water Quality

Box Canyon Reservoir is a cool-water system moderately rich in nutrients. Dam construction resulted in the river changing from a free flowing system to a slow flowing, run-of-river reservoir (Bennett and Liter 1991). The Pend Oreille County PUD operates the dam as a run-of-river reservoir with no live storage. The Box Canyon reach is typified by reasonably high water quality with no known water quality problems (Falter *et al.* 1991). However, the Pend Oreille River is listed on the 1998 WDOE 303(d) list for temperature, pH, and exotic aquatic plants (WDOE 1998). The final 1998 Section 303(d) list identifies impaired and threatened water bodies and the type of pollution from which they suffer.

A short flushing time and shallow depth do not allow vertical temperature stratification. Temperatures can exceed 25°C in the summer months. Aquatic plants, particularly the proliferation and control of EWM, have been identified as water quality concerns (EPA 1993). Total Dissolved Gases in the Pend Oreille River exceed Washington standards at certain times of the year. The Washington State water quality standard for TDG is 110% (WAC 173-201A-030 (2)(c)(iii). Total Dissolved Gas levels at least as high as 147% have been recorded below Box Canyon Dam (Appendix E2-2 of Final License Application 2000). Regional efforts are being focused on this issue in an effort to more effectively manage TDG levels throughout the Columbia River Basin. Velocities in Box Canyon Reservoir range from .03 m/s (0.1 ft/s) during the summer up to .6 m/s (2.0 ft/s) during the spring (Falter *et al.* 1991).

The sloughs of Pend Oreille River are mesotrophic (moderate nutrients) to eutrophic (high nutrients) (Falter *et al.* 1991). The sloughs and the river are homeothermous November through mid-April and are typically cooler than the river in the summer. The major sloughs weakly stratify in the spring; however, only Tiger Slough and Big Muddy Slough are known to remain strongly stratified throughout the summer. Water quality among the sloughs is similar with the exception of Calispell Slough and Trimble Slough, which have soft water (low conductivity and low total alkalinity). High fecal coliform levels have been identified as a concern in selected tributaries and sloughs (Pelletier and Coots 1990; Coots and Willms 1991).

Vegetation

Known information about existing botanical resources in the Lower Pend Oreille subbasin includes a plant species list of Pend Oreille County (Layser 1980) and a number of documented

rare plant occurrences (Washington Natural Heritage Program [WNHP] 1996), a database for which is housed at the WNHP and the Idaho Conservation Data Center. The Pend Oreille PUD has conducted botanical fieldwork as part of its relicensing efforts and has additional knowledge of rare plants and other plant species of special interest along Box Canyon Reservoir.

The majority of the subbasin is located in the Okanogan Highlands Physiographic Province (Franklin and Dyrness 1973), which is characterized by conifer forest communities except on wet sites. The northern portion of the river corridor is within the western hemlock vegetation zone (Franklin and Dyrness 1973). Western red cedar is a major climax species in this zone, and grand fir is an important and persistent seral species. Sitka alder is characteristic at moist sites in this zone including riparian areas (Figure 9). Management activities within the landscape have reduced the function of the uplands by eliminating mature forests. An example of this change is evident in the number of plant and animal species present in the subbasin that are listed as threatened or endangered under the ESA (Appendix 2).

The southern portion of the subbasin near Albeni Falls Dam is within the ponderosa pine vegetation zone, broadly defined to include areas where persistent, fire-maintained ponderosa pine forests predominate. Within this zone, groves of black cottonwood and quaking aspen typically occur on riparian or poorly drained sites. Other representative conifer tree species in this zone are Douglas fir, western larch, and grand fir. Lodgepole pine is a common seral species on burned sites. Representative shrub species in this zone include snowberry, shiny-leaf spiraea, and rose. On more mesic sites in the zone, ninebark, western serviceberry, and black hawthorn are typical.

Nearly all of the original forests between the major roads east and west of the Pend Oreille River are believed to have been logged or burned at least once, or permanently cleared for agriculture or residential development. A large part of this area is in pasture, hayfields, and fallow land. Seasonally flooded wetlands are extensive. Wetland types include seasonally flooded fields, scrub-shrub, and forests; persistently flooded, emergent wetlands; persistently flooded, shallow riverine sloughs; old sloughs that are presently connected to the river only during flood conditions; and ponds not connected hydrologically to the river. Riparian cottonwood galleries are in decline as managed hydrology and land use practices have limited regeneration and replacement.

Noxious weeds dominate disturbed areas of the subbasin. The Pend Oreille County Weed Board identified several noxious weed species, which receive most of the attention within the subbasin.

Rare plants, whether listed under ESA or not, are well distributed in the subbasin. The USFS and USFWS provide the majority of support for rare plant issues. Other entities such as the KT and the Pend Oreille County PUD are active in identifying and managing botanical resources (Figure 9).

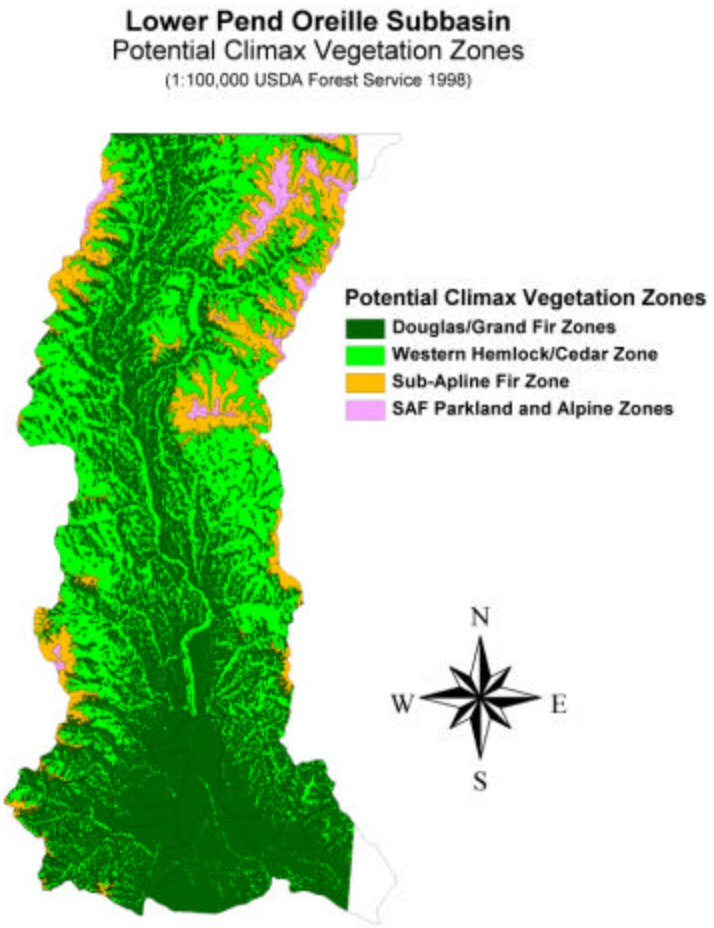


Figure 9. Potential climax vegetative cover types for the Lower Pend Oreille subbasin in Washington

Fish and Wildlife Resources

Fish and Wildlife Status

Fisheries

An estimated 27 fish species are found within the Lower Pend Oreille subbasin (Table 8).

Table 8. Fish species found within the Lower Pend Oreille subbasin

Common Name	Genus species	Native
Bull trout	*Salvelinus confluentus*	Yes
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*	Yes
Rainbow trout	*Onchorhynchus mykiss*	No
Brook trout	*Salvelinus fontinalis*	No
Brown trout	*Salmo trutta*	No
Mountain whitefish	*Prosopium williansoni*	Yes
Pygmy whitefish	*Prosopium coulteri*	Yes
Lake whitefish	*Coregonus clupeaformis*	No
Kokanee	*Onchorhynchus nerka*	No
Lake trout	*Salvelinus namaychush*	No
Smallmouth bass	*Micropterus dolomieui*	No
Largemouth bass	*Micropterus salmoides*	No
Yellow perch	*Perca flavescens*	No
Walleye	*Stizostedion vitreum vitreum*	No
Black bullhead	*Ictalurus melas*	No
Brown bullhead	*Ictalurus nebulosus*	No
Northern pike	*Esox lucius*	No
Northern pikeminnow	*Ptychocheilus oregoninsis*	Yes
Peamouth	*Mylocheilus caurinus*	Yes
Redside shiner	*Richardsonius balteatus*	Yes
Tench	*Tinca tinca*	No
Sculpin (various species)	*Cottus spp.*	Yes
Pumpkinseed	*Lepomis gibbosus*	No
Black crappie	*Pomoxis nigromaculatus*	No
Burbot	*Lota lota*	Yes
Largescale sucker	*Catostomus macrocheilus*	Yes
Longnose sucker	*Catostomus catostomus*	Yes

Anadromous Fish

Prior to the construction of Grand Coulee Dam on the Columbia River, the Pend Oreille River was reported to have supported anadromous runs of chinook salmon, *Oncorhynchus tshawytscha*, and steelhead trout, *O. mykiss*. However, these fish were restricted primarily to the lower reaches of the Pend Oreille River due to natural fish barriers at Z Canyon (river mile 18) (Bennett and Falter 1985), and Metaline Falls (river mile 27) (Bennett and Falter 1992; D. Bennett, University of Idaho, personal communication).

Bull Trout

Bull trout were once abundant in the Pend Oreille River (Gilbert and Evermann 1895). Fish as large as 66 cm (26 in) long and weighing 1.9 kg (5 pounds) or more were in the possession of individual Kalispel tribal members (Gilbert and Evermann 1895). However, due to factors such as degraded habitat, loss of connectivity, and non-native fish introductions, bull trout populations in the Lower Pend Oreille subbasin are low. Currently, only small remnant bull trout populations

are found in the following tributaries: Indian Creek, East Branch LeClerc Creek, West Branch LeClerc Creek, Fourth of July Creek, Mill Creek, Cedar Creek, Sullivan Creek, the mouth of Slate Creek, and the South Fork of the Salmo River. It is suspected that the majority of these remaining populations are resident and not adfluvial.

Since 1998, the KT has implemented an adfluvial trapping program on priority tributaries to Box Canyon Reservoir. Only one bull trout was found in the trap and may have come from Trestle Creek, a tributary to Lake Pend Oreille, since it had an adipose fin clipped. Many tributaries to the Pend Oreille River have not been surveyed to determine bull trout presence or absence.

Only a few bull trout have been found in the mainstem Pend Oreille River (Ashe *et al*. 1991, Bennett and Liter 1991). The KT has done extensive electrofishing in Box Canyon Reservoir since 1997 and has not found any bull trout.

Westslope Cutthroat Trout

Westslope cutthroat trout in the Lower Pend Oreille subbasin are primarily the resident form residing in the tributaries. Some of the fish exhibit their migratory form as they are found in the reservoir and observed in adfluvial traps.

There has been some debate as to the origin of these westslope cutthroat trout populations. Behnke (1992) concluded that the historic distribution of westslope cutthroat trout in the Clark Fork/Pend Oreille drainage extended downstream only as far as Albeni Falls Dam. Williams (1998) believed that the historic distribution actually extended as far downstream as Metaline Falls, suggesting that the cutthroat trout populations in the tributaries of the lower Pend Oreille River above Metaline Falls were native. Extensive stocking of both westslope cutthroat trout and Yellowstone cutthroat trout in these tributaries adds doubt as to the origins of these populations (Williams 1998; WDFW unpublished hatchery records).

In 1999, WDFW collected genetic information for westslope cutthroat trout in eight Pend Oreille tributaries below Box Canyon Dam. The results indicated that genetically distinct populations of westslope cutthroat trout occurred in Pen Oreille tributaries. The results also failed to detect introgression by any of the hatchery strains of cutthroat trout examined, except in Slate Creek, which supports the conclusion by Williams (1998) that the populations were native (McLellan 2000).

Rainbow Trout

It is unknown if rainbow trout are native to the Pend Oreille River or introduced, but there is speculation that some may be native redband trout. Rainbow trout found in the Pend Oreille River and its tributaries are likely descendants of hatchery plantings in the early 1930's through the early 1950's. In what is now Box Canyon Reservoir, 226,328 rainbow trout were planted from 1935 to 1953.

Managers may also want to re-evaluate current rainbow trout stocking in the Pend Oreille River (Williams 1998). Rainbow trout have been documented to hybridize with cutthroat trout (Reinitz 1977; Leary *et al.* 1996). Not all of the cutthroat trout populations surveyed in this study occur above fish passage barriers, so planting rainbow trout in the Pend Oreille River may expose native westslope cutthroat trout to introgression.

Brook Trout

Eastern brook trout are non-native and are the principle fish species in most tributaries. This is due, in part, to an extensive stocking program by WDFW from the 1930’s to the early 1990’s.

Brook trout inhabit areas where the habitat is disturbed from land use practices. Behnke (1979) described how clearcutting along two streams in the Smith River drainage of Montana increased erosion, sediment loads, and water temperatures; the westslope cutthroat trout population was eliminated in the disturbed area, and brook trout was the principle species. Of all the factors threatening bull trout and westslope cutthroat trout, hybridization and interspecific competition with introduced salmonids are the most detrimental (Liknes and Graham 1988, Leary *et al*. 1991, Markle 1992).

Brown Trout

Brown trout were introduced to the Pend Oreille River via plantings in the 1890's from an original Scottish strain (Hisata, as cited in Ashe and Scholz 1992). Brown trout populations appear to be the most common adfluvial species as they can tolerate warmer temperatures. Brown trout are regularly seen in the Pend Oreille River and in some of the tributaries. Data collected during the two years of adfluvial trapping indicated that the streams likely to contain adfluvial populations included Indian Creek, Skookum Creek, and Cee Cee Ah Creek.

Previous investigations by the University of Idaho (Bennett and Liter 1991; Bennett and Garrett 1994) and Eastern Washington University (Ashe and Scholz 1992) describe the fisheries resources in Box Canyon Reservoir and its tributaries. Trout, although present in the reservoir, comprised less than 1% of the total fish captured using electroshocking, gillnetting, and seining methods. Brown trout were the most abundant, with 492 captured from 1988 to 1990. The WDFW annually stocks approximately 167,000 rainbow trout, 127,000 westslope cutthroat trout, and 14,000 eastern brook trout.

Mountain Whitefish

Mountain whitefish are native to the Lower Pend Oreille subbasin. Previous investigations by the University of Idaho (Bennett and Liter 1991; Bennett and Garrett 1994) and Eastern Washington University (Ashe and Scholz 1992) found that mountain whitefish were the most numerous salmonid in Box Canyon Reservoir, with 4,385 captured (5.4% of the total). Mountain whitefish are also found in tributaries to the Pend Oreille River.

Largemouth Bass

Bennett and Liter (1991), Bennett and Garrett (1994), and Ashe and Scholz (1992) found that largemouth bass are the fourth most common species in Box Canyon Reservoir. Over the past several decades, the largemouth bass fishery has received increasing interest from local Spokane fishing clubs and has become an important fishery for tribal and non-tribal members.

Ashe (1991) indicated that largemouth bass growth rates during the first four years in Box Canyon Reservoir were lower than bass from other locations in the northern U.S. and, conversely, growth rates after the fourth year were comparable or even higher than those in other locations. Slower growth combined with a high rate of juvenile mortality associated with overwintering has reduced the potential for the bass population within the reservoir.

Non-Native Fish

Non-native fish species have been introduced into the Pend Oreille River and its tributaries. Northern pike have migrated downstream from the Clark Fork River, Montana. Walleye were

planted by WDFW in 1983 and 1984 (500,000 and 253,000 larvae, respectively) (Bennett and Liter 1991). The WDFW also planted 148 tagged adult walleye in 1987 (WDFW, Spokane, as cited in Ashe and Scholz 1992). During the course of past fisheries studies, several anglers reported catching walleye, but there were no confirmed sightings of walleye, nor were there any walleye caught during the fisheries studies (Ashe and Scholz 1992; Bennett and Liter 1991).

The data collected by Bennett and Liter (1991), Bennett and Garrett (1994), and Ashe and Scholz (1992) indicate that the most abundant game species in the reservoir are yellow perch (37% of the total), pumpkinseed (21.1%), largemouth bass (7.7%), and black crappie (2.2%). The most abundant non-game species is tench (7.6% of the total) (Bennett and Liter 1991; Ashe and Scholz 1992).

Wildlife

There are an estimated 247 wildlife species that are found in the Lower Pend Oreille subbasin, 28 of which are considered to be decreasing in status, 17 species are increasing, 102 are stable, and the status for 100 species is unknown (Appendix 3). There are currently five wildlife species that are listed as threatened or endangered under the ESA with several more that are proposed or petitioned for listing.

The population status of selected WDFW Priority Habitats and Species (PHS) within the Lower Pend Oreille and Priest River subbasins is summarized in Table 9.

Table 9. Population status of Priority Habitats and Species within the Lower Pend Oreille and Priest River subbasins

Species	Estimated Population[1]
Lynx	20 to 30
Caribou	34[2]
Grizzly bear	50[2]
Mule deer	250 to 300[3]
Osprey	231[6]
Bald Eagle	60+[4]
Waterfowl	7,000 to 20,000[5]
Great-blue Heron	690+[7]
Cormorant	237[6]

Bald eagle populations have recovered and reached target levels in the Lower Pend Oreille subbasin, but the species is still vulnerable. Maintaining high quality habitat for prey

1 Population estimates provided by Steve Zender, WDFW District Wildlife Biologist.
2 This is the estimated population for the Selkirk ecosystem including portions of Washington, Idaho, and Montana.
3 WDFW estimates that 20 mule deer bucks are harvested annually in the Pend Oreille River drainage within Washington State.
4 Includes both breeding and non-breeding bald eagles.
5 Population estimates are for Calispell Lake/marsh only. Includes 20,000 ducks, geese, and swans, during the Spring migration and 7,000 waterfowl in the Fall.
6 Box Canyon Hydroelectric Project Draft License Application (1999).
7 Estimated from number of nests assuming 3 birds for each nest from Box Canyon Hydroelectric Project Draft License Application (1999).

species, fish, and waterfowl and protecting nesting and winter roost sites are critical. Nest territories and the years each nest site was active are listed in Table 10.

Table 10. Bald eagle territories within the Lower Pend Oreille subbasin and years each nest was active

Territory	Years Active
Sand Creek	1989-2000
Everetts Island	1989-2000
Trimble Creek	1990-2000
Indian Island	1992-2000
Z Canyon	1992 then inactive until 2000
Riverbend	1986-2000
Lost Creek	1994-2000
Mill Creek	1997-2000
Kalispel Tribe	1998-2000
Usk Mill	2000
Newport	1999-2000
Box Canyon	2000
Calispell Lake	1985-2000

Habitat Areas and Quality

"The Pend d'Oreille River is one of the most beautiful and picturesque in America. It is a magnificent river, probably averaging over 1,000 feet in width and being very deep throughout most of its course. In most places there is a good, strong current, becoming dangerous rapids in the narrower places. The water is clear and pure and cold--an ideal trout stream. The depth varies greatly, high water occurring in July from melting snows. Late in August or September the water is many feet lower than in July. High mountain slopes ascend abruptly from the river's banks throughout most of its course, and these are covered with a heavy evergreen forest and a dense growth of underbrush. In other places, as at Usk, La Claires, and Metaline, the river bottom widens out and there are many acres of excellent farming land. During high water large areas of this level land are covered by water, but when the water subside these tracts become valuable meadow lands. Trout are abundant in this river; salmon trout are

also quite abundant, and both bite readily. We know of no stream which offers finer opportunities for sport with the rod than the lower Pend d'Oreille. Deer, wild geese, and ducks were also seen in considerable numbers"

Gilbert and Evermann - 1894

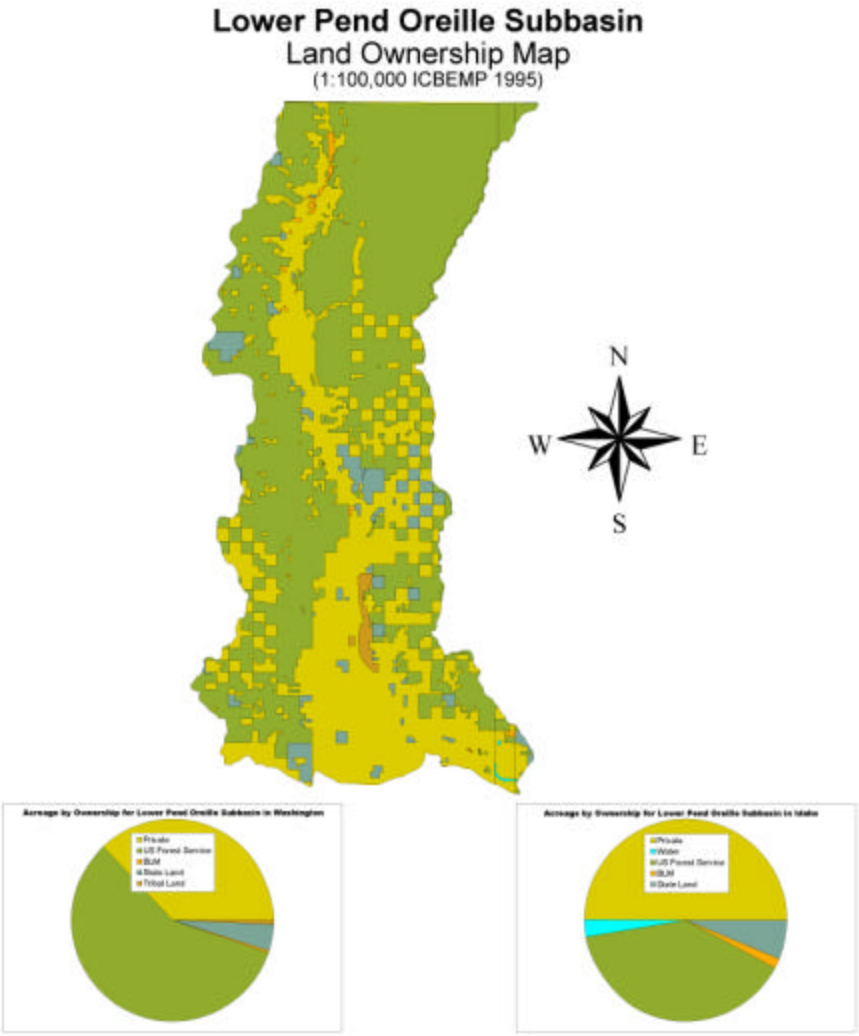
Fisheries

Fire history, past timber harvest activities, and dams have influenced the landscape in the Lower Pend Oreille subbasin. The subbasin was first logged from 1915 to 1930 and much of the old-growth timber was removed. Logging railroad and log flumes were used on the mainstem Pend Oreille River and several of its tributaries. Log flumes were common, simplified the instream habitat, and decreased the recruitment source for large woody debris. In more recent years, road construction and maintenance, timber harvest, and cattle grazing have degraded stream habitat conditions. Numerous forest fires occurred between 1910 and 1929 and impacted many watersheds. From 1917 to 1929, an estimated 60 to 70% of the LeClerc Creek watershed burned. The largest fire in the LeClerc Creek watershed occurred in 1929.

Wildlife

Wildlife habitat within the subbasin consists of two major types: riparian/floodplain bottomland and inland moist forest uplands. The upland habitats are diverse ranging from open and drier ponderosa pine/larch stands to moist cedar/hemlock-dominated stands. The lowland habitats are equally diverse and contain wetland and riparian habitats associated with the Pend Oreille River floodplain. Remnant gallery cottonwood forests are present in these areas but remain as decadent, fragmented and limited in distribution. Less than one third of the Cusick Valley floodplain is undeveloped. The KT manages much of the undeveloped portion of the Cusick Valley as part of the Kalispel Indian Reservation. Generally, the habitats within the subbasin are moderately to severely altered and habitat quality is low. There are several wildlife species within the subbasin that are listed as endangered or threatened under the ESA.

Managed forests in the subbasin encompass approximately 271,770 ha. The state, various tribes, and private landowners own an estimated 42% of those lands (Figure 10) (USFS ICEBMP 1995). Fragmentation associated with management and ownership patterns is one of the more expansive problems associated with upland forested habitat (Figure 11 and Figure 12) (Lehmkuhl and Ruggiero 1991).



All Acreage by Ownership
1) Private - 252,187 acres
2) Open Water - 373 acres
3) US Forest Service - 388,277 acres
4) BLM - 2,260 acres
5) State Lands - 28,821 acres
6) Tribal Lands - 4,535 acres

Figure 10. Land ownership patterns for the Lower Pend Oreille subbasin

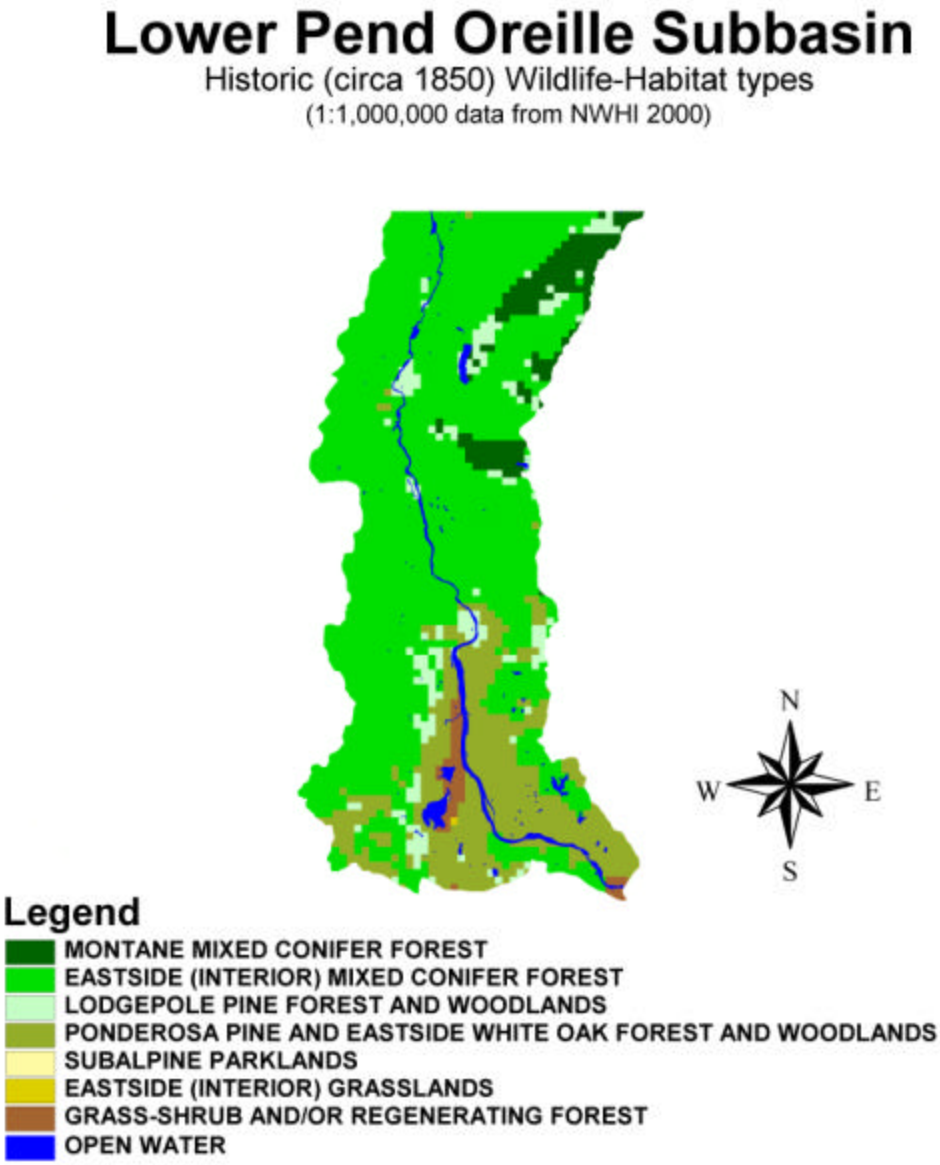


Figure 11. Wildlife habitat in the Lower Pend Oreille subbasin circa 1850

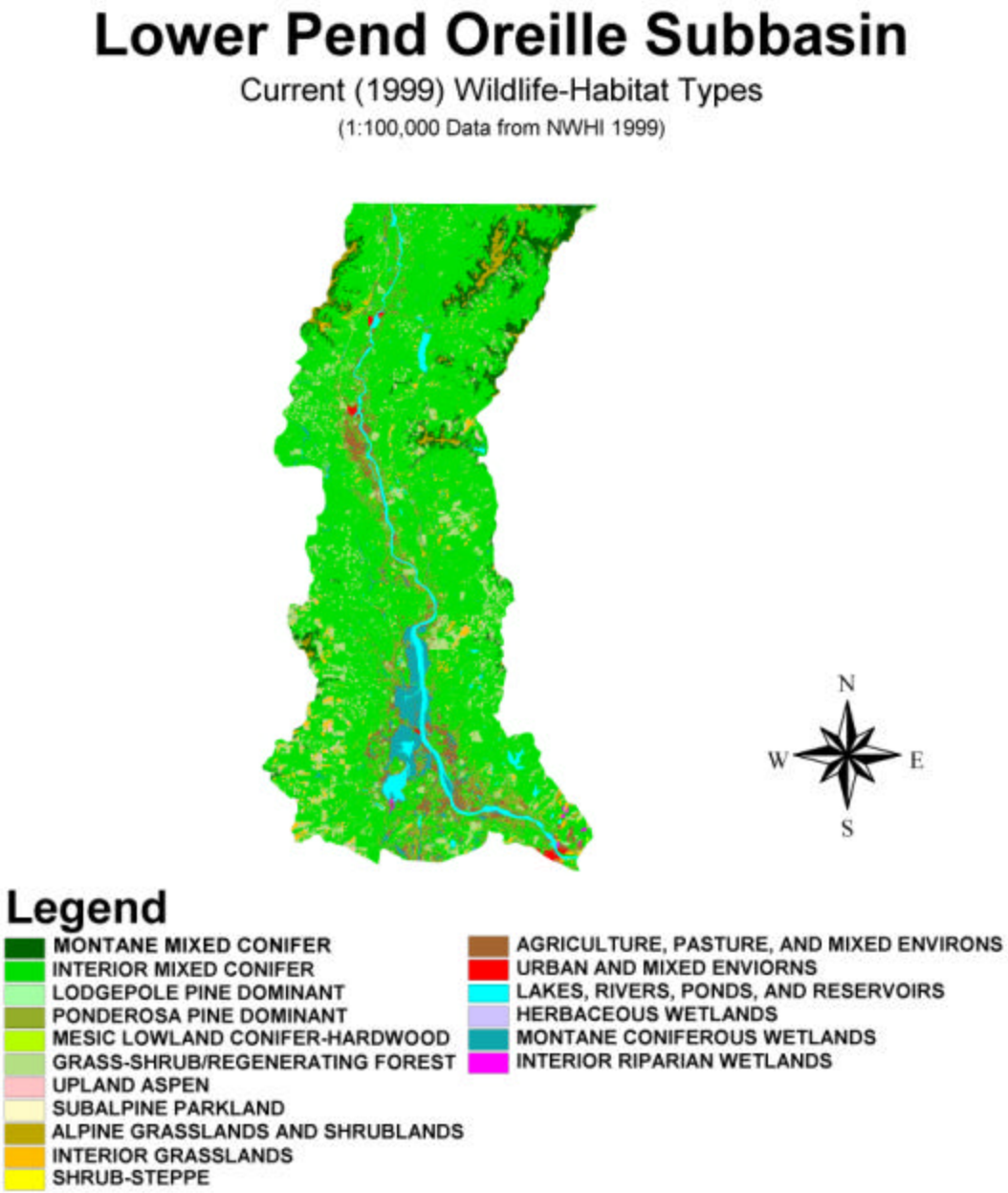


Figure 12. Wildlife habitat in the Lower Pend Oreille subbasin, 1999

Floodplain/Riparian

Riparian habitat is limited geographically and is vulnerable to loss and degradation through human activities and land uses. Since the arrival of settlers in the early 1800's, 50 to 90% of riparian habitat in Washington has been lost or extensively modified. Protecting riparian habitat

may yield the greatest gains for fish and wildlife across the landscape while involving the least amount of area (Knutson and Naef 1997). Traditionally, wildlife habitat management has sought to maximize edge effect in managed forests. This has benefited species such as white-tailed deer, elk, and ruffed grouse. Fragmentation of habitat and increased edge, however, might be detrimental to other wildlife species. Lehmkuhl and Ruggiero (1991) summarized seven detrimental edge effects: 1) competition between forest interior and edge species might occur, reducing the viability of interior species populations; 2) generalized species found in forest patches at time of fragmentation might benefit from the altered environmental conditions outside the patches (a "cross boundary subsidy") and increase in population size or viability to the potential detriment of interior species (Raedeke and Lehmkuhl 1986); 3) nest predation and nest parasitism can increase in forest patches with substantial edge (Wilcove 1985, Temple and Gary 1988); 4) the forest edge might be a "unidirectional filter" from which animals will pass out cannot return; for example, some species are more vulnerable to predation outside of forest patches; 5) elimination of interior species as a result of forest fragmentation might lead to secondary extinction because of altered community interactions; 6) extrinsic processes such as blowdown or ground fire can reduce forest patch size or quality through "edge creep"; and 7) forest patch edges are subject to microclimatic changes which alter conditions for interior plant and animal species; in the Pacific Northwest these microclimatic changes are thought to extend up to two tree lengths (160 m) inside a forest patch (Harris ~1984, Franklin and Forman 1987).

Negative impacts of forest fragmentation on wildlife and riparian habitat require that increased attention be given to buffer zone design (O'Connell *et al.* 2000). Although there is general agreement for the need to provide riparian buffers in managed forests, there is much less understanding as to the size and desired characteristics of these buffers. Currently, riparian buffers average 9.1 m for Pend Oreille River tributaries (Washington State Forest Practices Board 1988).

Timbered Uplands

Upland forests management practices contribute to riparian and in-stream impacts. Increased sedimentation, roads, and reduced connectivity have lead to habitat and population declines as evidenced by the number of listed and candidate species within the subbasin. Loss of forest function and ecosystem contributions by the uplands may lead to more species listings and impacts to important species not well suited to increased edge effect and fragmentation. In order to manage the subbasin in an ecosystem context, a change in philosophy is necessary in the management of upland habitats. Road densities in the Lower Pend Oreille subbasin are nearly 2 km/km^2 (3.1 mi/mi^2) (Figure 13).

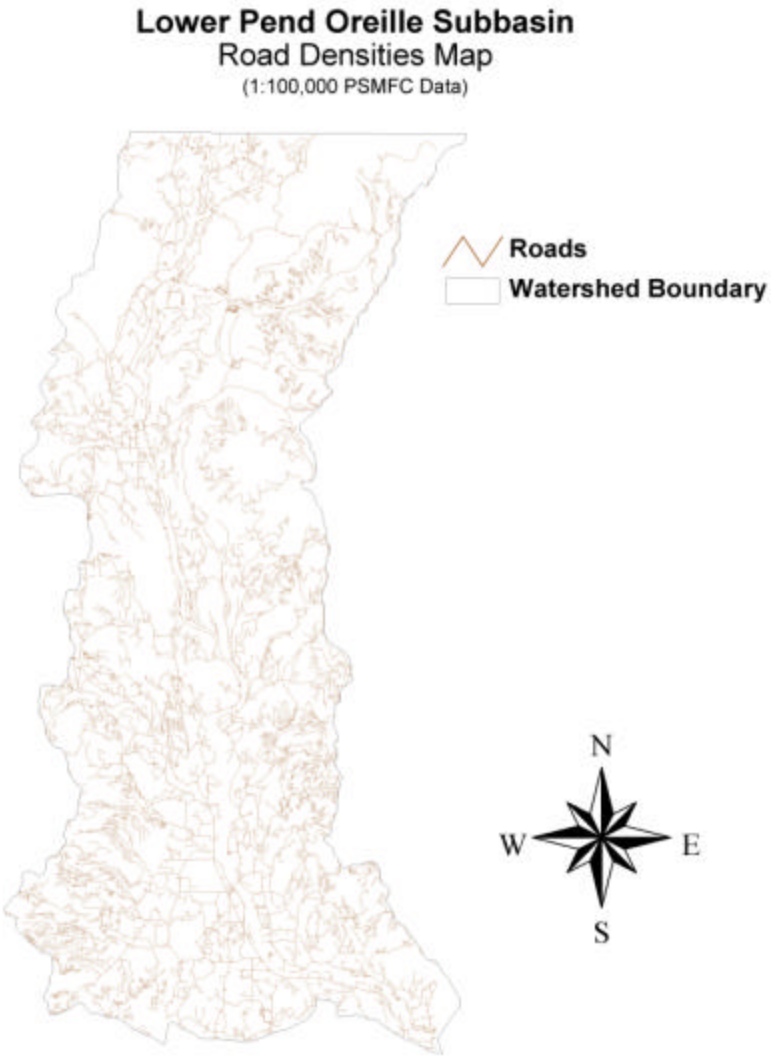


Figure 13. Road density and location in the Lower Pend Oreille subbasin

This is significantly higher than the 0.62 km/km^2 (1 mi/mi^2) considered as optimum. This is of particular concern considering some key watersheds have densities exceeding 3.1 km/km^2 (5 mi/mi^2) and there are several roadless areas within the subbasin. High road density, land ownership patterns, and a lack of consistent management have decreased the biodiversity and habitat potential for the subbasin (Table 9, 10).

Wetlands

More than half of the wetlands that once existed in western Washington have been lost. Often the cause has been agricultural conversion, but today wetlands are increasingly at risk due to urban

and suburban development (Leschine *et al.* 1997). Many of the state's remaining wetlands have been degraded through impacts to hydrology, soils, and vegetation. This has had an adverse impact on wetland species diversity, the quality of fish and wildlife habitats, and wetland functions and values (Stevens and Vanbianchi 1993). Currently, less than one-third of the wetlands in the subbasin is in protected status (R. Entz, KT, personal communication). Wetland habitats are important to migratory waterfowl, amphibians, reptiles, and many other species. Without adequate wetland diversity, density, quality, and quantity to provide important plant and animal life history requisites, ESA listings will likely rise within the subbasin. The USFWS estimates that as many as 43% of threatened and endangered species rely directly or indirectly on wetlands for their survival. The loss of wetland habitat ultimately results in a decline in fish and wildlife populations (Appendix 2).

Watershed Assessment

The WDOE developed the *Draft Pend Oreille River Watershed Initial Assessment* in 1995. This report presents some actions that could be taken in response to the results of this assessment, including 1) make decisions on 38 pending applications for new water rights; 2) water quality and quantity is greatly affected by conditions and activities upstream in Idaho and Montana; 3) interconnection between surface and groundwater; and 4) limited streamflow data on small tributary streams. The assessment describes existing data on water rights, streamflows, precipitation, geology, hydrology, water quality, fisheries resources, and land use patterns.

In 1997, Stimson Lumber Company completed a level 2 watershed analysis for the 268 km^2 LeClerc Creek Watershed Administrative Unit. As required by the watershed analysis process, a Resource Assessment Team (RAT) of qualified analysts evaluated the current state of the watershed by examining mass wasting (landsliding), surface erosion, hydrologic change, and riparian condition. Resource vulnerabilities were addressed by examining channel conditions, fish habitat, water supply, and public works. The Field Managers Prescription Team developed management prescriptions in response to the information provided by the RAT. These prescriptions are designed to avoid future adverse impacts to streams and aquatic resources, while allowing forestry operations to continue within the watershed.

In 1997, the USFS, Colville National Forest, completed the *LeClerc Watershed Assessment*. This document contains information on topics including the characterization of the watershed, issue identification, current conditions, and recommendations. The Colville National Forest has also completed Gardner-Tacoma, New Moon, Sullivan Creek, Slate Salmo, and Lost Ruby watershed analyses as well as a watershed analysis for Box Canyon Reservoir and its tributaries. These watershed assessments cover a large portion of the Lower Pend Oreille subbasin.

In 1995, the KNRD and WDFW began the development of the Kalispel Resident Fish Project. During that field season, the East Branch LeClerc Creek, Fourth of July Creek, Mineral Creek, and Whiteman Creek were surveyed. Since that time, the KT has collected more information on Browns Creek, West Branch LeClerc Creek, Seco Creek, Saucon Creek, Winchester Creek, Smalle Creek, and Middle Branch LeClerc Creek. This information comprises fish abundance, distribution, and habitat data. Data collected were evaluated to identify specific limiting factors of habitat to resident fish populations. These limiting factors were used to develop specific enhancement objectives.

Major Limiting Factors

The two primary limiting factors for fish, wildlife, and associated habitats in the Lower Pend Oreille subbasin are habitat loss and non-native species competition. Habitat loss can be described in a variety of ways, but is generally referred to as the loss of connectivity, quality, quantity, and diversity. Many environmental and managed factors can contribute to these limiting factors. Several of these key factors are described further in more detail.

Fisheries

Water Quality

Lower Pend Oreille River water temperatures are above 10° C from May through October. Bennett and Garrett (1994) suggest that summer water temperatures are defined by the surface flow out of Lake Pend Oreille. A special condition has been established by the State of Washington for maximum water temperature criteria for the Pend Oreille River. The maximum allowable temperature is 20° C. Surface water releases from Albeni Falls Dam exceed 20° C ffrom early July through late September and is on the state's 303(d) list for temperature.

The WDOE (Pelletier and Coots 1990, Coots and Willms 1991), the KT (unpublished data for ongoing program), and, most recently, the Pend Oreille County Conservation District have conducted water quality monitoring studies. Coots and Willms (1991) collected fecal coliform, fecal streptococcus, and conventional water quality grab samples at several points along Bracket Creek, Skookum Creek, Lost Creek, and South Fork Lost Creek to assess potential water quality concerns. Total phosphorus in Calispell Creek and Trimble Creek exceeded the EPA's (1986) recommended guideline of 50 micrograms per liter (ug/l) phosphorus. Skookum Creek accounted for 87% of the fecal coliform river load. Skookum Creek, Bracket Creek, and South Fork Lost Creek's fecal coliform densities exceeded Class A State water quality criteria during sampling in both July and August 1990. Lost Creek and Cedar (Ione) Creek exceed Class AA state water quality standards for water temperature. The Pend Oreille County Conservation District is working with landowners along Bracket Creek to implement BMPs aimed at reducing potential agricultural sources of elevated coliform levels in the tributaries.

Total dissolved gas is a concern for the Pend Oreille River. Albeni Falls Dam, Box Canyon Dam, and Boundary Dam contribute to high levels of TDG. Forebay TDG measurements at Box Canyon Dam typically range from 98% to 112% saturation. One mile below the Box Canyon spillway, TDG levels have been recorded as high as 139% saturation.

Dams

The five dams on the Pend Oreille river are believed to be a significant reason for the decline of native salmonid populations, particularly bull trout, in the Lower Pend Oreille subbasin. These dams include Waneta (Canada), Seven Mile (Canada), Boundary (U.S.), Box Canyon (U.S.), and Albeni Falls (U.S.). None of these dams were built with fish passage facilities. Other dams and diversions such as Cedar Creek Dam, Sullivan Lake Dam, Mill Pond Dam, and North Fork Sullivan Creek Dam constructed in Pend Oreille tributaries further fragment the connectivity of native salmonid populations.

Hydropower construction and operations continue to have an effect on bull trout and other native salmonid species habitat. The dams have forever changed the habitat from that of a cold water fast-moving river to warm and shallow reservoirs. For example, Box Canyon Reservoir has velocities ranging from 0.03 mps (0.01 fps) during summer low flows to upwards of 0.6 mps (2.0 fps) during high flows (Falter *et al*. 1991). These velocities are unsuitable for

native salmonids. Non-native fish such as yellow perch, tench, and largemouth bass dominate the fish community in Box Canyon Reservoir. All of these non-natives fish species have an optimum rearing habitat preference for zero velocities. Habitat preference curves begin to reach zero for these fish when velocities are greater than 0.2 mps (0.8 fps).

Dams have also impacted the connectivity for fluvial and adfluvial bull trout migratory life forms. Bull trout were once highly abundant in the Pend Oreille River and its tributaries (Gilbert and Evermann 1895), but this is no longer the case. The five mainstem dams have isolated bull trout subpopulations, eliminated individuals from subpopulations, and reduced or eliminated genetic exchange. All of these characteristics are important in ensuring the long-term persistence of self-sustaining fish populations.

Typical spawning and rearing habitat in a free flowing river with pools, glides, riffles, and side habitat has been eliminated. Water temperatures have risen during the summer months, and macrophytes and warm water fish species have proliferated in this changed environment.

Juvenile overwintering survival was determined to be the limiting factor for largemouth bass in the Box Canyon Reservoir (Ashe *et al*. 1991, Bennett and Liter 1991). Lack of cover is believed to be related to observed declines in standing crops of largemouth bass and may result in reduced food availability and higher predation on young-of-year (Brouha and von Geldern 1979). Box Canyon reservoir fluctuations have had adverse effects on largemouth bass (Figures 14, 15, and 16). Decreases in reservoir elevation during spawning may cause eggs to be exposed to air while increases in elevation during the same period may increase predator-related mortality. Reservoir fluctuations will result in a decrease in young-of-year age class, resulting in a decrease of overall population (Ashe and Scholz 1992).

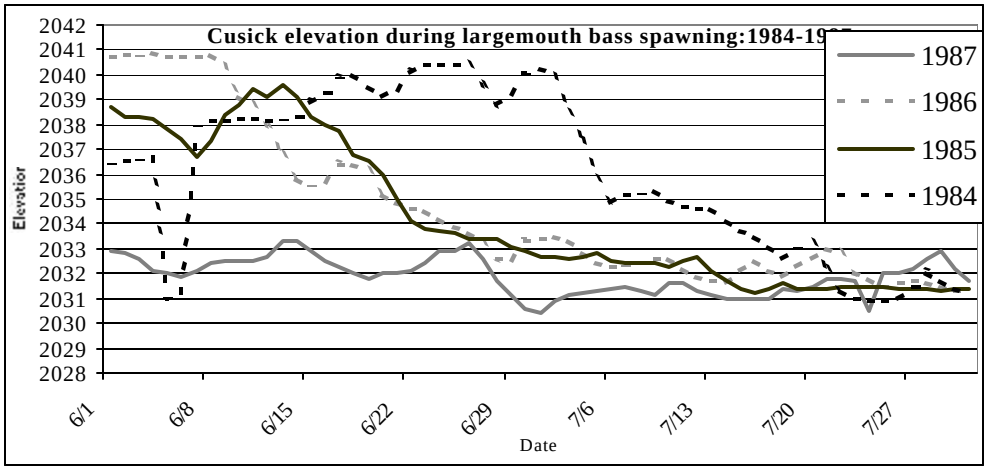


Figure 14. Cusick elevations during largemouth bass spawning, 1984 -1987

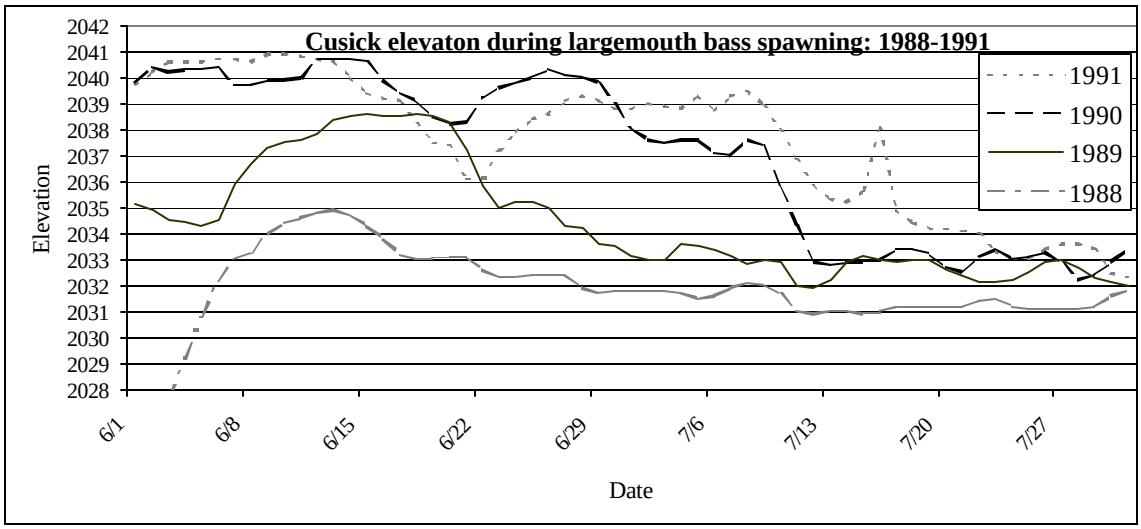


Figure 15. Cusick elevation during largemouth bass spawning, 1988 -1991

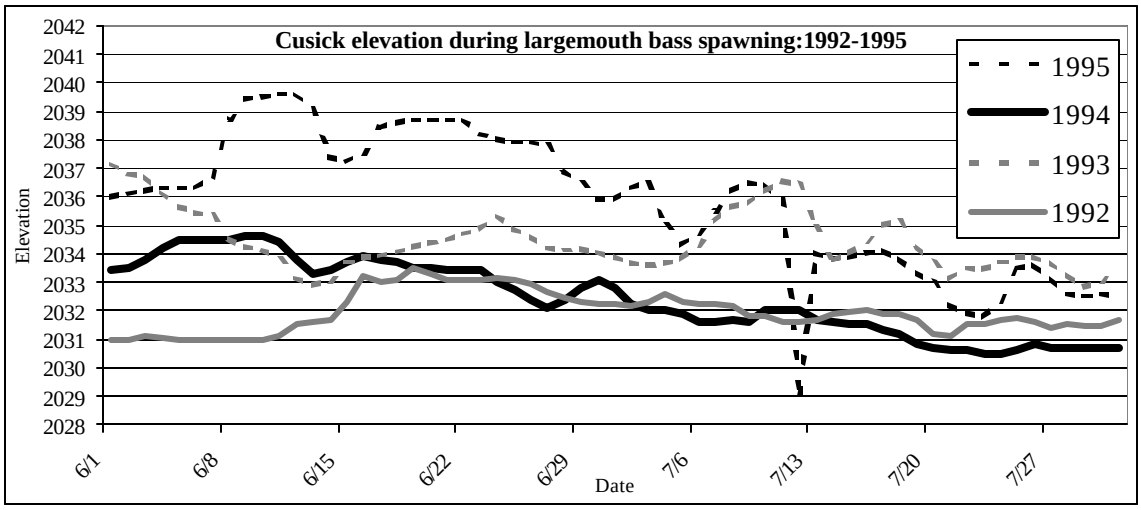


Figure 16. Cusick elevations during largemouth bass spawning, 1992 -1995

Forest Management Practices

Tributary habitat has been degraded by the following human disturbance including timber harvest in riparian areas; over utilization of riparian vegetation by livestock; road building, use and maintenance; forest fires; blockage to fish passage by improper road crossing structures; small hydroelectric dams; splashdams and dewatering for log transport; clearing of instream large woody debris; instream mining; conversion of forest land to agricultural and residential areas; and water diversions.

The predominant industry in the Lower Pend Oreille subbasin is logging. Heavy forest use and harvest have lead to the general decline in the quality of habitat available to native salmonid species. Riparian and upland management practices aimed at extracting the maximum amount of timber have contributed to poor riparian buffer health, lack of large woody debris in

the channel, poor large woody debris recruitment potential, mass wasting, and point and non-point sediment input.

Livestock grazing

Livestock grazing has impacted public and private upland and riparian areas in most subbasin tributaries. The USFS has an extensive grazing program in many tributaries to the Pend Oreille River. Direct impacts are evidenced by water quality problems, bank erosion, over utilization of riparian vegetation, and sediment input.

Agricultural Practices

Agriculture in the Lower Pend Oreille subbasin is limited by the available land base on which to farm, but all available agricultural land is farmed. Agricultural practices have contributed to fisheries impacts through stream channelization, sediment input and water quality problems.

Roads

Culvert installation and sediment input are the major problems caused by road maintenance and construction. Many timber hauling roads are within the riparian zone causing sedimentation to streams. These problems are apparent in most watersheds within the Lower Pend Oreille subbasin. Road densities are high in the majority of the subbasin. New road construction continues to occur and contributes to further habitat fragmentation.

Residential Development

The mainstem Pend Oreille River has grown in popularity as a preferred area for primary residential and secondary recreational home sites. As the population increases, more impacts to riparian areas and water quality are inevitable.

Non-Native Species

Non-native species have had an impact on native salmonids in the Lower Pend Oreille River subbasin. Brook trout have impacted bull trout populations through competition and hybridization. Brook trout are abundant in the Pend Oreille River and the majority of its tributaries.

The introduction of the eastern brook trout into northeastern Washington streams and rivers occurred at least as early as the 1920's and continued into the 1980's. The introduction of brown trout from Europe occurred at least as early as the 1940's and into the 1990's. Both species are only stocked in lakes without stream outlets and compete with bull trout for habitat and resources. Brook trout can interbreed with the bull trout and the progeny are normally sterile. Brown trout are effective predators and can reduce a bull trout population through mortality. Since the mid-1990's, these two species have been stocked in selected isolated lakes within the subbasin. Introductions of largemouth bass and other non-native species have contributed to predation pressures upon native salmonids in the Pend Oreille River and associated sloughs.

Isolation and Habitat Fragmentation

Habitat fragmentation has occurred due to road construction. Improper culvert placement prevents upstream migration and preclude bull trout from some subbasin tributaries. Hydropower

facilities without fish passage have eliminated functional bull trout passage upstream and downstream.

Wildlife

The presence, distribution, and abundance of a number of wildlife species in the Lower Pend Oreille subbasin have been affected by habitat losses due to several factors including hydropower development, agricultural development, urbanization, timber harvest, road construction, legal and illegal wildlife harvest, introduction of noxious weeds, and natural and human-caused events.

Large ungulate and predatory wildlife use several subbasins in order to meet critical life history needs. For example, the Selkirk Mountains woodland caribou population ranges across the Lower Pend Oreille, Priest River, Upper Pend Oreille, and Kootenai subbasins. Other species that utilize this broader area include species such as gray wolf, grizzly bear, and bald eagle. It is imperative to understand the interconnective nature of these subbasins. Management agencies are working together to restore connectivity within and between the subbasins.

Historically, wildfire was responsible for maintaining expansive early seral-stage forests like western larch, lodgepole pine, ponderosa pine, and western white pine. Fire frequencies kept shade-tolerant species from encroaching (Zack 1995); however, after years of fire suppression, shade-tolerant species such as Douglas fir and grand fir now dominate forest understory communities. The change in forest structure and composition impacts wildlife that depend upon early-seral forest communities. Fuel accumulations are very high and stand-replacing fires will occur and result in critical reductions of stored nutrients and an accompanying loss in potential productivity (USFS 1999). It is likely these changes in forest habitat components have altered habitat availability, utilization, and other factors that affect local wildlife populations.

Current operation of the hydropower system has reversed discharge patterns and altered seasonal and daily hydrology, reducing riparian diversity and cottonwood gallery recruitment. Increasing sedimentation from bank sloughing and oversteepening of riverbanks has also contributed to a loss of riparian function. Longstanding investigations of deciduous riparian vegetation along river systems (Rood and Heinze-Milne 1989, Merigliano 1996) have shown the impacts of hydroelectric operations on pioneering riparian species. Suchomel (1994) concluded that with regulated flows on the lower Flathead River, later successional riparian types were replacing pioneer species such as black cottonwood and sandbar willow, and the majority of the cottonwood galleries were mature to decadent.

Agricultural practices have impacted the low elevation habitats by reducing riparian and wetland vegetation, introducing herbicide and pesticide contaminants, increasing stream sediment loads, compacting soils, and causing geomorphologic changes to the bed and banks of streams. In Pend Oreille County, the majority of farming takes place within the low elevation floodplain habitats (Figure 10).

The majority of private landowners in the Lower Pend Oreille subbasin are located along the low elevation floodplain terrace of the Pend Oreille River and its tributaries (Figure 10). Development of these riparian areas has degraded and fragmented some of the most important wildlife habitats and impaired connectivity. Rural residential development has increased potential conflicts between humans and wildlife. In addition to the habitat impacts associated with residential development, increasing demand for rural residential homesites is increasing land prices. This makes it more costly to protect key wildlife habitats and reduces the opportunity to implement meaningful habitat enhancement and restoration projects.

Grizzly Bear

Human caused grizzly bear mortality, especially of females, by illegal shooting or killing bears in self defense is apparently the limiting factor in the recovery of the Selkirk grizzly bear population residing in Washington State. (Knick and Kasworm 1989, McLellan *et al.* 1999).

North American Lynx

Lynx are limited by the availability of a winter prey base, primarily snowshoe hare, as well as environmental/anthropogenic factors including forest management practices, habitat fragmentation, wildfires, fire suppression, insect epidemics, and lynx harvest management (Stinson 2000). Lynx were trapped or hunted in Washington until 1991 when a decline was readily apparent. It is postulated that the lynx population in Washington cannot sustain perennial exploitation due to the fragmented nature of subalpine-boreal habitats and low density of snowshoe hares (Stinson 2000).

The amount and quality of lynx foraging habitat is primarily a result of post timber harvest regeneration, wildfires, and to a lesser extent controlled burns. Grazing by livestock also has the potential to impact lynx by removing herbaceous forage that snowshoe hares use during the summer. Ruediger *et al.* (2000) suggest that cattle grazing is also a factor in the decline of aspen stand regeneration in Rocky Mountain subalpine areas, and probably degrades snowshoe hare habitat in riparian willow areas as well. In contrast, wind throw, insects, and disease aid in creating lynx denning habitat. Lynx are relatively tolerant of human activity; however, urban developments and roads with high traffic volumes may affect lynx movements (Stinson 2000). The lynx was listed as a state threatened species in 1993 and became a federal threatened species in April 2000.

Mule Deer

Without fire, logging, or some other mechanism to create forest openings and rejuvenate shrub browse species, mule deer winter range quality will continue to decrease throughout much of the Lower Pend Oreille and Priest River subbasins. Predation of adult and juvenile mule deer by cougars, coyotes, and black bear has also been identified as a potential limiting factor. These factors can and do affect mule deer numbers, as can subsistence/recreational hunting (Hamlin *et al*. 1984, Unsworth *et al.* 1999, Whittaker and Lindzey 1999) and inter-specific competition between sympatric species such as white-tailed deer and elk. Unfortunately, without additional investigations and research to identify and verify specific reasons for declines in mule deer numbers, the causes for decline will remain only speculative.

Selkirk Mountains Woodland Caribou

Caribou habitat in the U.S. is considered secure from human-caused changes, except for stand-replacement wildfires. Habitat in British Columbia is similarly protected, except in an area of private land used for timber extraction (Paquet 1997). Poaching and vehicle accidents have been reduced to near zero through aggressive law enforcement and public education.

Herd augmentation has been the main tool used by the agencies to increase the Selkirk caribou population (Audet and Allen 1996). The IDFG transplanted 60 caribou from British Columbia in three groups: 24 in 1987, 24 in 1988, and 12 in 1990. The WDFW transplanted 43 animals in three groups: 19 in 1996, 13 in 1997, and 11 in 1998. Only 21 of the 103 transplanted caribou remain alive in the wild today. Herd augmentation has likely prevented short-term

extinction of this population; however, this technique has not provided a secure population in the Selkirks probably because of the small numbers of animals transplanted in each group and the restriction of only three transplants for each area.

Great Blue Heron

Herons are generally sensitive to disturbance. Herons have abandoned heronries (nest colonies) in response to housing and industrial development, highway construction, logging activities, roads, and repeated human intrusion into nest colonies. The availability of alternative nesting and feeding habitat is probably critical to great blue herons as well.

There are two known active heronries on or near the Pend Oreille River; one at Campbell's Slough (approximately 20 nests) and the other near Usk (75-160 nests). Several other heronries in the Lower Pend Oreille subbasin have been abandoned due to logging or disturbance. One small rookery that has not been monitored for several years is also located on Lost Creek (5 nests), a tributary to the Pend Oreille River.

Osprey

The availability of nest sites (river pilings) appears to be the most significant limiting factor for osprey. Although the impacts are unclear at this juncture, double-crested cormorants have dramatically increased their presence along with the number of nests built on Pend Oreille River pilings.

Artificial Production

Native and non-native populations of salmonids and other species have been supplemented or introduced by means of hatchery plantings in the Pend Oreille River and its tributaries since before the turn of the century. Some fish, such as brown trout, were introduced to the Pend Oreille River via plantings in the 1890's from an original Scottish strain (Hisata, as cited in Ashe and Scholz 1992). In Box Canyon Reservoir alone, approximately 226,328 rainbow trout were planted from 1935 to 1953. An additional 48,445 cutthroat trout were planted during this period (Bennett and Liter 1991). A total of 32,500 cutthroat trout were planted in the Pend Oreille River in 1939. Hatchery plantings into the Pend Oreille River were discontinued in the late 1950's due to poor angler harvest. Net pen stocking and release has continuted intermittently in the Pend Oreille River at Ione, Ruby, Metaline, and other locations. Intermittent tributary stocking of hatchery brook trout continued into the 1990's (Bennett and Garrett 1994). WDFW planted 500,000 walleye larvae in 1983 and 253,000 walley larvae in 1984 (Bennett and Liter 1991). WDFW also planted 148 tagged adult walleye in 1987 (WDFW, Spokane, as cited in Ashe and Scholz 1992).

The WDFW operates a native westslope cutthroat trout egg collection facility at Kings Lake. Trout eggs collected at this site are utilized for fry and yearling trout stocking efforts within the Lower Pend Oreille subbasin.

Historically, WDFW operated a hatchery facility located on Slookum Creek from the early 1950's through the early 1960's. Fish propogated at this facility included cutthroat trout, rainbow trout, and eastern brook trout and were stocked in various area lakes, streams, and the Pend Oreille River. Hatchery operations were discontinued at this site due to poor fish growth and performance resulting from extremely cold hatchery source water temperatures (WDFW Region One archive files).

Currently, there are two ongoing hatchery operations in Box Canyon Reservoir: the Pend Oreille net pen operations in the Blueslide area, and the KT's largemouth bass hatchery, located on the Flying Goose Ranch. The Blueslide net pens have been operated continuously since 1991. The number of rainbow trout planted was 20,000 in 1991, 60,000 in 1993, and 40,000 in 1992, 1994, 1995, and 1996 (Jim Ebel, Spokane Hatchery, personal communication). The Newport High School project was conducted in 1990, 1992, and 1993. Numbers of rainbow trout planted were 10,000, 20,000 and 10,000, respectively (Gary Yann, Newport High School, personal communication).

The KNRD developed a largemouth bass hatchery, funded by BPA, to supplement populations of largemouth bass in Box Canyon Reservoir. Annual production includes 150,000 bass of which 100,000 are fry and 50,000 are fingerlings. The goal is to create a productive bass fishery in Box Canyon Reservoir that is available to tribal members and the public. Net pen operations have also been operated in the Metaline and Boundary pool areas by local cooperators working with WDFW during the 1990's. Local lakes are also stocked with westslope cutthroat trout and rainbow trout fry from the Colville Hatchery.

Existing and Past Efforts

Kalispel Tribe

In 1995, the KT, in conjunction with WDFW, initiated the Kalispel Resident Fish Project. This project consisted of habitat and population surveys to determine existing habitat conditions, fish distribution, and abundance. Habitat assessments were used to determine the types and habitat quality that were limiting to native bull trout and westslope cutthroat trout. Data collected in these assessments were compiled to develop recommendations for enhancement measures. From 1996 to 1998, the KT implemented those recommendations in Whiteman Creek, Mineral Creek, Fourth of July Creek, Middle Branch LeClerc Creek, Indian Creek, Cee Cee Ah Creek, Browns Creek, and Mill Creek. Restoration efforts primarily include instream structures and riparian restoration. Instream structures perform specific improvements for fish habitat, including spawning habitat, rearing cover, feeding areas, and overwintering habitat. These structures provide desirable conditions in areas where the stream conditions have been degraded.

The goals of instream restoration are to improve habitat quality and quantity in degraded areas, and increase cutthroat trout and bull trout populations. Riparian restoration includes fencing and vegetation planting. The purpose of riparian restoration is to reduce the impacts of land use practices, and enhance the natural recovery process in disturbed stream areas. Monitoring and evaluation of these enhancement measures started in 1997 and will continue at least through 2001 and beyond. The KT will continue to conduct habitat and fish population surveys and implement enhancement measures in additional tributaries. Since 1998, the Pend Oreille County PUD has surveyed an additional 104 km of stream. In 2001, an additional 56 km will be surveyed.

The KT, in cooperation with Pend Oreille County, replaced culverts with arched bridges at Mill Creek in 1997 and Cee Cee Ah Creek in 1998 to improve fish passage. The KT and the Pend Oreille County PUD, initiated an adfluvial trapping program in 1998 as part of the Resident Fish Stock Status above Chief Joseph and Grand Coulee Dams Project (JSAP). This project is a management tool using ecosystem principles to manage artificial fish assemblages in altered environments within the Columbia River Basin above Chief Joseph and Grand Coulee Dams.

For the past several years, the KNRD, WDFW, the Washington B.A.S.S. Federation, and the Inland Empire Bass Club have participated in a bass habitat enhancement project on Box

Canyon Reservoir. The project is intended to increase the survival of juvenile largemouth bass, thus enhancing recruitment of adult bass to the reservoir. These enhancement structures include Berkley Habitat Structures and Christmas trees. Funding sources for this project include the BPA, the KT, Fish America Foundation, and the Washington State B.A.S.S. Federation.

In 1996, the KNRD constructed a largemouth bass hatchery, funded by BPA, to supplement populations of largemouth bass in Box Canyon Reservoir. Annual production includes 150,000 bass of which 100,000 are fry and 50,000 are fingerlings. The goal is to create a productive bass fishery in Box Canyon Reservoir that is available to tribal members and the public.

U.S. Forest Service

The Colville National Forest has closed USFS roads in the subbasin where it has become necessary to prevent resource damage and provide isolation for threatened and endangered species, such as grizzly bear and woodland caribou. In the Le Clerc Creek watershed, the USFS, Stimson Lumber Co., the KT, and Pend Oreille County Roads Department have built a bypass road and are obliterating and rehabilitating 3.6 km of existing road. Road resurfacing, riparian planting, exclosure fencing, the armoring of livestock crossings, and range utilization monitoring in Le Clerc Creek have improved habitat conditions.

The USFS national road policy limits future road building in current roadless areas. The USFS has been inventorying all culverts on USFS service roads to determine whether the culverts are appropriate for maximum flows and whether they provide fish passage for all life stages of resident fish.

The USFS, Region 6, will be signing a Memorandum of Agreement with the WDOE to continue to reduce sources of sediment from forest roads.

The Colville National Forest continues to conduct Hankin-Reeves stream inventory surveys on segments of Pend Oreille River tributaries on USFS lands. Survey results, in addition to the culvert inventory, are used to determine where instream and/or riparian habitat restoration is needed and indicate sources ongoing direct and indirect effects.

Subbasin Management

Existing Plans, Policies, and Guidelines

Federal

U.S. Fish and Wildlife Service

The USFWS is the primary federal agency responsible for the conservation, protection, and enhancement of migratory birds, endangered species, and resident fish. The USFWS administers and manages the Little Pend Oreille National Wildlife Refuge. To protect and enhance fish and wildlife habitat, the USFWS reviews land management plans and permit applications for activities such as timber harvest, stream alteration, and hydroelectric projects. Federal plans, policies, and guidelines associated with the Lower Pend Oreille subbasin include the *Washington State Recovery Plan for Lynx*, *Selkirk Mountain Woodland Caribou (Rangifer tarandus caribou*) *Recovery Plan*, and the *Grizzly Bear Recovery Plan*. The Interagency Grizzly Bear Committee also established strategies for reducing female grizzly bear mortalities in the Selkirk and Cabinet-Yaak Recovery Zones.

U.S. Forest Service

The USFS uses several documents to manage lands: the *Colville National Forest Land and Resource Management Plan, Inland Native Fish Strategy* (INFISH), and the National Forest Management Act.

These plans provide standards and guidelines for management of national forest lands within the subbasin. The USFS is directed to maintain viable native vertebrate populations under the National Forest Management Act. The *Colville Forest Plan* directs the Colville National Forest office to protect native fish by reducing the risk of population loss and the potential negative effects to their aquatic habitat. The Colville National Forest fisheries goal is to restorr degraded riparian and instream habitat on USFS lands.

The INFISH provides riparian management objectives, riparian goals, riparian habitat conservation areas, and standards and guidelines for all resource management activities in order to protect and/or restore fish habitat. This strategy was adopted as part of the *Colville Forest Plan* and provides more specific direction for fish habitat management than the original plan.

The USFS currently has a Memorandum of Understanding (MOU) with WDFW. The MOU stipulates that both agencies agree to cooperate in the formulation and application of practical long-range objectives, plans and programs for the management of fish and wildlife species and their habitats on USFS lands.

Tribal Government

Kalispel Tribe of Indians

The KNRD *Fish and Wildlife Management Plan* (Plan) is a comprehensive accumulation of present and future KNRD resource direction based upon the KT's management authorities within its ceded lands. These authorities are based on federal law, tribal resolution, and agreements between the KT and other resource management agencies. The Plan identifies resource mission statements that are supported by specific goals and objectives. The Plan will direct each division’s development of annual work plans. Strategies are developed annually and drive each division’s on-the-ground activities to achieve its stated mission. It is important for the KT to actively manage resources within its ceded lands and provide management recommendations to attain resource improvement goals. The KNRD's approach is to manage sustainable native populations and habitats using watershed management principles. Non-native populations and/or artificial habitat management will be addressed based upon population health, habitat condition, and feasibility. The KT entered into an MOU with WDFW for co-management of fishery resources of the Pend Oreille River and its tributaries.

Other documents that pertain to plans, policies, and guidelines relevant to the Lower Pend Oreille subbasin include the *Kalispel Tribe of Indians Natural Resource Department Fish and Wildlife Management Plan* (1997), *Kalispel Resident Fish Project Annual Report* (1995), and *Kalispel Tribe of Indians Wildlife Mitigation and Restoration for Albeni Falls Dam: Flying Goose Ranch Phase I* (1993).

State Government

Washington Department of Fish and Wildlife

The Washington State Legislature has given WDFW the responsibility of preserving, protecting, and perpetuating all fish and wildlife resources of the state. The WDFW strives to preserve,

protect, and perpetuate the fish and wildlife species of the state. The Wild Salmonid Policy (WSP) (State of Washington 1997) is one of the guidance documents used to review and modify current management goals, objectives, and strategies related to wild salmonid stocks within the Lower Pend Oreille subbasin. Under the WSP, the goal of WDFW is to protect, restore, and enhance the productivity, production, and diversity of wild salmonids and their ecosystems to sustain ceremonial, subsistence, commercial, recreational fisheries, non-consumptive fish benefits, and other related cultural and ecological values. The WSP will serve as the primary basis for review of Washington hatchery and harvest programs, as well as development of watershed-based plans that insure adequate habitat protection. The WDFW currently entered into a Memorandum of Understanding with the KT to promote cooperation and coordination on management of fishery resources of the Pend Oreille River and its tributaries.

The Washington State Legislature in 1949 passed the "Hydraulic Code" (RCW 75.20.100-160). The law requires that any person, organization, or government agency wishing to conduct any construction activity in or near state waters must do so under the terms of a permit, called the Hydraulic Project Approval (HPA), issued by WDFW. State waters include all marine waters and fresh waters of the state. The law's purpose is to ensure that needed construction is done in a manner to prevent damage to the state's fish, shellfish, and their habitat.

Washington State Department of Natural Resources

Two of Washington State Department of Natural Resources (DNR) largest and most important responsibilities in resource protection are fire prevention and suppression, and regulating forest practices (or timber harvest). The Washington DNR is responsible for a continuing program of orientation and training relating to forest practices and regulation thereof, pursuant to RCW 76.09.250.

Washington State Department of Ecology

The mission of the WDOE is to protect, preserve, enhance Washington’s environment, and promote the wise management of its air, land, and water for the benefit of current and future generations. Washington State Department of Ecology goals are to prevent pollution, clean up existing pollution, and support sustainable communities and natural resources. A major role of the WDOE is to allocate water rights and to decide who gets to use the state’s surface and ground water for industry, agriculture, and homes.

Washington State House Bill 2496

The Washington State Legislature established Lead Entities in ESHB 2496, the state Salmon Recovery Act, which the Governor signed into law in April 1998. For the past three years, the legislature has provided funding to WDFW to support the infrastructure and capacity needs of Lead Entities engaged in salmon recovery at the watershed level. The Lead entity for Lower Pend Oreille subbasin is the Pend Oreille County Conservation District.

Local Government

The Pend Oreille PUD completed the *Box Canyon Habitat Evaluation Procedures Assessment Report* (1999) as part of its relicensing process.

Goals, Objectives, Strategies, and Recommended Actions

Fisheries

The overall goal for the Lower Pend Oreille subbasin is to mitigate and compensate for resident and anadromous fish losses caused by the construction and operation of federally operated and federally regulated hydropower projects. This will be accomplished by restoring sustainable, naturally producing populations of native fish to support tribal and non-tribal harvest and cultural and economic practices while protecting the biological integrity and genetic diversity of the subbasin, while recognizing that where impacts have irrevocably changed the native ecosystem, we can only protect and enhance the ecosystem that remains.

Goal 1: Protect, enhance, and restore native fish populations to maintain stable, viable levels, to ensure long term, self-sustaining persistence, and to provide ecological, cultural, and sociological benefits.

Objective 1: By 2020, restore bull trout and westslope cutthroat populations in the Lower Pend Oreille subbasin to a level where adult escapement is well distributed and they support healthy spawning populations.

Strategy 1: Restore, protect, and maintain spawning and rearing habitat in tributary streams to improve survival of bull trout and westslope cutthroat trout.

Recommended Actions:

- By 2005, complete westslope cutthroat trout and bull trout population inventories in remaining unsurveyed tributaries to the Pend Oreille River.
- By 2005, complete fish habitat inventories in remaining tributaries to the Pend Oreille River. Identify limiting factors and threats to existence for native fish.
- Inventory fish passage through stream crossings, diversions, or other man-made obstructions and restore fish passage where needed.
- Work with the USFS and other timberland owners and managers to identify and remove or repair failing roads and correct other problems that are negatively impacting stream habitat, flood function, and watershed condition.
- Work with the USFS and other interested parties to address sediment management and removal of the splash dam on West Branch LeClerc Creek.
- Design, construct, and maintain habitat improvements to address limiting factors in tributary streams for native fish (e.g. riparian planting, fencing, instream structures).
- Maintain restrictive fishing regulations, where appropriate, to provide protection to weak stocks.
- Support collaborative efforts by local watershed groups to accomplish site-specific protection and restoration activities by implementing existing regulations and BMP's.
- Purchase critical watershed areas for protection and restoration of native fish species and their habitat.

Strategy 2: Operate dams and reservoirs to minimize impacts to native fish.

Recommended Actions:

- Review operations of Albeni Falls Dam, Box Canyon Dam, and Boundary Dam. Provide recommendations through FERC relicensing process and/or federal consultation that minimize effects on bull trout, including fish passage, minimum flows, entrainment, temperature, stabilized flow regimes, and TDG.
- Provide upstream and downstream fish passage at Albeni Falls Dam, Box Canyon Dam, Boundary Dam, Calispell Creek Pumps, Power Lake Dam, Cedar Creek Dam, and Sullivan Creek Dam.

Strategy 3: Conserve genetic diversity of native fish populations and provide opportunity for genetic exchange among local populations.

Recommended Actions:

- Establish genetic baselines for each local population of native fish within Pend Oreille River tributaries.
- Maintain gene flow and opportunity for functional assemblages by expanding existing local populations of native fish where feasible and appropriate.
- Develop genetic preservation guidelines for possible future reintroductions.
- Explore and develop the use of conservation aquaculture facilities to increase westslope cutthroat trout and bull trout population levels.

Objective 2: By 2015, reduce competition between brook trout and native fish (westslope cutthroat trout and bull trout).

Strategy 1: Improve conditions for spawning and rearing cutthroat trout and bull trout in the Lower Pend Oreille subbasin by reducing competition with brook trout and other non-native fish species.

Recommended Actions:

- Develop, maintain, and support liberal bag limits on brook trout in the Pend Oreille River and tributaries.
- Discourage unauthorized fish introductions.
- Evaluate opportunities for experimental removal of brook trout or other competing non-native species from selected streams.
- Educate anglers about non-native fish, fishing regulations and proper identification of native species.
- Discourage providing passage to areas where native fish populations are isolated and the potential for invasion of non-native species exists.

Objective 3: Preserve and protect native non-game species above minimum viable population sizes that maintain adaptability and genetic diversity, while minimizing the probability of extinction.

Strategy 1: Identify current stocks, population levels, habitat conditions, genetic profiles, and geographic ranges of game and non-game fish.

Recommended Actions:

- Conduct stock assessments in the Pend Oreille River, tributaries and surrounding lakes.
- Establish genetic baselines for each local population within Pend Oreille River tributaries.

Goal 2: Where native habitats are not available within the main stem of the Pend Oreille River or its tributaries, manage non-native fish species or non-native stocks to maximize available habitats to provide a subsistence and recreational sport fishing resource. Non-native species are to be managed in a way that maximizes available habitat conditions and minimizes negative impacts to native species.

Objective 1: Provide a sport and subsistence fishery for tribal and non-tribal members.

Strategy 1: Increase the harvestable biomass of largemouth bass in Box Canyon Reservoir.

Recommended Actions:

- Construct and place artificial cover structures to increase the amount of largemouth bass fry winter cover in selected areas of the Pend Oreille River and its associated slough habitats.
- Operate and maintain a largemouth bass hatchery to produce 100,000 largemouth bass fry and 50,000 fingerlings for release annually.

Strategy 1: Operate dams and reservoirs to minimize impacts to non-native fish.

Recommended Actions:

- Review operations of Albeni Falls Dam, Box Canyon Dam, and Boundary Dam. Provide recommendations through FERC relicensing process and/or federal consultation that minimize effects on non-native fish, including minimum flows, entrainment, stabilized flow regimes, and TDG.

Wildlife Goals

The primary wildlife goal for the Lower Pend Oreille subbasin is to protect, enhance, restore, and /or maintain native wildlife populations at viable levels for ecological, social, recreational, subsistence, and aesthetic purposes within the lower Pend Oreille subbasin in Washington.

A diverse array of habitats, ranging from riparian to sub-alpine, occur within the lower Pend Oreille subbasin. Numerous wildlife species and critical habitats, including those identified by WDFW as PHS, are present within the subbasin (Figure 17). Several wide ranging species, including grizzly bear and caribou, occupy home ranges that span both state and international boundaries.

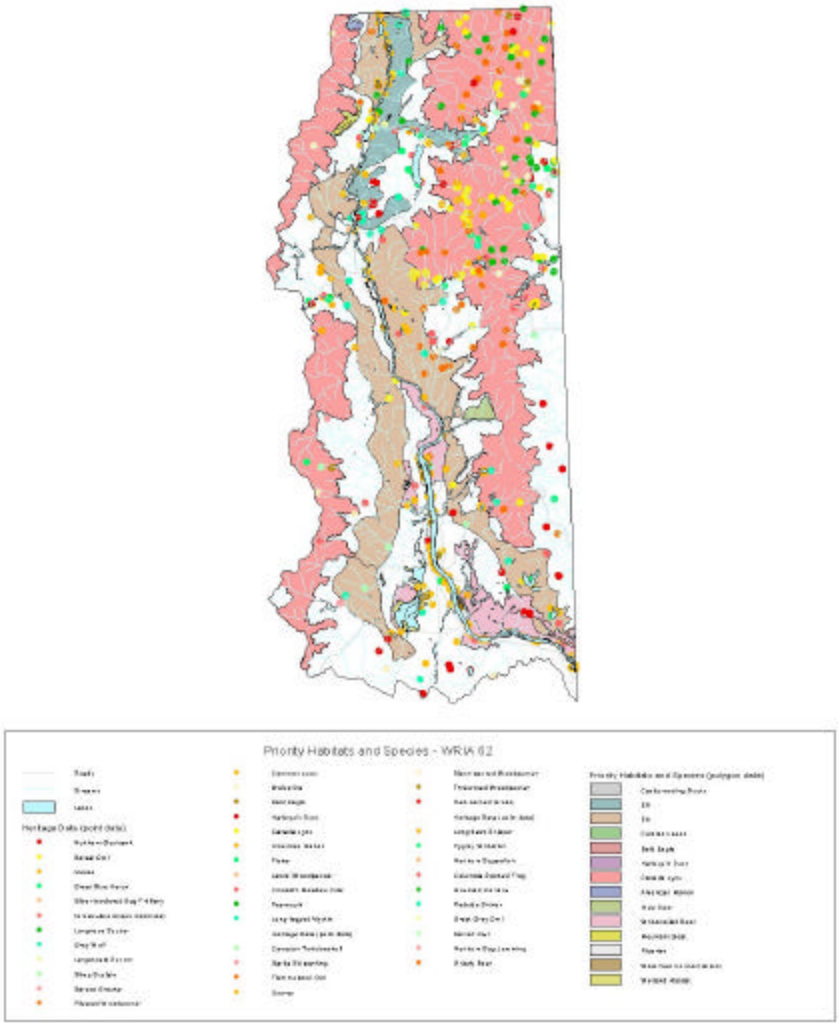


Figure 17. WDFW PHS map for the Lower Pend Oreille and Priest River subbasins in Washington

Grizzly Bear

The range of grizzly bears outside of Canada and Alaska is now confined to six recovery zones located within the states of Montana, Wyoming, Idaho, and Washington. One recovery zone, the Selkirk Mountains Ecosystem, is located within the Upper Pend Oreille, Lower Pend Oreille, and Priest River subbasins of Washington and Idaho (Figure 18). This zone is connected to grizzly bear range within British Columbia, Canada. The current population of grizzly bears within the Selkirk Zone is below the threshold level necessary for a viable population (Wielgus *et al.* 1993 and W. Wakkinen, IDFG, personal communication).

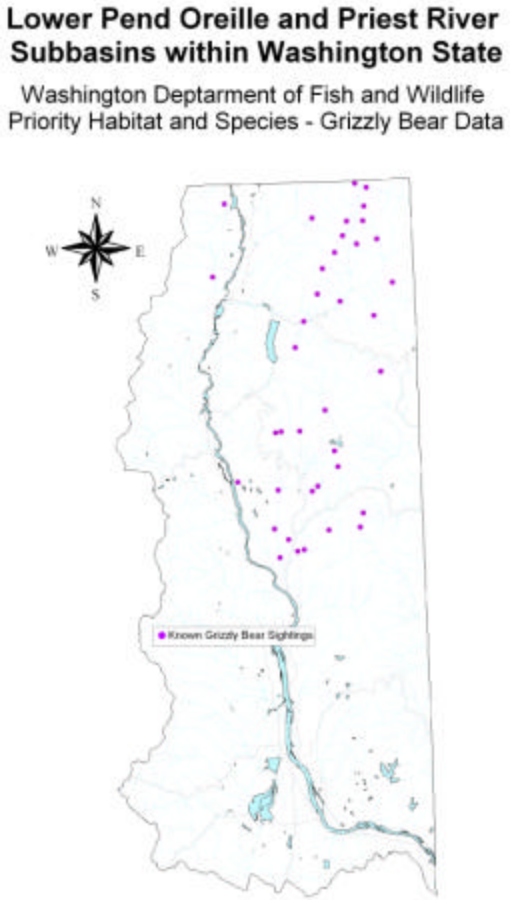


Figure 18. Grizzly bear recovery zone and grizzly bear observation locations within the Lower Pend Oreille and Priest River subbasins in Washington

Status: State Endangered and Federally Threatened Species.

Limiting Factors: Human caused grizzly bear mortality, especially of females, by illegal shooting or killing bears in self-defense is apparently the limiting factor in the recovery of the Selkirk grizzly bear population residing in Washington State. (Knick and Kasworm 1989 and McLellan *et al.* 1999).

Goal: Recover grizzly bear populations to a level necessary for viability in the Selkirk Ecosystem (WDFW and USFWS goal).

Objective: Eliminate all human caused mortality of grizzly bears in the Selkirk Ecosystem by 2005.

Strategies:

- Cooperate and coordinate with the Interagency Grizzly Bear Committee (IGBC 1995).
- Monitor bear populations to determine population trends, productivity, distribution, and total numbers.
- Provide funding for information/education patrols to make contacts with people recreating in grizzly habitat within the subbasin, especially hunters. Provide funding for brochures, signs, and other informational materials.
- Develop and implement strategies to prevent human caused mortalities of grizzlies.
- Develop a strategic conservation plan that includes provisions for grizzly bear population monitoring as well as provisions for informing & educating the public on the needs of grizzly bears (ensure that increasing demands for human recreational usage within the Selkirk Zone are compatible with grizzly bear recovery).
- Instigate or develop with Idaho and/or British Columbia a cooperative grizzly bear trapping and radio marking project in Washington so that grizzly bear population information can be obtained.
- Improve community relations and garnish local support for grizzly bear recovery efforts. This would be accomplished by expanding the efforts of the information/education patrol position to a community contact person.

North American Lynx

There are two Lynx Management Zones (LMZ) in the Lower Pend Oreille and Priest River subbasins. The Little Pend Oreille Zone includes the Kalispel Mountain Range to the west of the Pend Oreille River and is made up of 10 Lynx Analysis Units (LAUs), seven of which are in the Pend Oreille River subbasin. The Salmo-Priest LMZ includes the Selkirk Mountain Range that includes both the Lower Pend Oreille and Priest River subbasins and has 19 LAUs or parts of LAUs in Washington. Lynx sightings and critical habitat within the subbasins are depicted in Figure 19.

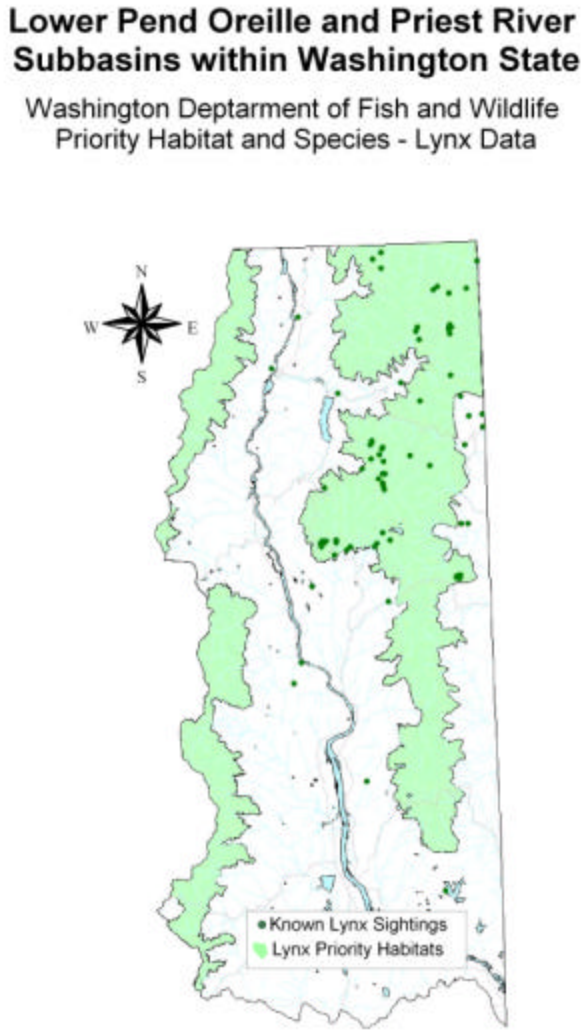


Figure 19. Lynx sightings and lynx priority habitats within the Lower Pend Oreille and Priest River subbasins

Status: State and Federal Threatened Species

Limiting Factors: Lynx are limited by the availability of a winter prey base, primarily snowshoe hare, as well as environmental/anthropogenic factors including forest management practices, habitat fragmentation, wildfires, fire suppression, insect epidemics, and lynx harvest management (Stinson 2000).

Goal: Restore and maintain viable lynx populations in Washington.

Objective 1: Document the presence of lynx in at least 75% of the LAUs, for 10 consecutive years within the Lower Pend Oreille and Priest River subbasins in Washington.

Strategies:

- Conduct annual surveys of the occupied LMZ's to determine population persistence by surveying each LAU at least every three years.
- Coordinate survey, monitoring, and management activities with the USFWS, USFS, Tribes, non-governmental organizations, and volunteers.
- Conduct intensive telemetry studies of lynx populations.

Objective 2: Document and monitor reproductive success of lynx populations within the Lower Pend Oreille and Priest River subbasins in Washington through 2010.

Strategies:

- Conduct prey species research (snowshoe hare and red squirrels).
- Investigate lynx use of habitats and travel patterns in relation to snowmobile, cross-country and downhill ski trails and other anthropogenic activities.
- Conduct investigations of potential competition between lynx and other carnivores and the possible role of anthropogenic induced habitat changes.

Mule Deer

Status: PHS Species

Limiting Factors: Lack of high quality winter range and possibly predation. Unfortunately, without additional investigations and research to identify and verify specific reasons for declines in mule deer numbers, the causes for decline will remain only speculative.

Goal: Recover mule deer populations to at least 1980 levels in the Lower Pend Oreille and Priest River subbasins.

Objective 1: Rejuvenate 200 ha of browse per year through controlled burns in cooperation with the USFS, WDFW, USFWS, tribe(s), other agencies, and private landowners.

Objective 2: Determine how predators, hunting, and inter-specific competition from sympatric species impacts mule deer populations in the subbasins by 2006.

Strategies:

- Increase mule deer winter range carrying capacity. Manage forest ecosystems toward the more natural open mature stands that favor mule deer.
- Where ecologically appropriate, encourage fire management planning and practices that provide natural fire created openings in the higher elevations.

- Through logging and thinning develop natural open forest stands throughout the subbasins where feasible.
- Review present winter range maps from WDFW and USFS, and identify and ground truth specific sites where burning will enhance browse production for mule deer.
- Provide funds to develop fire plans and implement activities on high elevation habitats controlled by the USFS and/or owned by private individuals/timber companies.
- Initiate road management activities such as road and/or gate closures to vehicular traffic (may be seasonal closures).
- Conduct research on how predators, hunting, and inter-specific competition from sympatric species impact mule deer populations within the subbasins.

Selkirk Mountains Woodland Caribou

The Selkirk Mountains caribou was first listed in 1984. The Caribou Recovery Team (Recovery Team) prepared a federal recovery plan in 1985, followed by a revision in 1994. The Recovery Team oversees most activities related to mountain caribou recovery in the Selkirks. In response to recent caribou population declines, the Recovery Team requested that an interagency Caribou Steering Committee be appointed to raise the level of agency involvement and to promote rapid agency decisions regarding strategies and funding. Through international interagency agreements the Recovery Team established a caribou Recovery Zone, which covers portions of Washington, Idaho, and British Columbia. Caribou have been observed at the locations shown in Figure 20.

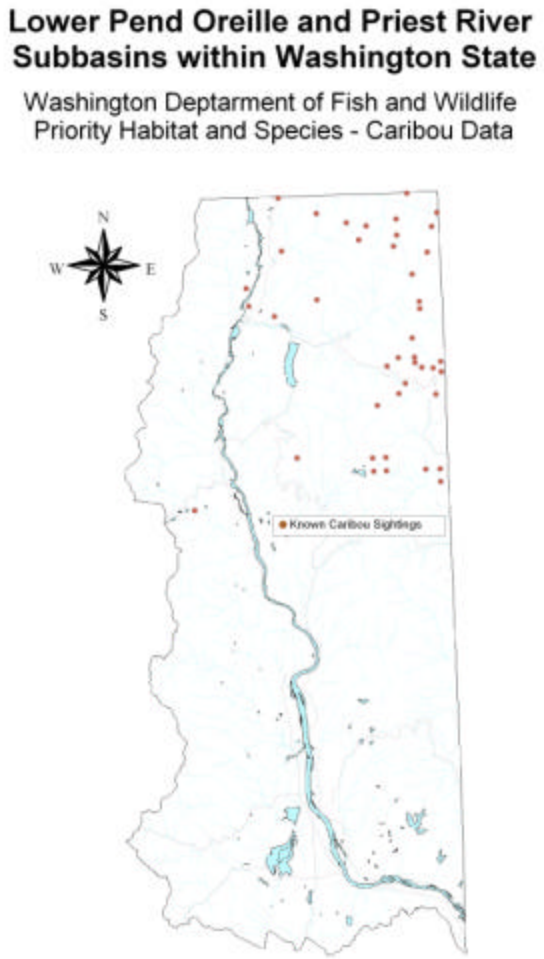


Figure 20. Caribou observation locations in the Lower Pend Oreille and Priest River subbasins in Washington

Status: State and Federal Endangered Species

Limiting Factors: Predation probably plays a major role in recovery of this caribou population. Grizzly bears and cougars are currently studied to determine predation relationships with caribou. Information is needed on caribou predation by black bears, wolverines, lynx, and wolves (USFWS 1994). Until recently, poaching and collisions with vehicles also limited the Selkirk caribou population.

Goal: Recovery of the mountain caribou as a viable population in the southern Selkirk Mountains of Washington, Idaho, and British Columbia.

Objective: Increase the Selkirk woodland caribou herd to 50 animals or more by 2010.

Strategies:

- The overall strategy for recovery of this population is to secure adequate habitat, prevent human-caused mortality, and increase the population by herd augmentation.
- Continue monitoring of radio-collared caribou to determine population dynamics, seasonal habitat use, and population survival and document population trends.
- Continue monitoring radio-collared cougars and grizzly bears to determine predation on caribou, population dynamics, and seasonal habitat use.
- Implement herd augmentation whenever the caribou population is documented at less than 50 animals.
- Analyze the efficacy of other techniques to increase the Selkirk caribou population such as captive-rearing caribou and artificial insemination.

Bald Eagle

The WDFW developed bald eagle management guidelines in *WDFW Bald Eagle Management Recommendations* and *Bald Eagle Site Management Plan Guidelines* (Olympia, Washington). Individual nest location maps and associated survey data are available from WDFW Wildlife Resource Data System program staff in Olympia, Washington. The first 12 nest territories are near the shoreline of the Pend Oreille River and extend from Newport to Boundary Dam. The Calispell Lake nest is adjacent to the east shore of the lake (Figure 21).

Status: State and Federal Threatened Species

Limiting Factors: Loss of nesting and winter roost sites and disturbance from development and other anthropogenic activities (USFWS 1986).

Goal: Fully recover and maintain viable bald eagle populations in the Mountain Columbia Province.

Objective: Maintain bald eagle populations at or above present levels within the Mountain Columbia Province.

Strategies:

- Protect bald eagle nesting and winter roost sites by securing existing and potential nesting/roosting areas (including a 400 m to 800 m radius buffer around nests).
- Identify and map all potential existing and winter roosting habitats.
- Monitor and/or research water quality and prey abundance and production.
- Restore potential nesting/roosting areas to full potential within 50 years.

Figure 21. Bald eagle nest sites and territories within the Lower Pend Oreille and Priest River subbasins

Great Blue Heron

Status: Washington Priority Species

Limiting Factors: Herons are generally sensitive to disturbance. Herons have abandoned heronries (nest colonies) in response to housing and industrial development, highway construction, logging activities, roads, and repeated

human intrusion into nest colonies. The availability of alternative nesting and feeding habitat is probably critical to great blue herons as well.

WDFW Goal: Maintain heron populations at current levels within present use areas.

KT Goal: Maintain and expand heron population levels within the subbasin.

Objective: Protect existing heronries and secure a minimum of two potential alternative nesting sites near high use feeding locations such as Calispell Lake and the Pend Oreille River by 2010.

Strategies:

- Identify and map heron nesting colonies and important feeding sites present within the subbasins.
- Identify and map potential nesting habitat currently not occupied by herons.
- Consider developing cottonwood stands on islands to provide security for herons as well as potential future nesting sites.
- Secure long-term protection of heron habitat through acquisitions, easements, and management agreements. These sites should be a minimum of 4 ha and comprised of large cottonwood trees.
- Develop site-specific management plans for existing and potential heron rookeries.
- Develop cottonwood stands on islands and river frontage to provide security for herons as well as potential future nesting sites.

Osprey

While ospreys are not a listed species, they deserve special attention because they are important to the residents of Pend Oreille County and the KT. Ospreys are a highly visible watchable wildlife species that attract tourism to the area. In 1989, the last year WDFW completed survey a of nesting osprey, there were approximately 52 active nests and 19 inactive nests documented in Pend Oreille County (WDFW, Wildlife Resource Data System). Nest site locations are shown on Figure 22.

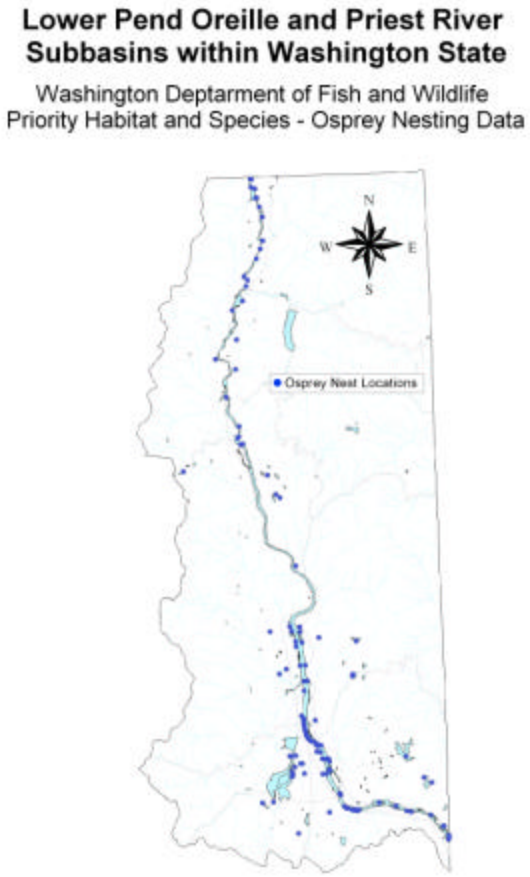


Figure 22. Osprey nest site locations within the Lower Pend Oreille and Priest River subbasins

Status: Not listed

Limiting Factors: The availability of nest sites (river pilings) appears to be the most significant limiting factor. Although the impacts are unclear at this juncture, double-crested cormorants have dramatically increased their presence along with the number of nests built on Pend Oreille River pilings within the subbasin.

Goal: Maintain osprey populations at or above present levels in the Lower Pend Oreille subbasin for the next 25 years.

Objective 1: Develop 25 new osprey nest pole sites on the Pend Oreille River by 2010.

Strategies:

- Secure the long-term protection of nesting pilings on the Pend Oreille River.
- Replace existing natural or man-made nest structures on the Pend Oreille River as needed.
- Determine ownership or control of the river pilings.
- Conduct an intensive osprey nesting status survey, map nest locations, and document nest activity.
- Investigate options and mitigate potential competition for nesting structures by double-crested cormorants. Place single poles away from other nests structures to avoid the colony preference shown by cormorants. Document which osprey nests have been impacted, replace them with isolated structures, and develop alternative actions.
- Develop a plan to monitor the status of decadent nesting structures (river pilings) and to replace the pilings as needed. Identify funding sources. Determine if cormorants are impacting ospreys in the Lower Pend Oreille subbasin.

Objective 2: Maintain osprey nest sites on the Pend Oreille River and encourage increased suitable riparian habitat by 2010.

Strategies:

- Monitor the status of decadent nesting structures (river pilings) and increase suitable riparian habitat to replace river pilings as they fail.

Albeni Falls Wildlife Mitigation Project

Albeni Falls wildlife mitigation is completed under the agreement *Albeni Falls Interagency Work Group Operating Guidelines and Guiding Principles for Wildlife Mitigation Implementation* (1998). The IDFG, KT, Kootenai Tribe, and CDAT comprise the core team membership responsible for implementing wildlife habitat mitigation.

Location: Three target priority areas: 1) Lands in the Upper Pend Oreille subbasin adjacent to or below 631m msl, 2) Lower Pend Oreille subbasin to Box Canyon Dam, and 3) the Kootenai subbasin and the Coeur d'Alene subbasins in Idaho.

Size: Approximately 2,000 hectares.

Limiting Factors: Inundation of habitat, land ownership and land availability.

Goal: Fully mitigate wildlife habitat losses within the three priority areas as per the Operating Guidelines.

Objective 1: Protect habitat through the purchase of management rights by 2010 (acquisition, easements, binding long term agreements).

Strategies:

- Identify willing sellers.
- Prioritize protection actions annually per the Operating Guidelines.

- Pursue long-term agreements, conservation easements, or acquisition of identified priority properties.

Objective 2: Enhance and restore habitat through peer-accepted methodologies for the target habitat cover types by 2050.

Strategies:
- Complete site-specific management plans.
- Implement habitat enhancement and restoration activities.

Objective 2: Maintain, monitor, and evaluate habitat through peer-accepted methodologies for the target habitat cover types in perpetuity.

Strategies:
- Implement Operations and Maintenance plans.
- Implement monitoring plans and evaluate project success and contribution to meeting goals.
- Implement adaptive management to meet project goals.

Recommended Actions:
- Continue funding for the Albeni Falls Wildlife Mitigation Project at a level of $5 million annually. Wildlife losses for Albeni Falls Dam are referenced in the Program (NPPC 1997, Table 11-4).

Calispell Lake/Marsh

This lacustrine complex is a significant migration resting/foraging/staging area for ducks, geese, and swans each spring. It is also a highly productive area for other wetland obligate/facultative species. The Calispell Duck Club and adjacent landowners currently manage the area.

Location: Approximately 4.8 km southwest of Usk, Washington in Pend Oreille County.

Size: Approximately 1,000 hectares.

Limiting Factors: Water level management and ownership.

Goal: Protect and maintain lake and wetland habitats for wildlife.

Objective: Purchase the lake and/or water management rights by 2010 (acquisition, easements, binding long term agreements).

Strategies:
- Pursue long-term Habitat Conservation Plans (HCPs) or acquisition of Duck Club properties.
- Identify legal agreements relative to managing lake levels and pursue HCPs, irrigation district agreements, or acquisition of affected lands.
- Facilitate biological studies to establish BMPs for managing the lake level.

Pend Oreille River Floodplain - Cusick Valley

This floodplain valley is significant to many habitats and species associated with the subbasin. It is a highly productive area for black cottonwood galleries, scrub-shrub wetland, sloughs, and other wetland obligate/facultative species and floral and faunal species. This area is primarily in private ownership with agricultural production ranging from cattle to hay operations.

Location: General vicinity is Cusick, Washington in Pend Oreille County, Washington.

Size: Approximately 20,000 hectares.

Limiting Factors: Land use practices, flood control within the valley and water management in the form of dam operations.

Goal: Protect, restore, and enhance natural functions, habitats, and species compositions to benefit the riparian and wetland habitats and associated wildlife.

Objective: By 2005, acquire lands and/or management rights (tribal, USFWS refuge, Washington DNR, NRCS Wetland Reserve Program easements) on 400 ha in order to add to current management blocks.

Strategies:

- Pursue permanent easements and/or acquisitions from willing sellers.
- Identify legal agreements relative to flood control.
- Establish and implement consistent management practices.

Everett Island

The WDFW, the KT, and the Pend Oreille PUD identified this island as important habitat for amphibians and waterfowl. Waterfowl nesting habitat and potential cottonwood gallery sites are severely impacted by livestock grazing (Ashley, Entz, and Stiehl pers. obs. 1999).

Location: Approximately 2 km south of Usk, Washington in Pend Oreille County.

Size: Approximately 100 hectares.

Limiting Factors: Erosion, ownership, and land use practices.

Goal: Protect, restore, and enhance island habitats for wildlife.

Objective: By 2010, acquire management rights to the island through fee-title acquisition, conservation easements, and/or long- term agreements.

Strategies:

- Pursue long-term HCPs or acquisition of Duck Club properties.
- Identify legal agreements relative to managing lake levels and pursue HCPs, irrigation district agreements, or acquisition of affected lands.

- Facilitate biological studies to establish BMPs for managing the lake level.

Forested Uplands - Federal

The fish and wildlife managers consider this forested system to be significant to fish and wildlife species management. Management issues associated with forested lands directly impact all ESA, state and tribal species of concern.

Location: Pend Oreille County, Washington.

Size: Approximately 1 million ha

Limiting Factors: Land use practices and management.

Goal: Protect and maintain important habitats for wildlife.

Objective: By 2006, ensure that all forest practices, including road building and maintainance are being implemented by the USFS as specified in the *Colville National Forest Plan*.

Strategies:

- Start discussions with the USFS to determine adequacy of the forest plan.
- Identify and implement changes to the forest plan.
- Facilitate discussions to ensure adequate funding reaches the Forests to implement the *Colville National Forest Plan*.

Forested Uplands - Private

The fish and wildlife managers consider this forested system to be significant to fish and wildlife species management. Management issues associated with forested lands directly impact all ESA, state and tribal species of concern.

Location: Pend Oreille County, Washington.

Size: Approximately 100,000 ha

Limiting Factors: Land use practices, ownership, and management.

Goal: Protect and maintain important habitats for wildlife.

Objective 1: By 2010, ensure that all forest practices, including road building and maintainance are being implemented as specified in the Washington DNR Forest Practices Rule.

Strategies:

- Start discussions with the USFS to determine adequacy of the forest plan.

- Identify and implement changes to the forest plan.
- Facilitate discussions to ensure adequate funding for plan implementation reaches the forests.

Objective 2: By 2006, identify priority habitat areas for acquisition.

Strategies:
- Identify priority habitat areas.
- Identify willing sellers within the priority habitat areas.
- Protect, restore, and enhance newly acquired habitats.

Research, Monitoring and Evaluation Activities

Fisheries

Kalispel Tribe

Many of the research, monitoring, and evaluation activities implemented by the KT are directly related to the activities in the "Existing and Past Efforts" section. Most of these activities are funded by BPA; however, there are other research, monitoring, and evaluation activities that are funded by other entities. Much of the monitoring includes conducting pre- and post-assessments on areas where stream restoration has occurred. Specific research, monitoring, and evaluation activities for BPA and non-BPA funded activities are detailed further.

BPA Funded Research, Monitoring and Evaluation Activities:

Kalispel Resident Fish Project

The Kalispel Resident Fish Project (NPPC Program Measure 10.8B.14-16, 18 and 19) was designed to assess and determine the habitat conditions in the tributaries to the Pend Oreille River that are limiting to the native bull trout and cutthroat trout populations. Based on the habitat assessments, enhancement recommendations were developed to increase the native salmonids habitat quality and quantity. All enhancement sites were subjected to an intensive pre-assessment of habitat and fish populations. The pre-assessment will be used with a three-year post-assessment to determine the types of enhancement that provide the most benefit to habitat conditions. In conjunction with the tributary enhancement efforts, this project has a mainstem enhancement component. A largemouth bass hatchery was constructed to facilitate the production and rearing of juvenile bass for supplementation and thereby increase the production of harvestable bass within the reservoir. To enhance the overwinter survival of juvenile bass, artificial habitat will be added. Subsequent habitat and population assessments will be used to determine the effectiveness of enhancement measures toward meeting the established biological objectives for both the tributaries and mainstem. Specific monitoring and evaluation activities include:

- Monitor and evaluate instream enhancement structures built during 1996 -1998 by an intensive assessment of the enhancement area and conduct a fish snorkel survey. Compare data with baseline information. Based upon results, develop recommendations for additional instream enhancement.
- Monitor and evaluate fencing and riparian planting reaches completed during 1996 and 1997 by an intensive assessment of the enhancement area and conduct a fish snorkel

survey. Compare data with baseline information. Based upon results, develop recommendations for additional enhancement.

- Monitor and evaluate warmwater habitat enhancement project. Electroshock enhancement structures placed in Box Canyon Reservoir to determine fish utilization and enhancement effectiveness.

Resident Fish Stock Status Above Chief Joseph and Grand Coulee Dams

The JSAP (Blocked Area) is composed of 32 unique water bodies covering 3.8 million hectares. The project boundary is defined as all water bodies upstream of Chief Joseph Dam within the state of Washington. The JSAP allows managers to view the Blocked Area as a system by compiling previously collected data, organizing available data, identifying data gaps, performing necessary research, and recommending management actions. Managers acknowledge that to effectively manage the fisheries, information such as species presence and relative densities are required. It is important to realize that this project has been set up to centrally accommodate all managers. This avoids effort duplication and ensures area wide coordination at achieving the stated vision. In 1993, managers identified a need for a coordinated approach to fish management in the Blocked Area. This coordinated approach included a baseline stock inventory of the resident fish species inhabiting the area and is the basis for NPPC Program measure 10.8B.26. The Independent Scientific Review Panel in their 1998 report also recognized this need. Recommendations made by the ISRP are similar to the JSAP. The JSAP is centered around the concept that management actions should be based upon and supported by the best available scientific knowledge (NPPC Program section 4[h][6][B]] and the stated vision of the Blocked Area Management Plan (in press). By integrating information, the JSAP uses information collected by all Blocked Area projects and other sources to identify data gaps and fill necessary voids. The information collected by the JSAP combined with information collected by other projects and sources increases the scientific knowledge of the whole system. This increased knowledge allows for more educated decisions on fish management actions, greatly increasing the chances for native fish recovery and providing successful subsistence and recreational fisheries. Because Blocked Area managers will use this information in implementing projects that address specific NPPC Program measures, success of the JSAP increases the likelihood of other project success. Specific monitoring and evaluation activities within the Mountain Columbia Province include:

- Monitor adfluvial salmonid migrations in tributaries to Box Canyon Reservoir through adfluvial traps.
- Compile baseline ecological information for Yocum and Half Moon lakes.
- Monitor movement of brown trout, rainbow trout, cutthroat trout, largemouth bass, and mountain whitefish in Box Canyon Reservoir.

Non-BPA Funded Research, Monitoring and Evaluation Activities:

- Monitor and evaluate the effect instream structures have on the freshwater macroinvertebrate community.
- Conduct habitat assessments and snorkeling surveys in tributaries to Box Canyon Reservoir under the settlement agreement for the Box Canyon Dam license amendment. This is a joint project with the Pend Oreille County PUD.
- WDFW's resident fish genetic analysis of fish stocks occurring within managed lakes of Pend Oreille County.

- On going bull trout recovery efforts within the Northeast Washington Recovery Unit.
- Settlement for FERC license amendment for Box Canyon Dam - tributary fish population and habitat assessments. Joint project between WDFW, Pend Oreille County PUD, and the KT.
- Timber Fish and Wildlife-funded Riparian Management Zone research to determine fish and wildlife responses to Washington State forest practice standards and modified standards.
- Pacific Salmon and Wildlife: Ecological Contexts, Relationships, and Implications for Management 2000.
- East Leclerc Creek road relocation project. Designed to reduce sedimentation loads and address fish passage issues in Leclerc Creek. Project cooperators include USFS, WDFW, Stimson Timber Company, KT, and Federal Highways Department.

Information is available at the WDFW Spokane Regional Office (509) 456-4082, Fish Management Program, 8702 N. Division Spokane, WA 99218, and at the Kalispel Natural Resources Department (509) 445-1147, Kalispel Tribe of Indians, P.O. Box 39, Usk, WA 99180.

U.S. Forest Service - Colville National Forest

The Colville National Forest will continue to monitor range condition, utilization and range improvements on grazing allotments, road conditions and follow-up maintenance on system roads within the subbasin.

Wildlife

BPA Funded Projects

Albeni Falls Wildlife Mitigation Project

The Albeni Falls Wildlife Mitigation Project is a cooperative multi-agency wildlife mitigation project developed and coordinated through the Albeni Falls Interagency Workgroup. Implementation efforts provide in-kind mitigation for habitat types impacted by the construction and inundation of Albeni Falls Dam. Target habitats identified for protection, restoration, and enhancement efforts include riparian corridors, wetlands, floodplains, and scrub-shrub habitats. Specific activities associated with this project include:

- Acquisition and enhancement of 1,500 ha (Pend Oreille Wetlands Project).
- Acquisition and assessment of 3,125 ha (Albeni Falls Wildlife Mitigation Project).
- Neo-tropical migratory bird monitoring on the Pend Oreille Wetlands Project.
- Waterfowl monitoring on the Pend Oreille Wetlands Project.
- 5-year habitat monitoring assessments using HEP on the Pend Oreille Wetlands Project.
- Restoration and enhancement success monitoring on the Pend Oreille Wetlands Project.

Pend Oreille Wetlands Wildlife Mitigation Project

The Pend Oreille Wetlands Wildlife Mitigation Project was proposed as partial mitigation for wildlife losses associated with the construction of Albeni Falls Dam. A total of approximately 243 ha of floodplain property was purchased by BPA (177 ha in 1992 and 66 ha in 1997) and is being managed by the KT to benefit wildlife habitats and associated species. Seven habitat types exist on the project including forested wetland, scrub-shrub wetland, emergent wetland, wet meadow or floodplain grassland, open water, upland forest, and riparian deciduous forest. The

HEP is used to monitor and evaluate habitat and is an accounting tool used to credit for wildlife mitigation. Restoration and enhancement activities include riparian reforestation, bio-engineered bank stabilization, hardwood stand enhancement, water control structures/water level management, prescribed burning, native vegetation enhancement, coniferous stand improvements, pasture management, nesting island construction, and general operations and maintenance activities that include monitoring and evaluation. In addition to the target species, species/guilds and populations that benefit from the project include, reptilian and amphibian guilds, native and non-native resident fish populations, black bear, neotropical migratory birds, and small mammal populations. Specific activities associated with this project include:

- Cottonwood restoration techniques - vegetation plots funded as part of the Pend Oreille Wetlands Project.
- Acquisition and enhancement of 1,500 ha (Pend Oreille Wetlands Project).
- Acquisition and enhancement of 3,125 ha (Albeni Falls Wildlife Mitigation Project).
- Neo-tropical migratory bird monitoring on the Pend Oreille Wetlands Project.
- Waterfowl monitoring on the Pend Oreille Wetlands Project.
- 5-year habitat monitoring assessments using HEP on the Pend Oreille Wetlands Project.
- Restoration and enhancement success monitoring on the Pend Oreille Wetlands Project.

Non-BPA Funded Projects

- Reed Canary Grass management project (cooperative project with WSU and the KT). Caribou relocation project in cooperation with WDFW, IDFG, USFS, and British Columbia.
- Cougar predation study to determine impacts on caribou.
- Leclerc Creek Wildlife Area. Comprised of four disjunct parcels owned by WDFW (1,532 total ha). These areas are managed primarily for big game, waterfowl, and raptors.
- Caribou relocation project in cooperation with WDFW, IDFG, USFS, and British Columbia.
- Cougar predation study (to determine impacts on caribou).
- Leclerc Creek Wildlife Area. Comprised of four disjunct parcels owned by WDFW (1,532 total ha). These areas are managed primarily for big game, waterfowl, and raptors.
- Caribou relocation project in cooperation with WDFW, IDFG, USFS, and British Columbia.
- Cougar predation study to determine impacts on caribou.
- Implementation of wildlife habitat compensation for Box Canyon Dam. $2.5 million to acquire and enhance/restore 403 Average Annual Habitat Units (AAHUs).
- Lynx surveys
- Monitoring elk re-located from Hanford, Washington.
- Grizzly bear surveys
- Bald Eagle surveys
- Osprey surveys
- Great blue heron surveys
- Big horn sheep capture and disease control monitoring
- Mountain goat surveys
- Goshawk surveys/inventories
- Deer/elk harvest surveys

- Trapper harvest surveys
- Fisher distribution research
- Winter furbearer surveys (fisher, lynx, and wolverine)
- Waterfowl surveys (includes ducks, geese, and swans)

Information available at the WDFW Spokane regional office (509) 456-2823, Wildlife Management Program, 8702 N. Division Spokane, WA 99218; or WDFW Data Retrieval System located in Olympia, Washington, and the KNRD office (509) 445-1147, Kalispel Tribe of Indians, P.O. Box 39, Usk, WA 99180.

Statement of Fish and Wildlife Needs

Fisheries

- Restore, protect, and maintain spawning and rearing habitat in tributary streams to improve survival of bull trout and westslope cutthroat trout.

- Conserve genetic diversity and provide opportunity for genetic exchange among local populations.

- Review operations of Albeni Falls Dam, Box Canyon Dam, and Boundary Dam. Provide recommendations through FERC relicensing process and/or federal consultation that minimize effects on fish, including fish passage, minimum flows, entrainment, stabilized flow regimes, and TDG.

- Complete westslope cutthroat trout and bull trout population inventories and habitat surveys in remaining unsurveyed tributaries to the Pend Oreille River. Identify limiting factors and threats to existence for native fish.

- Purchase critical watershed areas for protection and restoration of native fish species and their habitat.

- Improve conditions for spawning and rearing cutthroat and bull trout in the Lower Pend Oreille subbasin by reducing competition with brook trout.

- Increase the harvestable biomass of largemouth bass in Box Canyon Reservoir.

- Determine stock status of game and non-game species within the Pend Oreille River, tributaries, and surrounding lakes.

- Continue to monitor and expand resident fish relative abundance and species distribution surveys on the Pend Oreille River and its tributaries. Coordinate appropriate management practices for the protection and enhancement of sensitive native stocks, with emphasis on bull trout and westslope cutthroat trout.

- Continue to collect genetic information on resident native stocks of westslope cutthroat trout, bull trout, possible red band rainbow trout stocks, and potentially unique kokanee

salmon stocks to develop better management guidelines to conserve and enhance sensitive stocks.

- Evaluate the predator/prey balance of lake trout and kokanee salmon in Bead Lake to evaluate recently enhanced public access on federal land and resulting increased recreational fishing pressure and harvest of lake trout.

- Evaluate the Pend Oreille River bass tournament fishing pressure on largemouth bass; potential nest predation impacts upon incubating eggs; and subsequent egg to fry survival rates on natural bass recruitment.

In the near term, the Colville National Forest plans to improve degraded fish and wildlife habitat within forest lands in the subbasin. Depending upon available funding, the recommendations from the various watershed analyses for fish and wildlife enhancement should be implemented in the next 5 to 10 years. This may include prescribed burning for deer winter range; fencing of riparian areas; armoring of livestock crossings; removal of non-native fish species; changes in grazing systems; instream structure placement; riparian planting; culvert removal, realignment, or replacement; and road closure, relocation, resurfacing, or repair.

Wildlife

- Continue monitoring radio-collared caribou, grizzly bears, and cougars.

- Continue annual censusing of the Selkirk caribou population.

- Determine the genetic background of the mountain and northern ecotypes of woodland caribou in British Columbia, in order to determine the best source herd for future transplants.

- Initiate a radio telemetry study of black bear predation on caribou.

- Conduct research to identify and monitor all sources of caribou mortality within the subbasin.

- Develop a fire management program/plan for the Selkirk Mountains designed to diminish the probability of a stand replacement fire in the ecosystem (caribou).

- Fund additional caribou trapping and transplanting efforts with British Columbia.

- Initiate a mule deer radio telemetry study to identify and map winter mule deer range

- Develop and implement road management plans (gates, closures) to protect vulnerable mule deer populations. Coordinate with federal, state, tribal and private timberland interests.

- Conduct research on the relationship between predators, hunting, and inter-specific competition from sympatric species and declining mule deer populations.

- Provide funding to WDFW to conduct an intensive Pend Oreille County osprey nesting status survey to update maps and document nest activity.

- Conduct research to determine if and how cormorants impact ospreys within the Lower Pend Oreille subbasin.

- Develop a monitoring/implementation plan and identify funds to replace dilapidated Pend Oreille River pilings used as nest structures by osprey.

- Fund a seasonal information/education position to educate hunters and the public regarding grizzly bears in the Selkirk Mountain Range (could be a cooperative position between WDFW, IDFG, USFWS, and USFS).

- Fund a cooperative (WDFW, BC, IDFG) grizzly bear capture and radio telemetry study on 10 to 20 bears.

- Secure management rights to control water levels at Calispell Lake through easements, acquisitions, and agreements.

- Determine impacts to farming/ranching operations on lands adjacent to Calispell Lake if lake levels were managed for optimal wildlife values.

- Identify recent historical and present farming practices and limitations relative to marsh management at Calispell Lake.

- Develop and implement a long-term wildlife conservation plan for Calispell Lake in cooperation with landowners, the duck club, the irrigation district, and any other affected or interested entities.

- Conduct intensive surveys or studies to document the extensive use of the Calispell Lake marsh by waterfowl, shorebirds, and other wildlife species.

- Fulfill Albeni Falls wildlife mitigation projects using the *Albeni Falls Interagency Work Group Operational Guidelines and Guiding Principles for Mitigation Implementation* (1998).

- Implement an aggressive habitat based approach to maintaining and enhancing species and habitats of concern.

- Restore additional cottonwood galleries to the Pend Oreille River floodplain.

- Implement all aspects of the USFS Forest Plans.

- Implement and monitor effectiveness of Washington DNR Forest Practice Rules.

- Continue Tribal Interdisciplinary approach to habitat and population projects within the subbasin.

- Increase continuity and connectivity of protected lands within the subbasin.

- Continue reed canary grass management research and monitoring.
- Restore hydrology to protected areas of the floodplain.

- Increase wetland diversity and density within the Cusick Valley floodplain.

- Develop vegetative protocols for bank erosion stabilization.

- Develop landowner handbook for bio-engineered bank stabilization.

- Implement bio-engineered shoreline stabilization techniques on the banks of the Pend Oreille River.

References

Almack, J. 1998, 2000. Mountain caribou recovery in the southern Selkirk Mountains of Washington, Idaho, and British Columbia. Progress Reports from September 1995 - March 2000. Washington Dept. of Fish and Wildlife, Olympia.

Ashe, B.L., K.L. Lillengreen, J.J. Vella, L.O. Clark, S. Graves, M.R, Barber, G.J. Nenema, Jr., and A.T. Scholz. 1991. Assessment of the fishery improvement opportunities on the Pend Oreille River. Upper Columbia United Tribes Fisheries Center, Dept. of Biology, Eastern Washington Univ., Cheney. Prepared for U.S. Dept. of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 88-66, Agreement DE-A179-88BP39339.

Ashe, B.L. and A.T. Scholz. 1992. Assessment of the Fishery Improvement Opportunities in the Pend Oreille River. Final Report. Upper Columbia United Tribes Fisheries Center, Dept. of Biology, Eastern Washington Univ., Cheney. Prepared for U.S. Dept. of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 88-66, Agreement DE-179-88BP39339.

Audet, S., and H. Allen. 1996. Selkirk Mountains woodland caribou herd augmentation in Washington. U.S. Fish and Wildlife Service, Spokane, Washington. 27 pp.

Behnke, R.J. 1979. The native trouts of the genus *Salmo* of western North America. Report to U.S. Fish and Wildlife Service, Denver, Colorado.

Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society, Monograph 6, Bethesda, Maryland.

Bennett, D.H. and C.M. Falter. 1985. Environmental impact statement for Ponderay Newsprint Company. Ponderay Newsprint Company, Usk, WA.

Bennett, D.H. and C.M. Falter. 1992. Letter to Dr. Allan Scholz, Eastern Washington University, Cheney. May 29, 1992.

Bennett, D.H. and M. Liter. 1991. Water quality, fish and wildlife characteristics of Box Canyon Reservoir, Washington. Fish Completion Report 1989-1990, Section 3: Department of Fish and Wildlife Resources College of Forestry, Wildlife and Range Sciences University of Idaho,Prepared for the Public Utility District No. 1 of Pend Oreille County, Washington July 1991. 94 pp.

Bennett, D.H. and J.W. Garrett. 1994. Abundance and habitat use of Box Canyon Reservoir, Pend Oreille River, Washington and tributaries by trout with emphasis on brown trout. Completion report 1992-1993. Dept. of Fish and Wildlife res., College of Forestry, Wildlife and Range Sci., University of Idaho, Moscow. Prepared for the Public Utility District No. 1 of Pend Oreille County, Washington. Sept. 1994.

Brouha, P. and C.E. von Geldern. 1979. Habitat manipulation for centrarchid production in western reservoirs. North Central Division American Fisheries Society Special Publication 6.

Coots, R. and R. Willms. 1991. Pend Oreille River primary productivity and water quality of selected tributaries. Washington Dept. of Ecology. Olympia, WA.

Dana, L. 1999. Selkirk Mountains Grizzly Bear Protection, Annual Report for 1999. WDFW

Environmental Protection Agency (EPA). 1993. Clark Fork-Pend Oreille basin water quality study: a summary of findings and a management plan. EPA 910/R-93-006. Region 10. Seattle, WA.

Entz, R.D. 2000. Personal communication on wetland status in Pend Oreille County. Kalispel Natural Resource Department.

Falter, C.M., C. Baines and J.W. Carlson. 1991. Water quality, fish and wildlife characteristics for Box Canyon Reservoir. Department of Fish and Wildlife Resources, University of Idaho Section 2 of Completion Report 1989-1990.

Franklin and Dyrness. 1973.

Franklin and Forman. 1987.

Geiger, D.D., A.T. Scholz, C.S. Doughtie and D.L. Richards. 1993. Annotated Bibiography of information about surface and ground water quality and quantity on the Kalispel Indian Reservation, including Reservation boundary waters on the Box Canyon Reservoir on the Pend Oreille River. Upper United Columbia Tribes, Eastern Washington University. Cheney, WA. UCUT Tech. Report No. 41 240pp.

Gilbert, C.H. and B.W. Evermann. 1895. A report on investigations in the Columbia River Basin with descriptions of four new species of fish. Bulletin U.S. Fish Commission 14:169-207.

Hamlin, K. L., Riley, S. J., Pyrah, D., Dood, A. R., and. Mackie, R. J. 1984. Relationships among mule deer fawn mortality, coyotes, and alternate prey species during summer. J. Wildl. Manage 48: 489-499.

Harris. 1984.

Interagency Grizzly Bear Committee. 1995. Strategies for reducing female Grizzly Bear mortalities in the Selkirk and Cabinet-Yaak Recovery Zones. Unpublished admin. rept. Libby, Montana. 4 p.

Knick, S.T. and W. Kasworm. 1989. Shooting mortality in small populations of Grizzly Bears. Wildl. Soc. Bull. 17: 11-15.

Knutson, K. L., and V. L. Naef. 1997. Management recommendations for Washington's priority habitats: riparian. Wash. Dept. Fish and Wildl., Olympia. 181pp.

Layser. 1980.

Leary, R. F., W. R. Gould, and G. K. Sage. 1996. Success of basibranchial teeth in indicating pure populations of rainbow trout and failure to indicate pure populations of westslope cutthroat trout. North American Journal of Fisheries Management 16:210-213.

Lehmkuhl, J.F. and L.F. Ruggiero. 1991. Forest fragmentation in the Pacific Northwest and its potential effects on wildlife. Pages 35-46 *in* L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M.H. Huff, tech. coords. Wildlife and vegetation of unmanaged Douglas fir forests. USDA For. Serv. Gen. Tech. Rep. PNW-GTR 285. 533 p.

Leschine,T. M., K. F. Wellman, and Green, T. H. 1997. The Economic Value of Wetlands: Wetlands' Role in Flood Protection in Western Washington. Washington Department of Ecology. Publication No. 97-100. 68 pp.

Liknes, G.A. and P.J. Graham. 1988. Westslope cutthroat trout in Montana: life history, status, and management. American Fisheries Society Symposium 4:53-60.

Markle, D. F. 1992. Evidence of bull trout x brook trout hybrids in Oregon. Proceedings of the Gearhart Mountain Bull Trout Workshop, Oregon Chapter of the American Fisheries Society.

McLellan, B.N., F.W. Hovey, R.D. Mace, J.G. Woods, D.W. Carney, M.L. Gibeau, W.L. Wakkinen, and W.F. Kasworm. 1999. Rates and causes of Grizzly Bear mortality in the interiormountains of British Columbia, Alberta, Montana, Washington, and Idaho. J. Wildl. Manage. 63 (3): 911-920.

McLellan, J. G. 2000. 1999 WDFW annual report for the project Resident Fish Stock Status Above Chief Joseph and Grand Coulee dams. *In press*. Report to U.S. Department of Energy, Bonneville Power Administration,Division of Fish and Wildlife, Contract No. 97-BI-35900.

Merigliano, M.F. 1996. Ecology and management of the South Fork Snake River cottonwood forest. Idaho BLM. Tech. Bull. 96-9. 79 pp.

Mountains Grizzly Bears. J. Wildl. Manage. 58(2): 266-272.

O'Connell, M. A., J. G. Hallett, S. D. West, K. A. Kelsey, D. A. Manuwal, and S. F. Pearson. 2000. Effectiveness of Riparian Management Zones in Providing Habitat for Wildlife. Timber Fish and Wildlife Program. TFW-LWAGl-00-001. 461pp.

Paquet, M. 1997. Toward a mountain caribou management strategy for British Columbia; background report. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria. 72 pp.

Pelletier, G. and R. Coots. 1990. Progress report No. 1 Pend Oreille River water quality study. Washington Dept. of Ecology. Olympia, WA.

Reinitz, G.L. 1977. Electrophoretic distinction of rainbow trout (*Salmo gairdneri*), west-slope cutthroat trout (*S. clarki*), and their hybrids. Journal of the Fisheries Research Board of Canada 34:1236-1239.

Rood, S. B. and S. Heinze-Milne. 1989. Abrupt downstream forest decline following river damming in Southern Alberta. Canadian Journal of Botany 67:1744-1749.

Ruediger, B. J. Claar, S. Mighton. B. Naney, T. Rinaldi, F. Wahl, N. Warren, D. Wenger, A. Williamson, L. Lewis, B. Holt, G. Patton, J. Trick, A. Vandehey, S. Gniadek. 2000. Canada Lynx Conversation Assessment and Strategy. U.S. Forest Service, USDI Bureau of land Management, National Park Service, and Fish and wildlife Service. 120 pp.

Siers, Randall, B. 1972. Pend Oreille River Piling Study. (Unpublished WA Dept of Game Rept.)

Stevens M. L. and R. Vanbianchi. 1993. Restoring Wetlands In Washington: a guidebook for wetland restoration, planning and implementation. Washington Department of Ecology. Publication #93-17. 62 pp.

Stinson, D.W. 2000. Draft Washington state recovery plan for the lynx. WDFW, Olympia, Washington. 86 pp. + 5 maps.

Suchomel. 1994.

Temple and Gary. 1988.

Unsworth, J.W., Pac, D.F., White, G.C., and Bartmann, R.M. 1999.

U.S. Fish and Wildlife Service. 1986. Recover bald eagle population and secure nesting and foraging habitat.

_____. 1986. Recovery plan for the Pacific bald eagle. Portland, OR, WDFW, Wildlife Resource Data System, Olympia
_____. 1993. Grizzly Bear recovery plan. Missoula, Montana. 181 p.

_____. 1994. Recovery plan for the woodland caribou in the Selkirk Mountains. Portland, Oregon. 71 pp.

U.S. Forest Service. 1995.

_____. 1999.

Wakkinen, Wayne. 1997 and 1998. Idaho Dept. of Fish & Game. Personal communication.

Washington Dept. of Ecology. 1994. Watershed assessment water rights and claims database, July 1, 1994. Washington Dept. of Ecology.

_____. 1995a. Primary water rights report for WRIA 56, 60, and 62 as found in the water right information system (WRIS), October 1, 1994.

_____. 1995b. Draft. Initial watershed assessment water resources inventory area 62 Pend Oreille River Watershed. Open-file Tech. Report 95-17.

_____. 1998. Section 303 (d) listing. June 16, 1998.

Washington Natural Heritage Program. 1996.

Whittaker, D.G. and Lindzey, F.G. 1999. Effect of coyote predation on early fawn survival in sympatric deer species. Wildlife Society Bulletin 27: 256-262.

Wielgus, R.B., F.L. Bunnell, W. Wakkinen, and P. Zager. 1994. Population dynamics of Selkirk _____.

Wilcove. 1985.

Williams, K. 1998. Westslope cutthroat trout status in Washington. WDFW unpublished report.

Zack. 1995.

Area 3: Priest River

Subbasin Description

General Location

The 2,538 km^2 Priest River subbasin is located primarily within the northwest corner of the Idaho Panhandle within Bonner and Boundary counties (Figure 23). The subbasin includes Upper Priest Lake, the Thorofare, Priest Lake, and the Priest River below the outlet dam at Priest Lake. The headwaters of Upper Priest River originate in the Selkirk mountain range in British Columbia, Canada. Headwaters of major tributaries on the western side of the subbasin are located in northeast Washington. The subbasin is bordered on the west by the mountain crest separating the Panhandle and Colville National Forests.

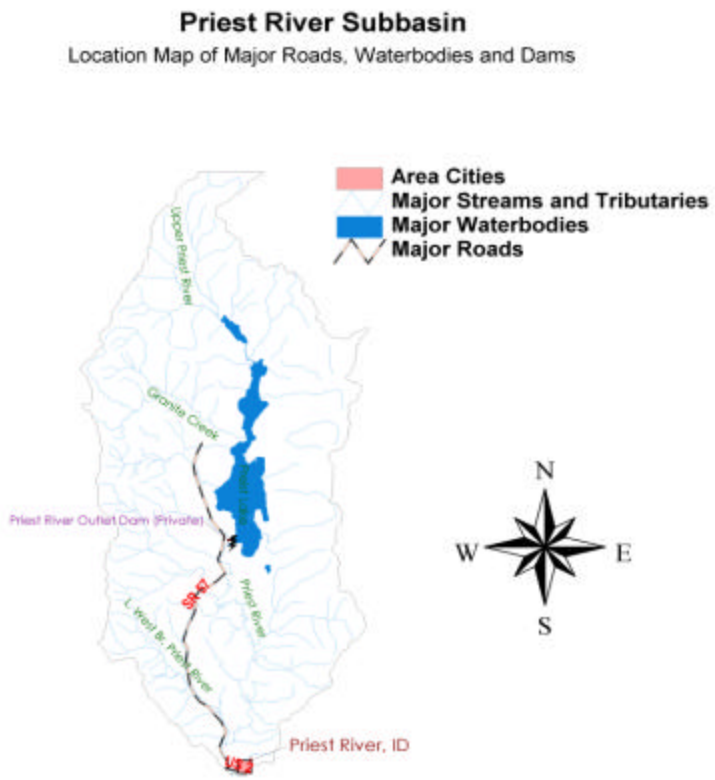


Figure 23. Location of Priest River subbasin, Idaho, Washington and British Columbia, Canada

Drainage Area

Upper Priest Lake has three major tributaries: Upper Priest River, the Hughes Fork, and Trapper Creek. Caribou Creek is the only tributary entering the Thorofare. The Thorofare contributes about 40% of the annual inflow to Priest Lake. Major streams draining the Selkirk range on the east side of Priest Lake are Lion Creek, Two Mouth Creek, Indian Creek, Hunt Creek, and Soldier Creek. Seven minor flow streams are interspersed between the major east side tributaries. The west side of the Priest Lake drainage extends from Beaver Creek, discharging just south of the Thorofare, to the southern end of the lake. The west side of Priest Lake has one major stream, Granite Creek, and one moderate flow stream, Kalispell Creek. The remaining tributaries are of low volume. The lower Priest River flows from the outlet dam on the southwest corner of Priest Lake 72.4 km to its confluence with the Pend Oreille River near the town of Priest River. Major tributaries include the Upper West Branch, Lower West Branch, and East River.

Topography/geomorphology

Savage (1965, 1967) and Miller (1982) conducted geological investigations and mapping of the Priest River subbasin. Summaries, maps, and updates of this work are provided by Bonner County (1989), Buck (1983), McHale (1995), Idaho Water Resource Board (1995), and Rothrock and Mosier (1997). Geology of the Priest River subbasin is shown in (Rothrock 2000). The entire Priest River subbasin lies within the Northern Rocky Mountain Geomorphic Province (USFS 1997). Faulting is the major structural factor affecting the geology and drainage patterns. During the Pleistocene Era, a series of glaciers scoured the area after which time the glaciers receded and the river downcut in places through the glacial debris. Continental glaciation left extensive fluvial, lacustrine, and morainal deposits overlying bedrock in the Priest River subbasin. The deposits include mixes of gravels, sands, silts, and clays. Elevation within the subbasin ranges from 742 m, where Priest River enters the Pend Oreille River, to more than 2,134 m within the Selkirk Mountains.

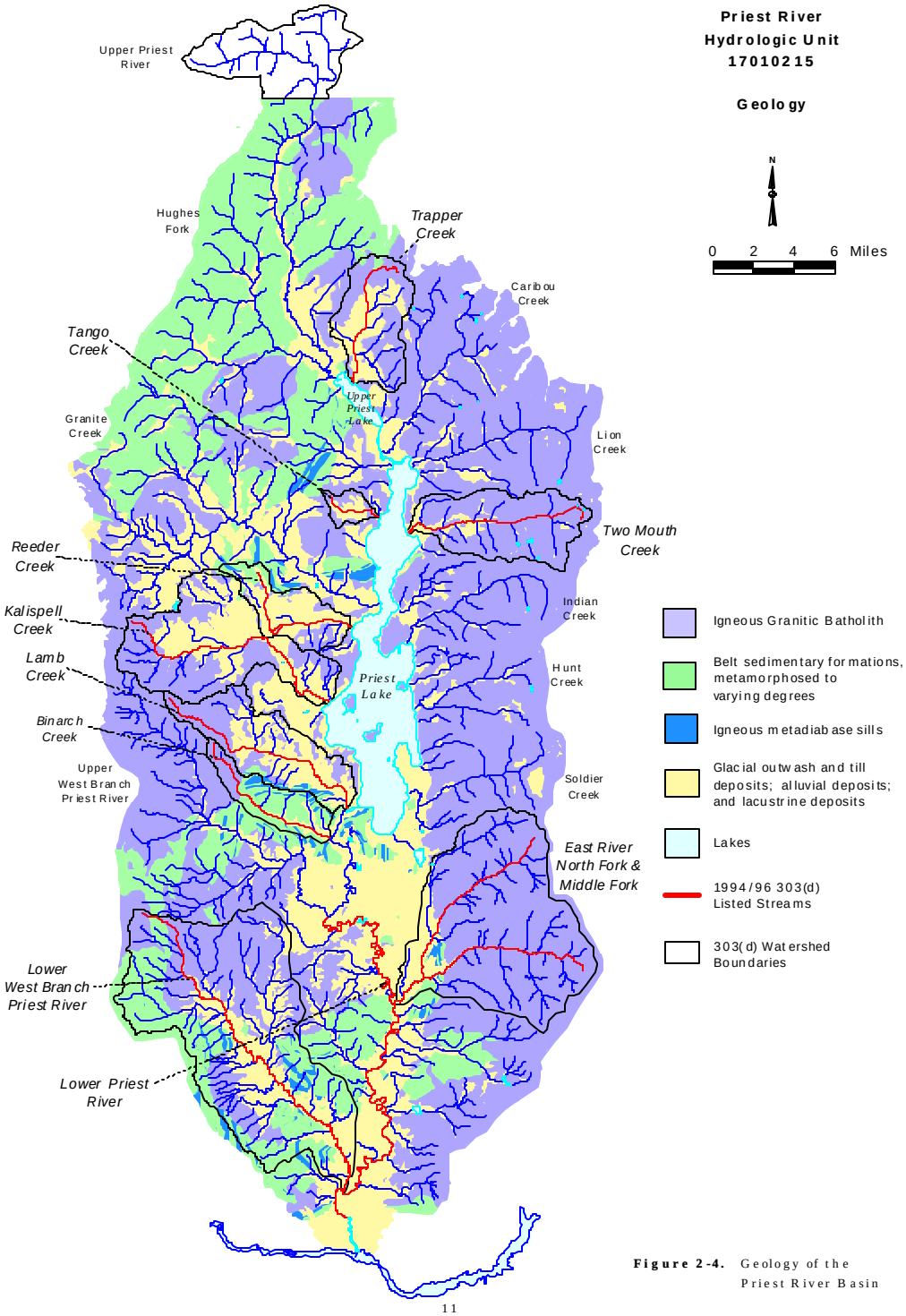


Figure 24. Geology of the Priest River subbasin, Idaho and Washington

Climate

The climate is transitional between a northern Pacific coastal type and a continental type (Finklin 1983). July and August are the only distinct summer months and temperatures are relatively mild due to influence from Pacific maritime conditions. The average daily summer maximums are around 28 °C. Winter temperatures also are relatively mild compared to areas east of the Rocky Mountains. The annual precipitation averages 81 cm. At elevations above 1,463 m, snowfall accounts for more than 50% of total precipitation (Finklin 1983). The wettest months normally are November, December, and January. The elevation zone between 610 m, and 1,067 m is subject to rapid snowmelt from winter storms. The lower half of the western side of the subbasin is particularly vulnerable to high discharge rain-on-snow events.

Major Land Uses

The majority of land within the Priest River subbasin is publicly owned and managed by the USFS or IDL (Figure 25). The British Columbia Ministry of Forests manages the headwaters of the Upper Priest River. Private property comprises approximately 10% of the total land area on the west side of the subbasin. There are some blocks of commercial timberlands owned by Burlington Northern Inc./Plum Creek Timber and a few large, private agricultural holdings in the Nordman and Lamb Creek areas (Fredenberg 2000).

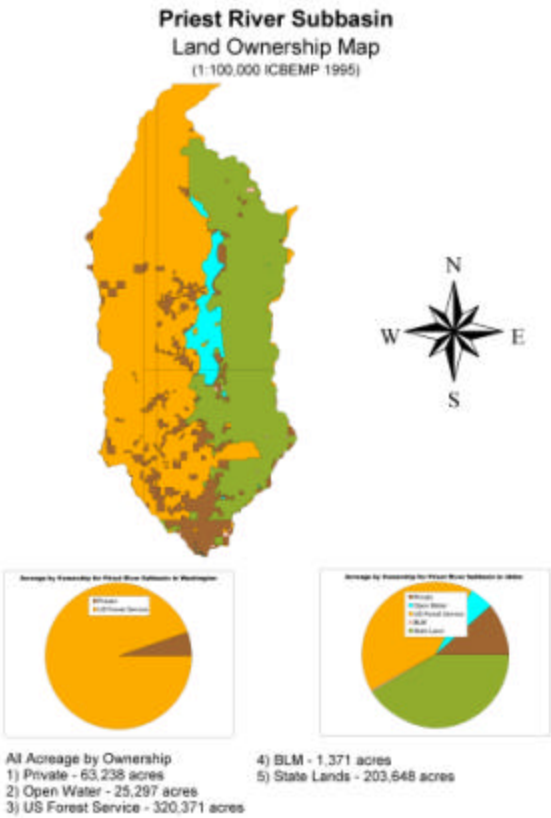


Figure 25. Land ownership characterization for the Priest River subbasin

The majority of west side of the subbasin is in the IPNF, Priest Lake Ranger District. The USFS also manages the three large islands on Priest Lake, Kalispell, Bartoo, and Eightmile (Fredenberg 2000).

More than 90% of the east side of subbasin is owned by the State of Idaho. Most of this land is administered by IDL under the State Endowment Trust. A substantial amount of private and commercial timberlands have been transferred to the state through various property exchange agreements, although some blocks of private forest land still exist (Fredenberg 2000). The IDPR manages Priest Lake State Park.

Approximately 26% of the Priest Lake shoreline is privately owned (Bonner County 1989); this area is where the most concentrated residential and business development has occurred (Figure 26). Within the Federal and state owned lands, there has been considerable waterfront development through lease lot programs (Fredenberg 2000).

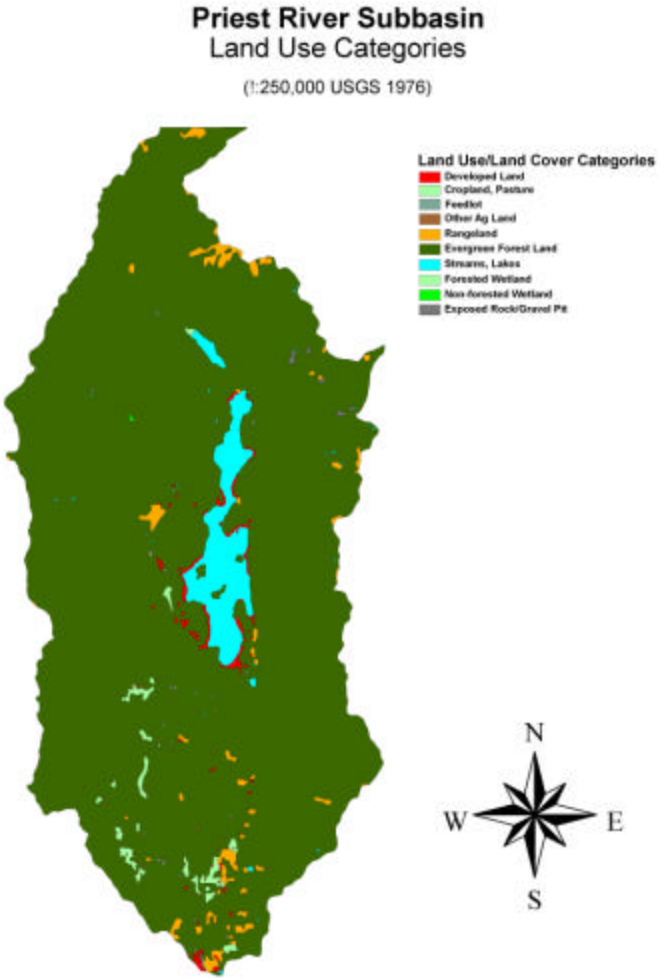


Figure 26. Land use categories for the Priest River subbasin

Hydrology

Upper Priest Lake has a surface area of 541 ha, a maximum depth of 31.4 m, a mean depth of 18.3 m, and a volume of 0.1 km^3 (Fredenberg 2000). The lake has a short hydraulic residence time, about three months on average. Lake level is controlled by the outlet dam on Priest Lake, since Upper Priest Lake, the Thorofare, and Priest Lake are all at the same elevation. Priest Lake has a surface area of 9,430 ha, a maximum depth of 112 m, a mean depth of 39 m, and a volume of 3.7 km^3. Average hydraulic residence time is about three years.

Water Quality

The State of Idaho has listed portions of the Priest River and the following tributaries as Water Quality Limited Segments: Binarch Creek, Kalispell Creek, Lamb Creek, Lower West Branch of the Priest River, and Tango Creek. The beneficial uses of Priest River include: domestic water supplies, agricultural water supply, cold water biota, and recreation. In 1987, the IPNF recommended that the Federal Government designate the mainstem of the upper 30 km of Upper Priest River as a Wild and Scenic River; however, the final designation is unresolved (USFS 1997).

Studies by the State of Idaho and the University of Idaho suggest that the aquifer underlying the Kalispell Basin likely extends far beyond the subbasin boundaries (USFS 1997). Preliminary data suggests that as much as 61 m of unconsolidated material underlies the basin and that the aquifer is one of the major water sources for Priest Lake.

Vegetation

Vegetation within the subbasin varies in association with soil moisture conditions, slope aspect, elevation, precipitation, temperature, wildfire history, and land use patterns. The area is predominately coniferous forest. In the higher elevations of the Selkirk range, subalpine fir and Engelmann spruce are the dominant species. A large area on both the east and west sides of the subbasin is occupied by western red cedar and western hemlock in moist soils, and Douglas fir, grand fir, western larch, white pine, lodgepole pine, and ponderosa pine in semi-dry soils. There are some spectacular stands of western red cedar, for example, at the Roosevelt Grove of Ancient Cedars on Granite Creek. The make-up of coniferous species has changed through time because of timber harvesting and replanting, fire, and plant diseases (Fredenberg 2000).

Fish and Wildlife Resources

Fish and Wildlife Status

The Priest River subbasin supports a significant complement of fish and wildlife species that are economically, aesthetically, ecologically, and culturally significant.

Fisheries

Over 20 species of fish, including 12 native species, are found in the Priest River subbasin (Table 11). The Priest subbasin supports diverse lake, river, and stream fisheries. A combination of habitat degradation and introductions of exotic aquatic species have modified historic native fish populations significantly.

Table 11. Fish species in the Priest River subbasin, Idaho and Washington

Species	Origin	Location	Status
Bull trout (*Salvelinus confluentus*)	N	L,R,T	A/S-D
Westslope cutthroat trout (*Oncorhynchus clarki lewisi*)	N	L,R,T	C/S-D
Mountain whitefish (*Prosopium williamsoni*)	N	L,R,T	C/S-D
Pygmy whitefish (*Prosopium coulteri*)	N	L	U/U
Rainbow trout (*Oncorhynchus mykiss*)	E	L,R,T	A/S
Kokanee salmon (*Oncorhynchus nerka*)	E	L,R,T	C/D
Lake trout (*Salvelinus namaycush*)	E	L	C/I
Brook trout (*Salvelinus fontinalis*)	E	T	C/I
Brown trout (*Salmo trutta*)	E	L,R,T	C/S
Northern pikeminnow (*Ptychocheilus oregonensis*)	N	L,R	A/S
Longnose dace (*Rhinichthys cataractae*)	N	L,R,T	C/U
Redside shiner (*Richardsonius balteatus*)	N	L,R,T	C/U
Peamouth (*Mylocheilus caurinus*)	N	L,R	C/U
Tench (*Tinca tinca*)	E	L,R	C/I
Largescale sucker (*Catostomus catostomus*)	N	L,R,T	C/U
Longnose sucker (*Catostomus macrocheilus*)	N	L,R,T	C/U
Slimy sculpin (*Cottus cognatus*)	N	L,R,T	C/U
Torrent sculpin (*Cottus rhotheus*)	N	L,R,T	C/U
Yellow perch (*Perca flavescens*)	E	L,R	A/S
Black Crappie (*Pomoxis nigromaculatus*)	E	L,R	C/S
Brown bullhead (*Ameiurus nebulosis*)	E	L,R	C/S
Largemouth bass (*Micropterus salmoides*)	E	L,R	C/S-D
Smallmouth bass (*Micropterus dolomieui*)	E	L,R	C/S-D
Pumpkinseed (*Lepomis gibbosus*)	E	L	C/S

E=Exotic, N=Native, L=Lake, R=River, T=Tributary, A=Abundant, C=Common, O=Occasional, U=Unknown, S=Stable, I=Increasing, D=Declining

Bull Trout

Bull trout are considered severely depressed in the Priest River subbasin, with Upper Priest Lake supporting the last viable population. Recent research on bull trout indicates the adult population of adfluvial adult bull trout in Upper Priest Lake is only around 120 fish (Fredericks *et al.* 1999). Bull trout redd counts in the tributaries to the lake have ranged from 12 to 58 from 1992 to 1999 (Fredericks 2000). Sympatric populations of bull trout and brook trout were found in five of the 13 tributary streams surveyed, and some hybrids were found (Fredericks 1999). Brook trout are numerous in tributaries where bull trout are not present. Bull trout were once common in Priest Lake and supported a sport harvest of up to 2,300 fish as recently as 1978 (Mauser *et al.* 1988, Table 12).

Table 12. Estimated effort and harvest, by species, in Priest Lake, Idaho, 1956-1994

Census period	Year	Angler hours	Kokanee	Cutthroat	Bull trout	Lake trout	Total harvest	Overall success (fish/h)
April 30-October 15	1956	96,630	102,360	3,580	1,590	270	107,800	1.12
		(48,984)				(10,758)		
April 30-November 30	1966	64,604	68,884	2,387	1,173	199	72,643	1.12
		(49,386)				(10,758)		
May 18-September 6	1968	48,286	32,314	1,611	1,096	0	35,021	0.73
		(36,652)				(5,711)		
June 2-September 6	1969	46,819	37,880	1,256	650	0	39,786	0.85
		(27,000)				(9,347)		
May 16-October 2	1970	82,063	79,840	2,776	1,526	138	84,280	1.03
		(46,216)				(9,347)		
April 15-December 15	1978	99,157	4,593	2,585	2,320	5,724	15,222	0.15
		(56,599)				(12,884)		
April 16-December 15	1983	47,039	66	105	92	4,620	4,883	0.10
		(56,599)				(12,884)		
April 12-November 7	1986	71,516	0	134	0	6,295	6,429	0.09
		(56,343)				(12,659)		
May 9-July 17	1987	27,903	0	11	-	2,969	2,980	0.11
		(25,001)				(2,422)		
January 23-March1	1993	12,918	0	0	0	2,605	2,605	0.20
		(0)				(0)		
January 1-December 31	1994	62,602	0	0	00	13,987	13,987	0.22

Numbers in parentheses are the 1994 equivalents for the survey period of previous years creel censuses

Bull trout harvest in Priest Lake and all tributaries was closed in 1984. Granite Creek, the main tributary to Priest Lake, still supports a few bull trout, but hybrids have also been observed in that drainage. The East River drainage, tributary to the Priest River below the outlet dam at Priest Lake, supports a remnant population of resident bull trout in the Middle Fork of East River, Tarlac Creek, and Uleda Creek (Horner *et al.* 1987).

Cutthroat Trout

Historically, fishing for cutthroat trout was the primary attraction at Priest and Upper Priest Lake. By the time the first creel census was conducted in 1956, however, annual harvest of cutthroat trout in Priest Lake had already declined to 3,500 fish with catch rates of 0.5 fish per hour (Bjornn 1957). Cutthroat trout harvest ranged from 1,300 to 2,700 fish during the 1960's and 1970's, but dropped abruptly after 1978 (Table 12, Davis *et al.* 2000). Various restrictive regulations, including reduced limits, minimum size limits, and tributary fisheries closures were applied in both the lake and tributary streams to address harvest issues. Cutthroat trout harvest has been closed in Upper Priest Lake and Priest Lake since 1992. Upper Priest Lake has been managed with catch-and-release regulations since 1994. The tributary streams producing adfluvial cutthroat trout in Priest Lake were closed to fishing from 1982 through 1991. Streams were then reopened in 1992 under very restrictive regulations that allowed harvest of resident cutthroat and brook trout. Despite harvest restrictions, the cutthroat trout fishery did not respond.

Non-native Yellowstone cutthroat trout fry and fingerlings were stocked in Upper Priest Lake and Priest Lake during the 1950's and 1960's. Catchable rainbow trout were also stocked into Granite Creek to provide a stream fishery. There is no evidence this stocking provided any benefit to the lake fishery. Ongoing genetic analysis of cutthroat trout from Upper Priest Lake has not shown hybridization with either Yellowstone cutthroat or rainbow trout (N. Horner, IDFG, personal communication). Westslope cutthroat trout fingerlings were stocked in Priest Lake between 1981 and 1991, but the lack of any apparent benefit caused a shift in management to wild trout in 1992 (N. Horner, IDFG, personal communication). The primary cause for the loss in wild adfluvial cutthroat trout production from tributary streams is believed to be from the combined effects of brook trout invasion and the loss of spawning and rearing habitat due to habitat degradation. Predation by lake trout on cutthroat trout smolts entering the lake may have been the primary reason cutthroat trout did not respond to restrictive regulations or hatchery supplementation.

Brook Trout

Brook trout were introduced into the Priest River subbasin by the U.S. Fish Commission during the early 1900's and are now widely distributed throughout most tributaries. Their presence in Upper Priest Lake and Priest Lake is very low, however. Research during the 1980's indicated that brook trout were having a negative effect on adfluvial cutthroat trout production in Priest Lake tributary streams (Irving 1987, Strach and Bjornn 1991). Limited surveys by the USFS in west side tributaries indicate that brook trout may have increased in abundance and distribution. Comprehensive surveys are needed in all tributaries to Upper Priest Lake and Priest Lake to determine the distribution and abundance of brook trout to better define native fish restoration options.

Lake Trout

Lake trout were introduced into the Priest Lake system in 1925 (Bjornn 1957). Lake trout were largely forgotten until being “rediscovered” in 1952, when over 2,268 kg of lake trout were weighed in during a fishing derby sponsored by the Priest Lake Sportsmen Association. The lake trout population and fishery was characterized by relatively few, large fish until Mysis shrimp were established in 1970 (Figure 27).

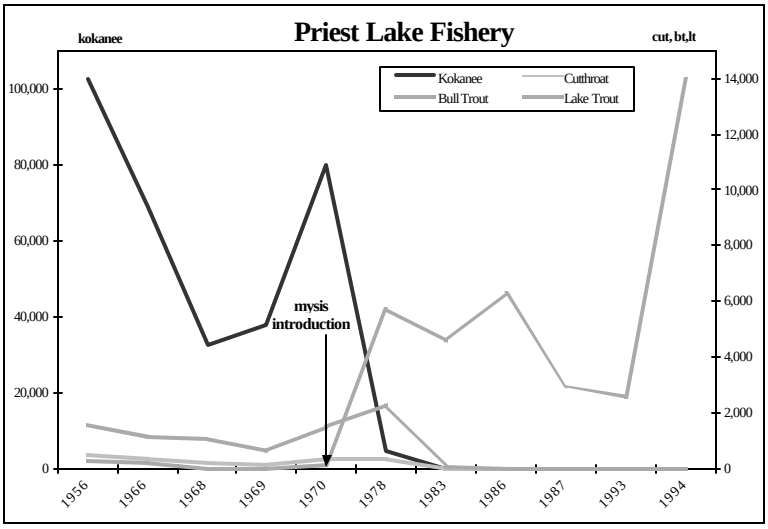


Figure 27. Estimated harvest of kokanee, cutthroat trout, bull trout, and lake trout in Priest Lake, Idaho from 1956 to1994

The presence of Mysis shrimp increased juvenile lake trout survival, increasing the population of lake trout, which then had adverse impacts on kokanee and cutthroat populations (Figure 27). Lake trout harvest increased to as much as 13,000 fish annually by 1994 (Davis *et al.* 2000) as interest shifted from the popular kokanee and cutthroat trout fisheries of the past to the only remaining harvest fishery. The average size of lake trout in the catch declined, primarily from the effects of increased exploitation (Figure 28). Young lake trout have now replaced kokanee as the primary forage fish for larger lake trout. The lake trout fishery is currently being managed as a yield fishery for fish in the 40 to 55 cm size range.

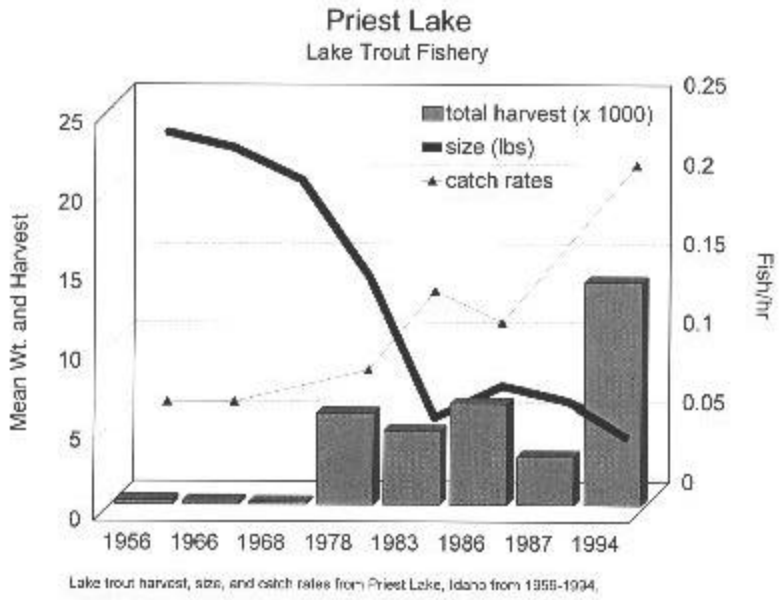


Figure 28. Lake trout size, harvest, and catch rates from Priest Lake, Idaho from 1956 to1994

Lake trout were absent from Upper Priest Lake during fishery surveys in 1956 (Bjornn 1957) and were still not present as late as 1979 (Rieman *et al.* 1979). Mauser (1986) reported lake trout were occasionally caught in Upper Priest Lake in 1985. Detailed angler diaries kept by two avid Upper Priest Lake anglers indicated lake trout were not uncommon in their catch by 1993, and their catch records show an increase in lake trout and decrease in bull trout the following years. Lake trout suppression efforts have been partially successful in Upper Priest Lake through a program of intensive gill netting. However, movement of fish from Priest Lake into Upper Priest Lake is nullifying any benefit (Fredericks *et al.* 2000). Studies are currently being conducted by the University of Idaho to determine lake trout movements between the lakes and define potential methods of excluding lake trout from Upper Priest Lake. Future management decisions for native cutthroat trout and bull trout enhancement will be dependant on the success of keeping lake trout out of Upper Priest Lake and/or the possibility of replacing the lake trout fishery with another sport fishery, such as kokanee, that has no impact on native fish restoration.

Kokanee

Kokanee were introduced into Priest Lake in the late 1940's from the same stock that colonized Lake Pend Oreille. They provided a very popular high yield fishery from the early 1950's until the early 1970's (Table 12, Figure 27). Kokanee were utilizing Mysis shrimp for forage during the early 1970's and obtaining sizes exceeding 2.5 kg. The increase in lake trout during the 1970's resulted in the rapid collapse of kokanee population in 1978 (Figure 27). There are still a few remnant kokanee persisting in both lakes, but they do not contribute to the fishery.

Wildlife

Based on the work of Groves *et al*. 1997; Mock 1980; Stebbins 1985; Nussbaum *et al*. 1983; and Hutto 1995, the Priest River subbasin includes 10 species of amphibians, 7 species of reptiles, 139 species of birds, and 58 species of mammals (Appendix 4). With the exceptions of caribou, grizzly bears, and hunted animals, funding to assess distribution, population trend and limiting factors for the vast majority of these species is absent.

Threatened and Endangered Species

Caribou (Federally listed as Endangered) inhabit the Selkirk Mountains, which forms the divide between the Priest, Kootenai, and Pend Oreille River drainages. Estimates for the Selkirk Range were as high as 100 animals as late as the 1950's (Flinn 1956, Evans 1960). By the 1970's, the estimated population for the Selkirks was just 20 to 25 animals (Freddy 1974). Despite transplants of 103 caribou between 1987 and 1999, the 2000 surveys indicated a population of only 34 caribou with a declining trend (Figure 29 Wakkinen 2000). The majority of caribou reside in the northern portion of the ecosystem.

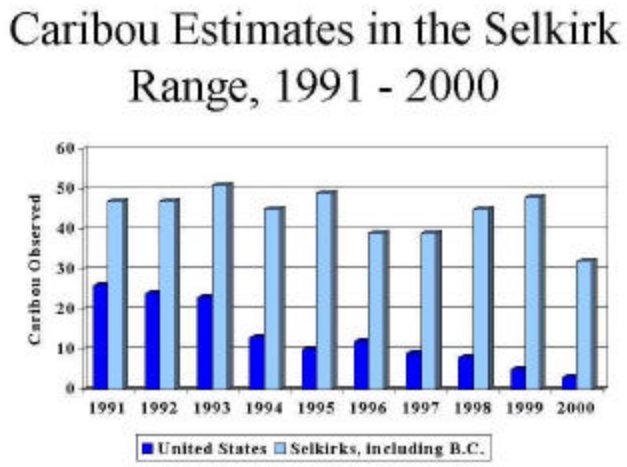


Figure 29. Caribou estimates in the Selkirk Range, Idaho, from 1991 to 2000

Gray wolves pass through the Priest River subbasin, but no resident packs are currently established. Wolves are fully protected as "Endangered" under the ESA.

Grizzly bears (Federally listed as Threatened) in the Priest River sub-basin are considered part of the grizzly population of the Selkirk/Cabinet-Yaak Ecosystem. Funds from Section 6 of the Endangered Species Act have been combined with state and private dollars to fund grizzly and caribou research and management in the ecosystem since 1983.

Based on the grizzly and caribou research, approximately 25 bears inhabit the Idaho portion of the sub-basin during some part of their lifetime. Recent data indicates this population is increasing at a little over one percent annually (Wakkinen and Johnson 2000). Despite the improving condition of this grizzly population, it is far from meeting de-listing criteria.

Bald eagles (Federally listed as Threatened) use the Priest River subbasin both for wintering and nesting each year. From 1991 to 2000, one to six bald eagles were observed annually on Priest Lake during incomplete, mid-winter surveys. During 2000, three active nests

were known in the subbasin, two on Priest Lake, and one on Upper Priest Lake (D. Spicer, IDFG, personal communication). Four additional nests are suspected in the subbasin based on incidental summer observations of adult eagles (T. Layser, USFS, personal communication).

Lynx (Threatened) are present in the Priest River subbasin and an analysis of snowshoe hare densities indicates this area has a higher forage base for lynx than measured elsewhere in Idaho (D. Murray, University of Idaho, personal communication).

Rare Species

For purposes of this document, rare species are those listed as State Species of Special Concern, Federal Proposed Threatened, BLM Sensitive Species, and USFS Indicator Species. Rare species present in the Priest River subbasin include: wolverine, fisher, otter, northern flying squirrels, northern bog lemmings, pygmy shrew, Townsend's big-eared bat, common loons, pygmy nuthatch, flammulated owls, boreal owls, black-backed owls, great gray owls, northern pygmy owls, three-toed woodpeckers, northern alligator lizard, ring-necked snake, rough-skinned newts, wood frog, and Coeur d'Alene salamanders.

Almost nothing is known as to distribution, population trend, and limiting factors for these species. This lack of knowledge precludes management to improve the health of these populations. Current management is limited to gleaning information from the few studies in other areas, then applying that information where thought to be appropriate.

Black Bear

The Priest River subbasin is considered some of the highest quality bear habitat in Idaho (Anonymous 1998). Beecham (1994) estimated 0.35 bears/km^2 for the period of 1979 to 1981. Harvest has increased in the subbasin over the past 15 years (Figure 30), but this population does not show signs of over-harvest relative to the objective of a light harvest regime (Wakkinen 2000). Consequently, it is assumed that the subbasin bear population has increased since the late 1990's.

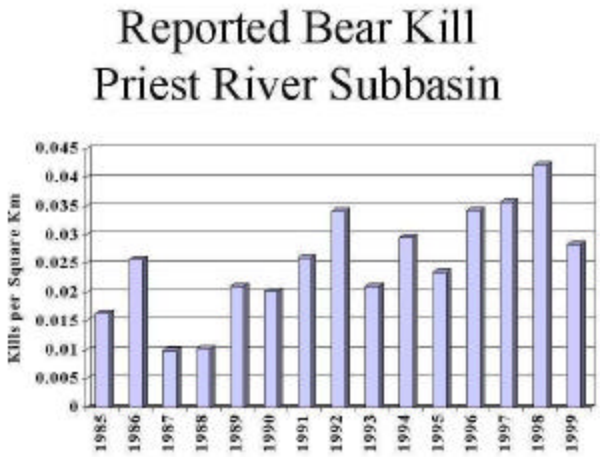


Figure 30. Reported bear kill in the Priest River subbasin, Idaho

Moose

Anecdotal reports of moose abundance in the Priest River subbasin have driven the issuance of permits for hunting moose in the past. The number of permits issued has risen steadily during the past years, suggesting an increasing trend in moose numbers (Figure 31). A 2000 survey by the IDFG indicated 0.42 moose/km^2 in the Priest River subbasin. This high density and the lack of twins observed mid-winter, suggests this population may be coming into equilibrium with that ecosystem.

Figure 31. Moose hunting permits issued in the Priest River subbasin, Idaho.

Mountain Goat

The Selkirk population has declined dramatically since an estimated 195 goats inhabited the Selkirks in 1955 (Brandborg 1955). This population was hunted from 1952 through 1970. Despite 11 years of closed seasons, only three goats were observed during a 1981 aerial survey. All three were within the Priest River subbasin. From 1981 to 1994, 31 mountain goats were trapped in other areas of the state and released in the Selkirks. During the most recent survey (1995), 33 mountain goats were observed in the Selkirk Range. All but three of these goats were observed in Lion and Bugle Creek drainages to the Priest River subbasin. The remaining three goats were observed in the Kootenai subbasin.

Mountain Lion

The harvest of mountain lions in the Priest River subbasin has risen steadily since the 1980's (Figure 32). Even after consideration of differences in seasons and numbers of hunters available, the pattern remains of a strongly increasing lion population through the mid 1990's.

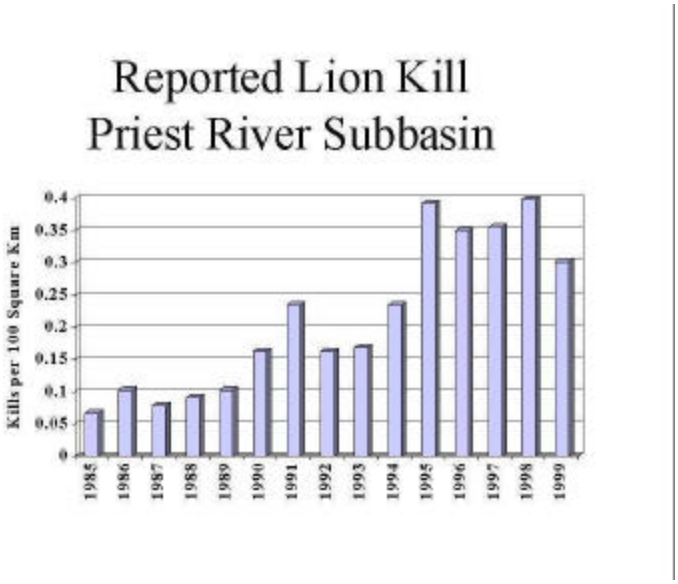


Figure 32. Reported lion kill in the Priest River subbasin, Idaho

Mule Deer

Mule deer population estimates have not been made in the Priest River drainage. Trend has been evaluated through public opinion and inferred from harvest data. Public opinion is strong that mule deer populations have declined substantially since the 1960's. Harvest data show an increase from 1974 through 1989, then a decline through 1999 (Figure 33). Approximately 15% of the Idaho annual harvest of deer in the Priest River Sub-basin is composed of mule deer. Long, either-sex hunting seasons are traditional in this area, with a 31 day either sex, any species deer season held November 1 through December 1. In response to public concern over lower mule deer numbers, the antlerless portion of the mule deer season was eliminated starting 2000.

Hunting is not believed to be a major influence on this population, based on mortality impacts observed on mule deer to the immediate north in British Columbia (J. Hayden, IDFG, personal communication). Predation, primarily by mountain lions, is the proximate source of most mortality observed in radio-collared adults. This is similar to the impacts observed from 1987 to 1995 for white-tailed deer in an IDFG study (Hayden and Spicer 1995).

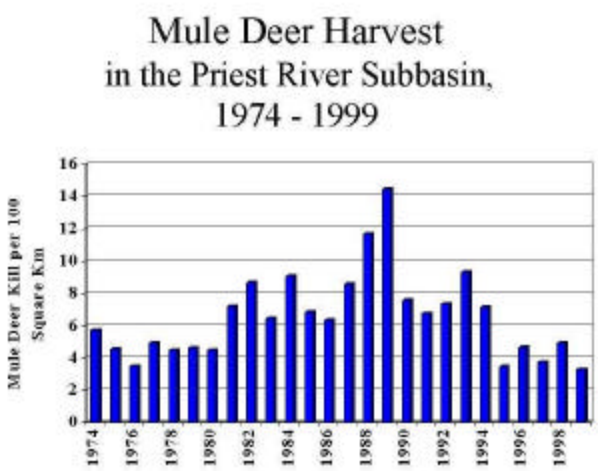


Figure 33. Mule deer harvest in the Priest River subbasin, Idaho, from 1974 to1999

White-tailed Deer

Habitat use, food habits, home range, and seasonal migrations of white-tailed deer were studied in the Priest River drainage between 1987 and 1993 (Pauley 1990, Secord 1993). Adult mortality was evaluated from 1987 to 1995 (Hayden and Spicer 1995). Based on adult mortality, there was a rough average of 5 to 6 white-tailed deer/km^2 during this period. No data are available to clearly assess population trends. Harvest estimates and check station success rates suggest only that populations increased during the late 1970's and 1980's, then decreased in the 1990's (Figure 34).

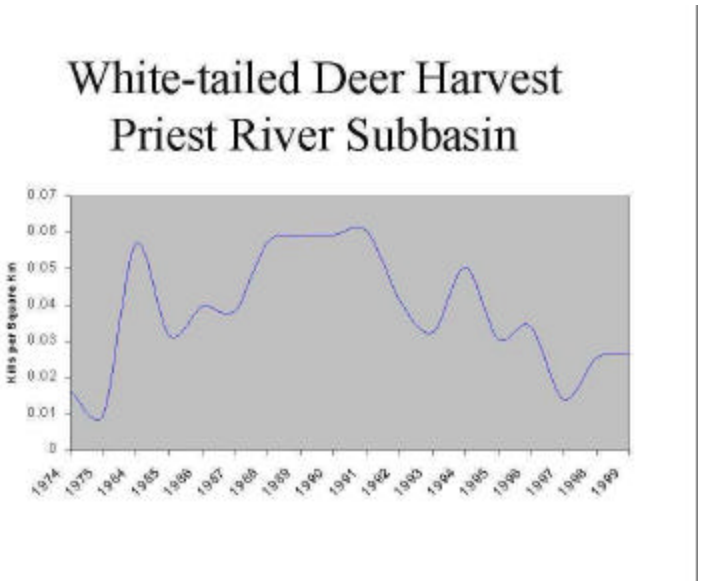


Figure 34. White-tailed deer harvest in the Priest River subbasin, Idaho

Other Wildlife

The status of the vast majority of the remaining 10 species of amphibians, 7 species of reptiles, 139 species of birds, and 48 species of mammals in the subbasin is unknown. Broad-scale distribution maps have been produced for avian and mammalian species based on select large-scale habitat characteristics (Groves *et al.* 1997). Isolated studies have been accomplished for a small percentage of these animals. The verification of presence, and assessment of relative abundance and trend has not been attempted.

Habitat Areas and Quality

Fisheries

Water quality in Upper Priest Lake and Priest Lake is currently of very high quality and both lakes are classified as oligotrophic (Milligan *et al.* 1983). Nutrient inputs come primarily in the form of sediment off land managed by the USFS and IDL. Approximately 90% of the Priest River subbasin is public land. Most of the shoreline is in public ownership and development has been clustered on private lands and along state and federal lease lots. Lakeshore cabins are generally on personal septic systems, but major communities have sewage treatment facilities. Productivity of both lakes is low and they are best suited for salmonids and native non-game fish, although some warmwater species are present in low abundance.

Land management activities and natural events in the Priest River subbasin have resulted in the loss and degradation of stream and riparian habitat. Excess sediment and channel instability has been linked to historic large fires; historic logging practices and initial construction of a transportation network to bring timber to market; current timber activities and the existing road network; agricultural practices such as wet meadow draining through cross ditches, channel straightening, and cattle access to streams; urbanization with clearing and excavation in riparian areas; and construction of substandard private roads. Confounding the analysis of sediment effect on the biotic community is the issue of legacy land use, fire, sediment input from current land use activities, and the effects from introduced brook trout in streams and

lake trout. Within the Priest River subbasin, there are ten streams listed under Section 303(d) of the Federal Clean Water Act as not meeting state water quality standards (Figure 35and Table 13), (Rothrock 2000).

Table 13. Streams not meeting state water quality standards

Stream Name	Water Body Identification Number	Pacific Northwest Rivers Systems in 1994 303(d)	Boundaries as Listed in 1998 303(d)	Revised Boundaries Listed	Pollutant/ Parameter*
Trapper	ID-17010215-017	1432	Headwaters to Upper Priest Lake		Sed, Halt
Two Mouth Creek	ID-17010215-012	1427	Headwaters to Priest Lake		Sed, Halt
East River	ID-17010215-003 ID-17010215-004	1415	Headwaters to Priest River	Headwaters of North and Middle Forks To Priest River	Sed, DO, Temp, Flow
Tango Creek	ID-17010215-021	1428	Headwaters To Priest Lake		Sed, Nut
Reeder Creek	ID-17010215-023	1424	Headwaters to Priest Lake		Sed
Kalispell Creek	ID-17010215-024	1421	Priest River/ Lake Basin	WA line to Priest Lake	Sed
Lamb Creek	ID-17010215-025	1419	Headwaters to Priest Lake	WA line to Priest Lake	Sed
Binarch Creek	ID-17010215-026	1418	Headwater to Priest River		Sed
Lower West Branch Priest River	ID17010215-030	1411	No Boundaries Stated	WA line to Priest River	None Listed
Lower Priest River	ID-17010215-001	1407	Upper West Branch Priest River to Pend Oreille River		Sed

* Sed: Sediment Nut: Nutrients
Halt: Habitat Alteration Temp: Temperature
DO: Dissolved Oxygen

Water appropriations in the Priest River subbasin equal the average annual runoff, but they are mainly non-consumptive. Water rights for recreation, aesthetics, fish and wildlife, held by the State of Idaho, comprise the largest appropriations. Based on IDWR records, approximately 24.7 million m^3 (20,000 acre-feet) of water are appropriated for consumptive uses annually within the Priest River subbasin; this is 1% of the annual volume of the Priest River. The major consumptive uses are irrigation and domestic water supplies. Surface water is the principal water source in the basin. Less than 1% of the subbasin's dedicated water is from ground water, but it is relied on heavily for domestic supplies (IDWR 1995).

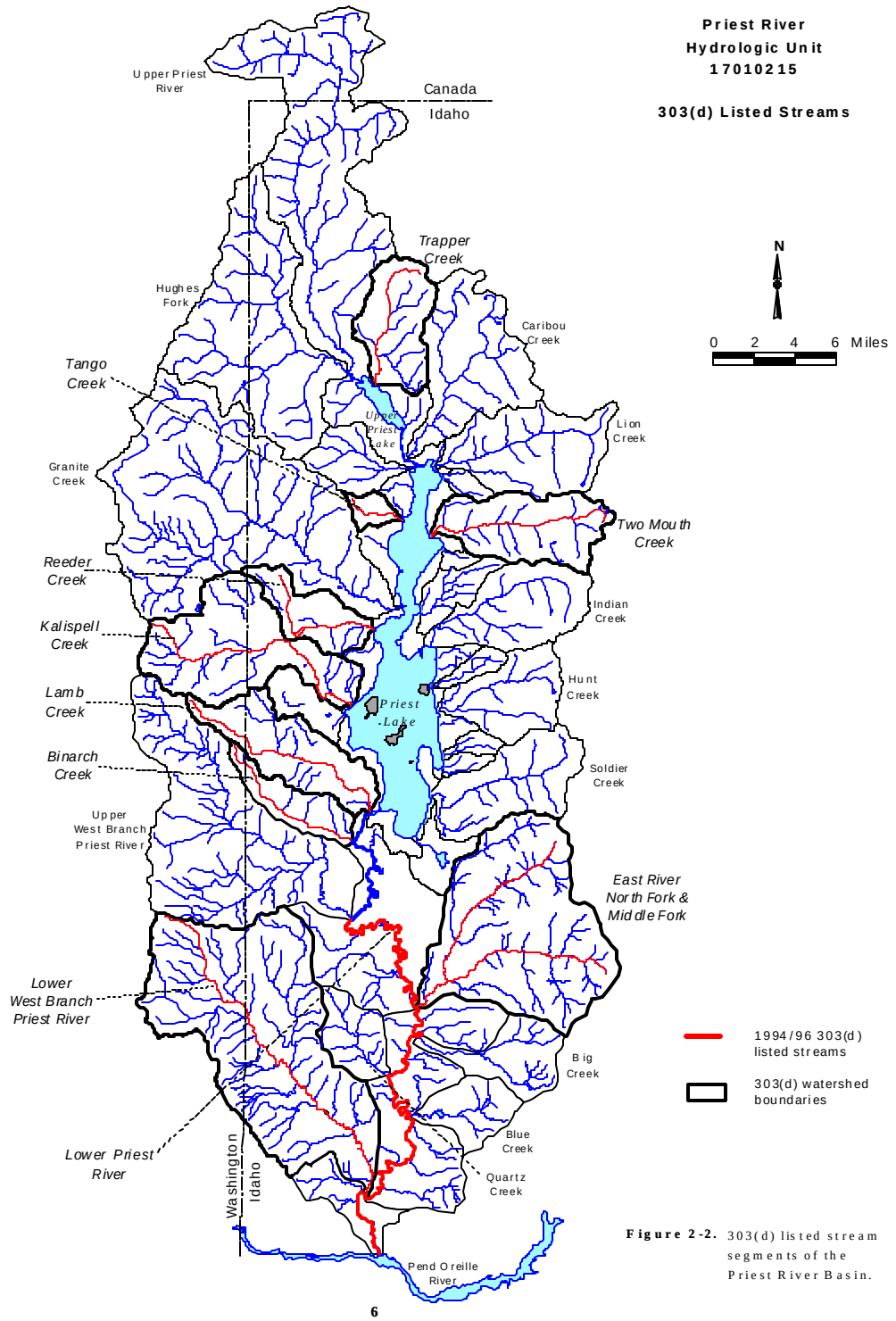


Figure 35. Locations of 303(d) listed stream segments of the Priest River subbasin, Idaho

Concern for maintaining the primitive character and aesthetic quality of the subbasin and a desire to maximize recreational opportunities lead to the implementation of several protective measures. Protection included Protected River Designations under the Columbia Basin Fish and Wildlife Program, State designation of Natural and Recreational River sections, and application for minimum stream flow appropriations on basin rivers and streams (Table 14 [Rothrock 2000] and Figure 36 [IWRB 1995])**.** All these measures will help to preserve and protect valuable fish and wildlife in streams and riparian corridors in the Priest River subbasin.

Table 14. Priest River subbasin: water body identification numbers, and 1994/6 303(d) listing categories

River Reach	Length	Values	Designation	Conditions
Upper Priest River, Canadian border to Upper Priest Lake(1990)	19.6 miles	Species of concern Spawning Recreation Area	Natural River	Prohibits- Construction or expansion of dams or impoundments, hydropower projects, or water diversion works: new dredge or placer mining: new mineral or sand and gravel extraction within the stream bed; stream bed alteration
Upper Priest Lake And The Thorofare(1990)	5.9 miles	Species of concern Boating opportunity Scenic Area Geologic Features	Natural River	Same as above
Hughes Fork (1990)	14.1 miles	Species of concern Spawning Recreation Use Scenic Area	Recreational River	Same as above except: allows for a of the stream bed for maintenance construction of bridges and culvert cleaning Maintenance and replacement Of diversion works, and Installation o fisheries Enhancement structures
Rock Creek (1990)	3.8 miles	Same as above	Recreational River	Same as above
Lime Creek (1990)	3.9 miles	Same as above	Recreational River	Same as above
Cedar Creek (1990)	4.2 miles	Same as above	Recreational River	Same as above
Trapper Creek (1990)	7.9 miles	Same as above	Recreational River	Same as above
Granite Creek (1990)	11.1 miles	Same as above	Recreational River	Same as above
Priest River, Priest Lake outlet structure To McAbee Falls(1990)	43.7 miles	Wildlife Boating Opportunity	Recreational River	Same as above
Lion Creek (1995)	11.1 miles	Species of concern Spawning Recreation Use Scenic Area	Recreational River	Same as above
Two-Mouth Creek(1995)	10.6 miles	Same as above	Recreational River	Same as above
Indian Creek (1995)	10.5 miles	Same as above	Recreational River	Same as above

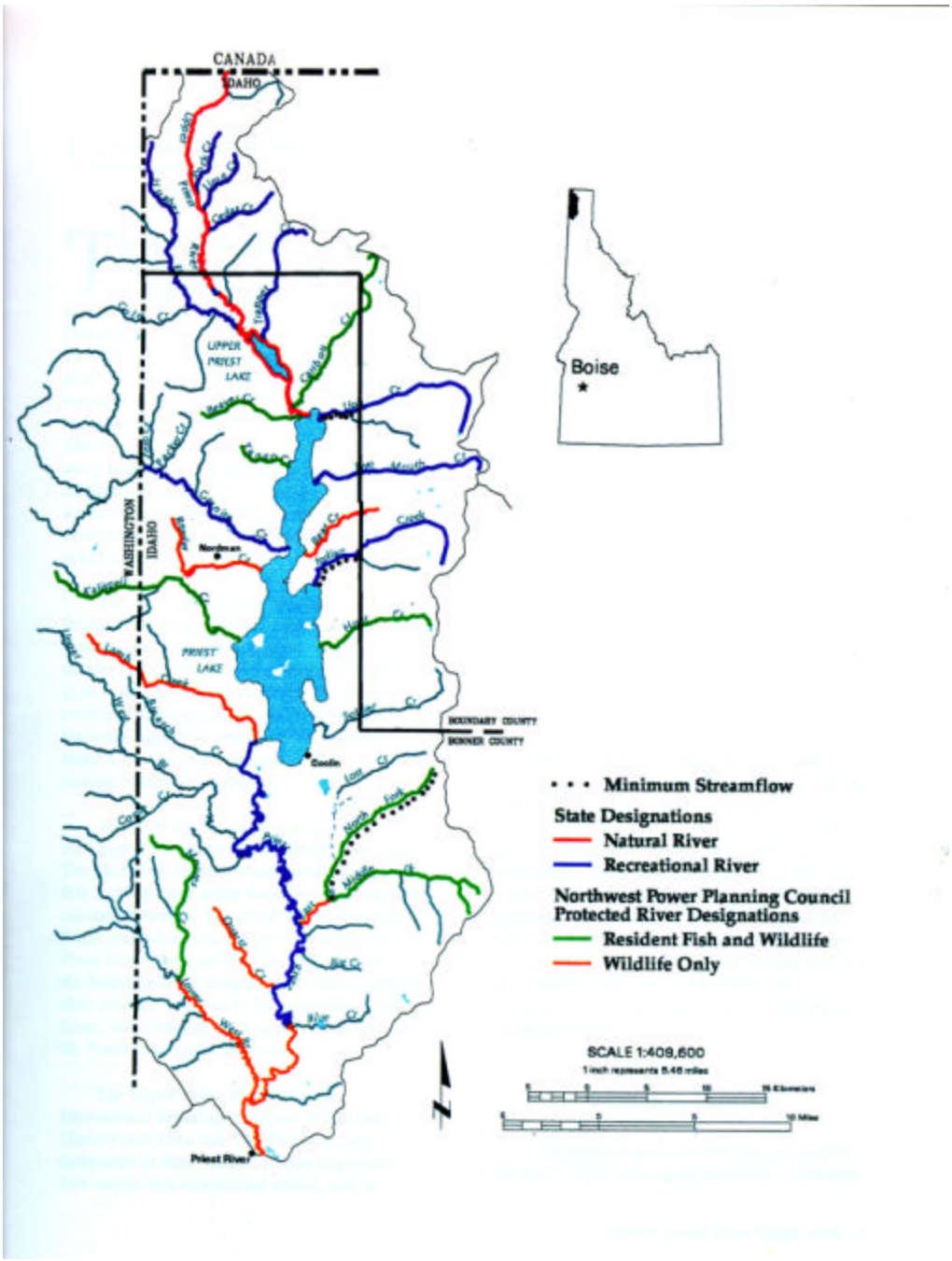


Figure 36. Protected river designations on streams and rivers in the Priest River subbasin, Idaho

A small dam at the outlet of Priest Lake regulates the summer pool level of Upper Priest Lake and Priest Lake (Figure 37). This dam was constructed in 1951 by the State of Idaho for the purpose of maintaining Priest Lake at a constant summer pool level for recreational use [Idaho Code, Sec. 70-501 to 70-507]. The law requires the lake level to be maintained at 1 m (3.0 ft) on the USGS outlet gage until the end of the summer recreational season. At this level, about 8.6 million m^3 (70,000 acre-feet) of water are stored in the system until September 30. Sometime between October 1 and November 30, the stored water is released to supplement flows in the

Pend Oreille and Columbia rivers for fall hydropower production (Figure 38). The IDWR provides oversight of the dam, and Avista operates and maintains the dam (IWRB 1995).

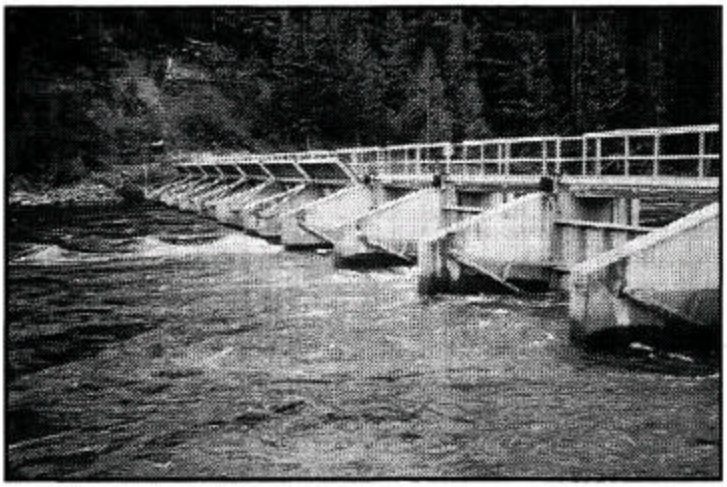


Figure 37. Dam on the outlet of Priest Lake, Idaho

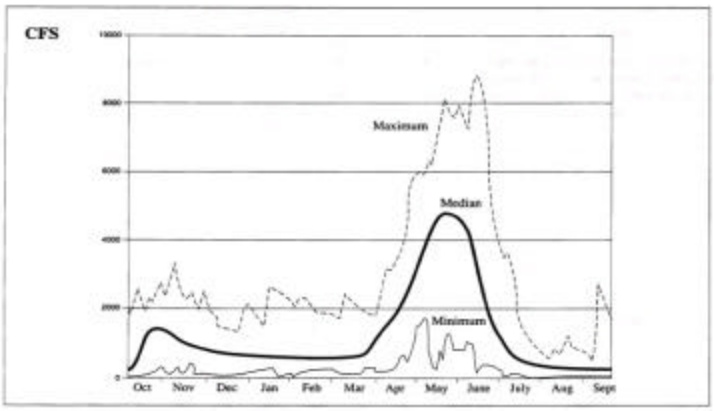


Figure 38. Average daily discharge for the Priest River at Dickensheet, 1951-1992 (USGS station no. 12394000)

Operating the outlet structure to benefit recreation at Priest Lake causes reduced flows in the Priest River during the warmest months of the year, August and September, and an unnaturally high flow period for a brief time in late October and November (Figure 39, IWRB 1995). Water temperatures exceeding 24 °C in the Priest River during the summer months can limit trout distribution to the mouths of tributary streams. Consideration was given to utilizing stored water in Priest Lake to supplement instream flows in the Priest River during critical times. However, it was not clear how far downstream favorable temperatures would extend, and the beneficiaries of stable summer pool levels in Priest Lake were unwilling to consider changes in lake level management if it meant lower summer pool levels (R. Graham, Idaho Water Resource Board, 2000).

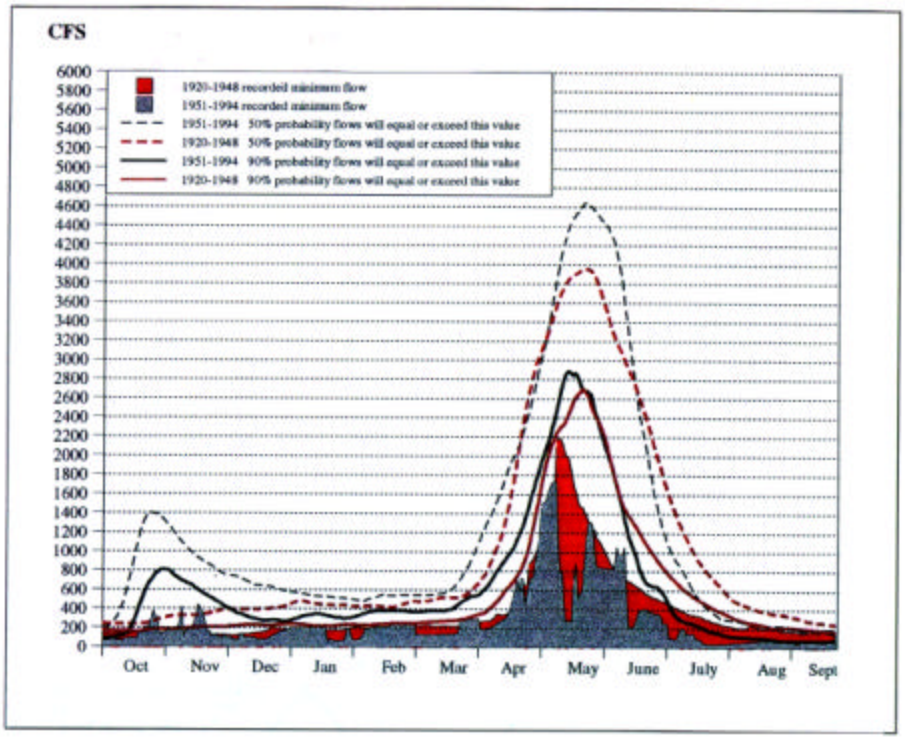


Figure 39. Comparison of pre-dam (1920-1948) and post-dam (1951-1994) discharge of the Priest River, Idaho, below the Outlet Dam at Priest Lake

Wildlife

The Priest River subbasin provides a myriad of habitats valuable for wildlife. This is a diverse area with riparian to sub-alpine habitat types supporting a wide range of wildlife species. In a relatively high precipitation zone, the subbasin has experienced fewer fires than most areas of Idaho. Historically, this produced large blocks of old-growth habitat in the area.

Watershed Assessment

Several reports describe the Priest River subbasin, its fish and wildlife resources, and the landscape that supports them. These documents include the *Draft Priest Basin Bull Trout Recovery Plan* (Fredenberg 2000), *Comprehensive State Water Plan Priest River Basin* (IDWR 1995), the *Draft Priest River Subbasin Assessment* (Rothrock 2000), and the *Idaho Department of Fish and Game Five Year Fish Management Plan* (IDFG 1996). Idaho Department of Fish and Game annual reports, funded by Sport Fish Restoration funds, have largely focused on the bull trout, cutthroat trout, kokanee, and lake trout fisheries in Priest Lake. Master's theses from the University of Idaho have investigated exotic species interactions with native trout, including historic studies of cutthroat trout and brook trout interactions in tributaries to Priest Lake and a more recent evaluation of lake trout invasion of Upper Priest Lake through the Thorofare. Funding from the USFWS through Section 6 of the ESA has focused on bull trout abundance and distribution in Upper Priest Lake and its tributaries and interactions with lake trout and brook trout. Descriptions of specific portions of the Priest River subbasin are also provided in USFS NEPA documents and CWE analyses performed by IDL.

Major Limiting Factors

The two primary limiting factors for fish, wildlife, and associated habitats in the Priest River subbasin are habitat loss and nonnative species competition. Habitat loss can be described in a variety of ways, but is generally referred to as the loss of connectivity, quality, quantity, and diversity. Many environmental and managed factors can contribute to these limiting factors. Several of these key factors are described further in more detail.

Fisheries

Natural Factors

Limiting factors for fish in the Priest River subbasin are related to both natural features and changes caused by man. The geology of the Priest River subbasin creates naturally unproductive water due to limited nutrient availability. The northern latitude and elevation of the watershed also limits the growing season for fish. Native fish populations were naturally limited in numbers relative to more productive areas of the state. The availability of tributary spawning and rearing habitat further limited adfluvial cutthroat and bull trout below what both Upper Priest Lake and Priest Lake would support.

Harvest

Historically, excessive harvest of cutthroat trout and bull trout played a role in reducing native fish populations in the Priest River subbasin. However, bull trout in the Priest River and Upper Pend Oreille subbasins were treated as desirable fish worthy of restrictive regulations, rather than a predator worthy of bounties. Bull trout harvest was restricted as early as 1946 in all tributary streams to Upper Priest Lake, Priest Lake, and the Thorofare when a May 21 to July 10 season was in effect (Fishing Seasons and Regulations pamphlet 1946). Restrictive regulations on native fish went into effect during the early 1980's when cutthroat trout harvest was limited to two fish over 38 cm and bull trout harvest was closed in 1984. Wild cutthroat trout harvest has been closed since 1990 and a complete harvest closure was implemented in 1992 (N. Horner, IDFG, personal communication). While harvest on native species was being restricted, additional

harvest of brook trout was encouraged with a bonus limit of 10 fish that went into effect statewide in 1990.

Current management direction is to provide a yield lake trout fishery in Priest Lake with a year round season and two fish limit. Fisheries for cutthroat trout and bull trout are closed to harvest.

Upper Priest Lake has been managed as a refuge for native fish since 1994, with catch-and-release regulations, requiring single barbless hooks and no bait. Much of the fishing in the lake is associated with camping or hike-in anglers, who may be less able to identify bull trout and more likely to keep them than more experienced boat fishermen. Illegal harvest is an issue in the Priest River subbasin, but its impact is largely unquantified. Despite harvest restrictions on cutthroat trout and bull trout, neither population has responded in Upper Priest Lake and Priest Lake.

The Priest River below the outlet dam supports a seasonal fishery for cutthroat trout during the spring spawning season. This river reach has historically been managed with a year-round season due, in part, to high temperatures that are thought to limit the cutthroat trout population during the late summer. Protection was given to cutthroat trout spawners by implementing the normal river fishing season, May 28 to November 30, during the 1994-95 fishing season. Major public opposition to this regulation change did not allow an evaluation of potential benefits, and the river has been managed with a year-round season since 1996 (N. Horner, IDFG, personal communication).

Habitat

Land use development has taken place in the entire Priest River subbasin, primarily from timber management and associated roads. As typically occurs in watersheds with an extensive history of timber harvest, many of the major haul roads encroached on the riparian zone causing sedimentation to streams. Increased use of these poorly designed and located road systems by recreationists add to the problem in this subbasin. Problems are particularly apparent along portions of the Upper Priest River, Hughes Fork, the lakeshore of Priest Lake, Lion Creek, Two Mouth Creek, Granite Creek, Indian Creek, Kalispell Creek, Soldier Creek, the lower Priest River, and the East River drainage.

In portions of Hughes Fork and Trapper Creek, the road densities are very high, exceeding 5.6 km/km^2 of land, with many of the roads constructed in the riparian zone. Lime Creek has 2.25 road crossings per km of stream, and several other drainages exceed 0.8 crossings per km. Logging has occurred in 5% of the Upper Priest River watershed, 18% of the Hughes Fork, and 55% of Trapper Creek (Panhandle TAT 1998).

In tributaries draining directly into Priest Lake, the portion of the subbasin with highly erodible soils ranges from 10-30%, with half or more of most watersheds in the rain-on-snow sensitive zone. Road densities tend to be lower (< 3.2 km/km^2 [3.0 mi/mi^2]) in the watersheds where bull trout spawning and rearing still occur: Caribou Creek, Lion Creek, Two Mouth Creek, Indian Creek, Granite Creek, and Soldier Creek. Major portions of the watersheds have been logged, including 23% of Caribou Creek, 35% of Lion Creek, 52% of Two Mouth Creek, 3% of Indian Creek, and 75% of Soldier Creek (Panhandle TAT 1998). In the East River, the only drainage in the lower Priest River watershed with a known bull trout population, 25% of the watershed has highly erodible soil types and 41% is in the rain-on-snow sensitive zone. Road densities are very high, averaging 8.2 km/km^2 (5.1 mi/mi^2), and there are 2.25 road crossings per

km of stream. The portion of the watershed that has been logged is high, but has not been quantified (Panhandle TAT 1998).

The streambed of the mainstem Hughes Fork above the Hughes meadows is dominated by sands, but is hydrologically stable. A reach of the stream running through Hughes Meadows was channelized during the 1940's for construction of an airstrip, and is now extremely unstable. This instability is apparent further downstream in the excessive depositional features and the lack of sufficient large organic debris.

Approximately half the Priest River subbasin has soil types that are classified as highly erodible, ranging from 15% in Lime Creek to 86% of the Rock Creek drainage (Fredenberg 2000). Half or more of the watersheds lie in the rain-on-snow sensitive zone, making them prone to flashy runoff patterns. These characteristics predispose the subbasin to habitat degradation with any ground disturbing activities. This is of special concern because the Upper Priest Lake watershed is the most intact habitat remaining for cutthroat trout and bull trout in the Priest River subbasin (Fredenberg 2000).

Five stream segments within the Priest River subbasin were listed as Clean Water Act Section 303(d) Water Quality Limited Segments (WQLS) on Idaho's 1996 list: Kalispell Creek, Reeder Creek, Tango Creek, Trapper Creek, and Two Mouth Creek. Streams listed as WQLS are considered not fully supporting designated or existing beneficial uses. Many streams in the subbasin fail to meet temperature standards for salmonid spawning and specific temperature criteria for bull trout protection. The State of Idaho is currently in the process of determining beneficial uses and support status for water bodies throughout the subbasin (Rothrock 2000).

Culvert barriers on forest roads that may have an impact on bull trout have been identified as potential fish passage impediments on Hughes Fork, Granite Creek, South Fork Granite Creek, and Kalispell Creek.

Non-Native Fish

Non-native fish species can limit native trout and char abundance and distribution through predation, competition, and hybridization. Bull trout are the only char species native to the Priest River subbasin. Other native fish species include westslope cutthroat, mountain whitefish, northern pikeminnow, peamouth, and three species of suckers. Brook trout are widely distributed throughout much of the historic range of bull trout and cutthroat trout in the Priest River subbasin, including portions of nearly all spawning and rearing streams. Lake trout are dispersed throughout the lakes and the Thorofare, with occasional presence in the lower Priest River. Brown trout also occur in the lower Priest River and the East River. Mysis shrimp were introduced in the mid 1960's and became established in both lakes. Many years of stocking catchable rainbow trout in Granite Creek and Yellowstone cutthroat in Upper Priest Lake and Priest Lake and its tributaries did not result in hybridization of native westslope cutthroat or naturalization of rainbow trout or non-native cutthroat trout.

The current distribution and abundance of brook trout in the subbasin is unknown, but believed to be widespread and increasing. Brook trout abundance appears to be highest in tributaries on the west side of Priest Lake and the Priest River, where sediment loads are highest, due partially to geology (Figure 28). Limited population data are available for some drainages based on timber sale assessments by the USFS and IDL and stream surveys by IDFG. A thorough evaluation of brook trout abundance and distribution in the subbasin is needed to determine the probability of re-establishing native trout and char fisheries. Work by University of Idaho graduate students during the mid 1980's (Irving 1987, Cowley 1987, Strach and Bjornn

1991) indicated that the presence of brook trout in Priest Lake tributaries reduced densities of cutthroat trout and that removal of brook trout resulted in increased production of cutthroat trout. However, recent brook trout removal experiments in three Upper Priest Lake tributaries had limited effect based on the amount of instream and overhead cover present and the difficulty in removing all fish (Fredericks *et al.* 2000). Brook trout were maturing as early as age 1 for male and age 2 for females, so missing large numbers of fry resulted in little population impact.

Lake trout were introduced into Priest Lake in 1925. With the introduction of Mysis shrimp in the 1960's, the population expanded dramatically, eliminating kokanee and all but eliminating bull trout from the lake. Fishery managers attempted a variety of methods to restore a diverse fishery, including stocking non-native rainbow trout and Yellowstone cutthroat as well as producing westslope cutthroat in net pens, but none of those efforts yielded tangible results. Lake trout now provide the only fishery in Priest Lake, and bull trout have been reduced to remnant status. Current regulations on lake trout allow a two fish limit, any size. Managers are skeptical whether the existing habitat quality in Priest Lake tributaries and the presence of brook trout could support a rejuvenated bull trout and cutthroat trout population, even if the lake trout threat could be removed.

Lake trout have been present in Upper Priest Lake for over a decade, but have increased at an alarming rate during the last five years. In 1997, IDFG conducted an intensive survey in Upper Priest Lake to assess lake trout population and bull trout abundance, and evaluate the feasibility of lake trout removal (Fredericks 1997). Study results confirmed the presence of a well-established lake trout population. The size distribution of lake trout depicts a relatively young and expanding population. The collection of numerous juvenile lake trout suggests that they are reproducing successfully in Upper Priest Lake (Fredericks *et al.* 1997). Movement of sonic and spaghetti tagged lake trout demonstrated that migration between Upper Priest Lake and Priest Lake is not uncommon.

In 1998, IDFG removed 912 lake trout from Upper Priest Lake by gillnetting (Fredericks and Venard 2000). An additional 321 lake trout were removed in 1999. Ratios of bull trout to lake trout were similar in both years (about 5:100). However, return rates of tagged fish provided a clear indication that interchange of lake trout between the two lakes is common and the upper lake cannot be treated as a closed system. Lake trout reduction in Upper Priest Lake is the most viable option for protecting and restoring the Upper Priest Lake bull trout population, but is unlikely to succeed unless a method can be established to control lake trout immigration through the Thorofare. Initial indications are that lake trout move through the area primarily at night, and mostly in the fall, although winter and spring periods were not sampled. Options to reduce lake trout movement are complicated by the strong public sentiment against obstructing free boat passage between the lakes. During 2000, the study will focus on the seasonal and diel use patterns of the Thorofare by lake trout and native fish species, with an emphasis toward developing alternatives to control fish migration (Fredericks and Venard 2000).

Current management direction is to continue the existing lake trout fishery in Priest Lake and attempt to maintain Upper Priest Lake as a refuge for native species. Native species are seriously compromised by the increased brook trout populations in tributary streams and the influx of lake trout. The existing study should identify the biological factors related to the feasibility of lake trout control. It needs to be joined with a fish passage engineering evaluation and eventual funding of a solution. If Upper Priest Lake can be protected, then options to eventually restore Priest Lake may remain viable. But, if bull trout are extirpated in Upper Priest Lake it is doubtful whether they can ever be successfully restored to this watershed.

Residential Development

A study conducted by IDEQ in 1993 through 1995 examined several components of the lake system, including trophic status indicators of the open waters (limnetic zone), bathymetry, plant growth in near shore (littoral) zones, quantity and quality of inflow waters, characteristics of selected ground water aquifers, and watershed characterization utilizing a geographical information system. Conclusions developed from the three-year water quality study include: 1) open waters of Upper Priest Lake and Priest Lake can be classified as oligotrophic; 2) lake waters of shallow, near shore sampling sites showed no indication of nutrient enrichment linked to onshore human development; 3) both lakes exhibit a marked decline in water clarity during tributary spring runoff; 4) phytoplankton growth in Priest Lake may be co-limited by phosphorus and nitrogen at least during summer months; 5) attached algae growth in the littoral zone of many Priest Lake shoreline areas appears excessive given the low nutrient content of ambient near shore waters; 6) the primary nutrient fueling sources relating to attached algae biomass were not determined; 7) phosphorus, nitrogen, and sediment loading from various sources into Priest Lake was determined to be low to moderate, except that loading per area of runoff from some residential areas can be high; 8) some isolated areas of ground water sampling indicate an altering of background water quality by sewage effluent plumes; and 9) project consultants consider human induced nutrients and sediments as a potential threat for deterioration of Priest Lake water quality (Rothrock and Mosier 1997).

Most of the residential development in this subbasin is seasonal and is related to the growing recreational demands from the expanding urban areas in northern Idaho and eastern Washington. Impacts are particularly acute on the two lakes and the Thorofare, although Priest Lake is the only lake with lakeshore development. Most of the drainages that enter Priest Lake have experienced growing recreational and urban use, with impacts most pronounced in the watersheds of Two Mouth Creek, Granite Creek, Kalispell Creek, the lower Priest River, and East River. These impacts will be expected to increase as the popularity of this area for recreational activities continues to grow.

Wildlife

There is a lack of knowledge regarding the identification of limiting factors for many of the rare and listed species in the subbasin.

The Selkirk Mountains woodland caribou population ranges across the Lower Pend Oreille, Priest River, Upper Pend Oreille, and Kootenai subbasins. Adjacent habitat in British Columbia is integral to the existence of this population (W. Wakkinen, IDFG, personal communication). During the 1980's, poaching and collisions with vehicles were believed to limit the Selkirk caribou population (USFWS 1994). Programs instituted in the Selkirks to reduce the effect of these factors were largely successful but populations did not improve substantially, even with translocations of 103 caribou into the range from 1987 through 1998 (Wakkinen and Johnson 2000). Predation is believed to be limiting for woodland caribou in general (Bergerud 1978, Caughley and Sinclair 1994) and the Selkirk population, in particular (Bergerud 1978, W. Wakkinen, IDFG, personal communication). It has been hypothesized that large, long-term changes in habitat and other factors may have led to increases in predator numbers, thereby increasing predation on caribou (W. Wakkinen and J. Hayden, IDFG, personal communication).

The range of grizzlies outside of Canada and Alaska is now confined to six recovery zones located within the states of Montana, Wyoming, Idaho, and Washington. One recovery zone, the

Selkirk Zone, includes portions of the Lower Pend Oreille, Priest River, Upper Pend Oreille, and Kootenai subbasins. This zone is adjacent to important grizzly bear range within British Columbia, Canada. The current population of grizzly bears within the Selkirk Zone is increasing slowly, but is far from meeting ESA de-listing criteria (Wakkinen and Johnson 2000). Human caused mortality, especially of females, by illegal shooting or killing bears in self-defense is apparently the limiting factor in the recovery of the Selkirk grizzly bear population (Knick and Kasworm 1989, McLellan *et al.* 1999).

The amount and quality of lynx foraging habitat is primarily a result of post timber harvest regeneration, wildfires, and to a lesser extent controlled burns. Grazing by livestock also has the potential to impact lynx by removing herbaceous forage that snowshoe hares use during the summer. Ruediger *et al.* (2000) suggest that cattle grazing is also a factor in the decline of aspen stand regeneration in Rocky Mountain subalpine areas, and probably degrades snowshoe hare habitat in riparian willow areas as well. In contrast, wind throw, insects, and disease aid in creating lynx denning habitat. Lynx are relatively tolerant of human activity; however, urban developments and roads with high traffic volumes may affect lynx movements (Stinson 2000). Lynx are limited by the availability of a winter prey base, primarily snowshoe hare, as well as environmental/anthropogenic factors including forest management practices, habitat fragmentation, wildfires, fire suppression, insect epidemics, and lynx harvest management (Stinson 2000).

Development is likely the greatest threat to waterfowl, upland game, and furbearers in the subbasin. The abundance and quality of suitable nesting, brood rearing, and foraging habitat is assumed to be limiting for waterfowl and upland game. Aquatic furbearers are most likely limited by development along watercourses while furbearers such as pine marten may be limited by a lack of old-growth habitat.

Management considerations for caribou and grizzly bears have provided some security for middle and upper elevation habitats. Although there is old-growth in the subbasin, this habitat type is now in short supply. The federally managed old-growth areas within the subbasin are more secure than those managed by private and state interests. Logging on the east side of Priest Lake has moved a large portion of this area from middle and old-growth stands to younger seral stages with high road densities.

Logging in the southern two thirds of the subbasin has impacted lower elevation areas. Interlocking, low-elevation forest canopies are critical to white-tailed deer survival during winter. These critical habitat areas are declining in abundance and quality.

Development and recreational use along the lakes and streams within the subbasin are important negative influences on habitat quality. Protection of meadow, wetland, and riparian habitat from development and recreational use is a high priority in the subbasin, addressing a broad range of species' needs.

It is important to note that some of the most critical wildlife habitats are those shared with the Kootenai and Pend Oreille subbasins. Wide ranging species, including several listed species, occupy home ranges that span both sides of the divide between these systems in the Selkirk and in the Cabinet Mountains.

Artificial Production

Fish stocking during the last 100 years has influenced fish populations in the Priest River subbasin. Many of the warmwater species found in lowland lakes and some non-native salmonids were hauled to Idaho in the early 1900's in milk cans on the Burlington Northern

Railroad. The initial introduction and consequent spreading of brook trout throughout the Priest River subbasin probably had the biggest impact to native cutthroat. In 1925, the U.S. Fish Commission stocked lake trout into Priest Lake.

The IDFG supplemented native westslope cutthroat trout in Upper Priest Lake and Priest Lake by stocking both fry and fingerling cutthroat trout directly into the lakes and into some tributaries from the 1940's through 1991. In 1989, 1990 and 1991, the IDFG attempted a net pen rearing program for cutthroat trout to provide a fishery for adipose-clipped cutthroat while requiring mandatory release of wild fish. This program was discontinued due to very poor returns of hatchery fish. Stocking records for the time period from 1976 to 1991 are summarized in Table 15. No cutthroat trout or kokanee have been stocked since 1991.

Table 15. Kokanee and cutthroat trout stocking history for Priest Lake, Idaho 1976-1991

	Cutthroat Trout		
Year	Fingerlings	Fry	Kokanee
1991	86,072	0	0
1990	95,284	0	0
1989	54,500	129,045	2,628,504
1988	0	900,105	1,924,774
1987	49,125	600,434	0
1986	247,080	0	1,263,554
1985	338,650	68,137	2,294,591
1984	266,216	300,440	3,714,880
1983	151,700	0	2,779,420
1982	142,845	0	925,368
1981	38,802	0	0
1980	0	4,104	0
1979	0	0	1,780,525
1978	0	0	62,424
1977	0	0	1,072,560
1976	0	0	0
Total	1,470,274	2,002,265	18,446,600

Stocking records did not distinguish between the Henry's Lake cutthroat trout broodstock (Yellowstone cutthroat trout), and the King's Lake cutthroat trout broodstock (westslope cutthroat trout) until 1982. The King's Lake westslope cutthroat trout broodstock was formed using adfluvial westslope cutthroat trout from Priest Lake in the early 1940's, but it is unknown when fish from this native broodstock were used in place of the non-native Henry's Lake stock. Limited genetic sampling has not shown any sign of introgression with non-native cutthroat or rainbow trout.

Rainbow trout were also widely stocked as fry, fingerling, and catchable fish in the Priest River subbasin. The catchable rainbow trout were stocked in Granite Creek, the main tributary to Priest Lake on the west side, and in the Priest River below the Outlet Dam. The catchable rainbow trout stocking program was discontinued by 1982 in Granite Creek and in the Priest River by 1992.

Kokanee were established in Priest Lake during the 1950's from eyed eggs taken from the population in Lake Pend Oreille and stocked in shoreline gravel beds. A naturally reproducing population was established and supplementation was no longer necessary. Kokanee eventually invaded Upper Priest Lake and provided a limited fishery. During and after the collapse of the kokanee fishery in the late 1970's, IDFG stocked kokanee fry in an attempt to re-establish a kokanee fishery. Between 1977 and 1989, a total of 18.4 million kokanee fry was stocked in Priest Lake (Table 15), but predation by lake trout continued to overwhelm the kokanee prey base. A remnant kokanee population of a few dozen fish has been observed spawning in historic shoreline spawning areas during the past several years.

It is unknown exactly when brown trout were stocked in the lower Priest River and the East River, but it was done prior to 1967 when more detailed records started to be kept. There is a remnant population of brown trout in the East River drainage.

Current and planned fisheries management direction in the Priest River subbasin is primarily for wild native salmonids. The IDFG conducts supplemental stocking of catchable rainbow trout in isolated small ponds to provide harvest opportunity for unskilled anglers (N. Horner, IDFG, personal communication).

Existing and Past Efforts

Fisheries management has largely focused on a shift away from stocking non-native species to toward managing for native species with wild stocks. Idaho Department of Fish and Game research and management on fish populations in the Priest River subbasin has been funded through the Federal Sport Fish program. Recently, funding from the USFWS through Section 6 of the ESA has been used to document bull trout abundance in the Upper Priest Lake system and evaluate the threat posed by brook trout and lake trout.

Habitat management has been the responsibility of the major landowners in the subbasin, primarily the USFS and the IDL. There is a need for a comprehensive survey of bull trout and cutthroat trout habitat conditions in the subbasin to prioritize where restoration efforts would best be spent.

Subbasin Management

Existing Plans, Policies, and Guidelines

Existing plans, policies, and guidelines that govern management of fish, wildlife and their habitats in the Priest River subbasin are described primarily in state and federal agency management plans.

Federal

Federal plans that address the Priest River subbasin include the current *Idaho Panhandle National Forests Plan* and the *Draft Priest Basin Bull Trout Recovery Plan* (Fredenberg 2000).

Tribal Government

Kalispel Tribe of Indians

The KNRD *Fish and Wildlife Management Plan* (Plan) is a comprehensive accumulation of present and future KNRD resource direction based upon the KT's management authorities within

its ceded lands. These authorities are based on federal law, tribal resolution, and agreements between the KT and other resource management agencies. The Plan identifies resource mission statements that are supported by specific goals and objectives. The Plan will direct each division's development of annual work plans. Strategies are developed annually and drive each division's on-the-ground activities to achieve its stated mission. It is important for the KT to actively manage resources within its ceded lands and provide management recommendations to attain resource improvement goals. The KNRD's approach is to manage sustainable native populations and habitats using watershed management principles. Non-native populations and/or artificial habitat management will be addressed based upon population health, habitat condition, and feasibility.

State Government

State plans that address the Priest River subbasin include the *Comprehensive State Water Plan Priest River Basin* (IDWR 1995), the *Draft Priest River Subbasin Assessment* (Rothrock 2000), the *Idaho Department of Fish and Game Five Year Fish Management Plan* (IDFG 1996), and current IDL timber management plans for State endowment lands in the Priest River subbasin. The *Idaho Department of Fish and Game Five Year Fish Management Plan* is currently being rewritten and covers the 2001-2005 period.

Washington Department of Fish and Wildlife

The WDFW is the primary state agency within Washington State responsible for the conservation, protection, and enhancement of fish and wildlife resources. In 1999, the WDFW completed a statewide regulation review process for the Washington State Hydraulic Code (RCW 75.20) and portions of that law affecting recreational mineral prospecting. Modifications of this state law, administered through WDFW for the protection of fish life and fish habitats, provided enhanced protection for fish resources, with emphasis on salmonid resources, while providing for selective small scale recreational prospecting activities within limited in-stream work windows.

The WDFW conducts fish and wildlife monitoring activities within the Priest River subbasin with financial assistance through state fishing and hunting license sales and federal funding aid through sources such as the Aid in Sport Fish Restoration Program.

Goals, Objectives, Strategies, and Recommended Actions

The overall goal for the Priest River subbasin is to mitigate and compensate for resident and anadromous fish losses caused by the construction and operation of federally operated and federally regulated hydropower projects. This will be accomplished by providing for healthy, sustainable populations of fish and wildlife that will provide ecological, economic, cultural, recreational, and aesthetic benefits to the region. Restoration of native fish populations and maintenance of compatible sport fisheries will help to achieve this goal. In general this goal is likely to be reached by maintaining the functions and attributes of healthy portions of the ecosystem, and working with modified aspects of the ecosystem to either restore lost ecological components or replace them with other components that produce desirable outputs.

Fisheries

Goal 1: Protect, enhance, and restore native fish populations to maintain stable, viable levels, to ensure they are not vulnerable to extinction, and to provide ecological, cultural, and sociological benefits.

Objective 1: By 2015, restore bull trout and westslope cutthroat trout populations in Upper Priest Lake to a level where adult escapement is well distributed and, at any one time, at least six of the spawning tributaries supporting healthy spawning populations, defined as having a stable or increasing trend, with an estimated probability of persistence of 95% or better over the next 100 years. The probability of persistence is determined using the model described by Dennis *et al.* (1991).

Strategy 1: Restore, protect, and maintain spawning and rearing habitat in tributary streams to improve survival of stream spawning salmonids, with emphasis on bull trout and cutthroat trout.

Recommended Actions:

- Work with the USFS, private timberland owners, and managers to identify and remove failing roads and correct other problems that are negatively impacting stream habitat, floodplain function, and watershed condition in tributaries to Upper Priest Lake.
- Provide technical assistance and cost sharing on streambank stabilization, flood control, and stream crossing projects to ensure land managers and road maintenance agencies implement projects that are either benign or beneficial to target fish species.
- Inventory fish passage through stream crossings, diversions, or other man-made obstructions, and restore fish passage where needed. Protect, enhance, and restore the sport fisheries in the Priest River subbasin to provide sustainable harvest and recreational fishing opportunities.

Objective 2: By 2005, minimize competition between lake trout and bull trout by removing 90% or more of the lake trout from Upper Priest Lake and by preventing re-establishment from Priest Lake by migration through the Thorofare.

Strategy 1: Improve conditions for bull trout in Upper Priest Lake through fisheries management actions.

Recommended Actions:

- Investigate the potential for selectively preventing lake trout movement through the Thorofare, while still allowing desirable native fish and boats to pass.
- Define the engineering, economic, and social constraints of preventing lake trout movement into Upper Priest Lake.
- Obtain funding to construct, operate, and maintain a selective fish barrier in the Thorofare.
- Remove lake trout from Upper Priest Lake through intensive gillnetting. Investigate other methods of lake trout capture such as deep-water trap nets.

- Continue the angler education project to improve anglers' fish identification and fish releasing skills.

Objective 3: By 2015, reduce competition between brook trout, native cutthroat trout, and bull trout by removing brook trout from critical spawning and rearing streams to Upper Priest Lake and Priest Lake.

Strategy 1: Improve conditions for spawning and rearing cutthroat trout and bull trout in the Priest River basin by reducing competition with brook trout.

Recommended Actions:

- Conduct a thorough inventory of all tributaries in the subbasin to assess brook trout abundance and distribution and potential negative interaction with native salmonids. The first priority would be tributaries to Upper Priest Lake, then Priest Lake, and finally Priest River.
- Determine the best method of removing brook trout and preventing their reestablishment in priority streams.
- Obtain funding to remove brook trout and maintain priority streams free of brook trout.

Objective 4: By 2015, protect and restore remaining stocks of genetically pure westslope cutthroat trout in the Priest River subbasin to ensure their continued existence, and provide catch rates of over 0.5 fish per hour in Upper Priest Lake, Priest Lake, and Priest River.

Strategy 1: Improve conditions for westslope cutthroat trout in the Priest River subbasin through management actions.

Recommended Actions:

- Maintain restrictive regulations, where appropriate, to provide protection to weak stocks. Consider additional restrictions where harvest is resulting in reduced spawning escapement.
- Consider supplementation with genetically pure westslope cutthroat trout to more quickly rebuild depressed native stocks.
- Evaluate the benefit of increased minimum flows in the Priest River for westslope cutthroat trout, and implement changes if social and economic support is obtained.

Kalispel Tribe of Indians Objectives

Objective 4: By 2025, restore bull trout and westslope cutthroat trout populations in Priest Lake to a level where adult escapement is well distributed and, at any one time, at least six of the spawning tributaries supporting healthy spawning populations, defined as having a stable or increasing trend, with an estimated probability of persistence of 95% or better over the next 100 years. The probability of persistence is determined using the model described by Dennis *et al.* (1991).

Strategy 1: Restore, protect, and maintain spawning and rearing habitat in tributary streams to improve survival of stream spawning salmonids, with emphasis on bull trout and cutthroat trout.

Recommended Actions:

- Work with the USFS, IDFG, private timberland owners, and managers to identify and remove failing roads and correct other problems that are negatively impacting stream habitat, floodplain function, and watershed condition in tributaries to Priest Lake.
- Provide technical assistance and cost sharing on streambank stabilization, flood control, and stream crossing projects to ensure land managers and road maintenance agencies implement projects that are either benign or beneficial to target fish species.
- Inventory fish passage through stream crossings, diversions, or other man-made obstructions, and restore fish passage where needed. Protect, enhance, and restore the sport fisheries in the Priest River subbasin to provide sustainable harvest and recreational fishing opportunities.

Objective 5: By 2010, minimize competition between lake trout and bull trout by reducing lake trout from Priest Lake.

Strategy 1: Improve conditions for bull trout in Priest Lake through fisheries management actions.

Recommended Actions:

- Continue the angler education project to improve anglers' fish identification and fish releasing skills.
- Develop, maintain, and support liberal bag limits on lake trout in Priest Lake.
- Discourage unauthorized fish introductions.
- Evaluate opportunities for experimental removal of lake trout or other competing non-natives from Priest Lake.
- Educate anglers about non-native fish, fishing regulations and proper identification of native species.

Idaho Department of Environmental Quality

The Idaho DEQ administers several programs designed to monitor, protect, and restore water quality and aquatic life uses. These include BURP monitoring; 305(b) water quality assessments; 303(d) reports of impaired waters and pollutants; TMDL assessments, pollutant reduction allocations, and implementation plans; Bull trout recovery planning; 319 nonpoint source pollution management; Antidegradation policy; Water quality certifications; Municipal wastewater grants and loans; NPDES inspections; Water quality standards promulgation and enforcement; General ground water monitoring and protection; Source water assessments; and specific watershed management plans identified by the legislature. The Idaho Board of Environmental Quality oversees direction of the agency to meet responsibilities mandated through Idaho Code, Executive Orders, court orders, and agreements with other parties.

Wildlife

Goal 1: Protect, restore, enhance, and sustain populations of wildlife for aesthetic, cultural, ecological, and recreational values.

Objective 1: Increase the Selkirk woodland caribou herd to 75 animals or more by 2010, with the intent to meet ESA de-listing criteria by 2020.

Status: Endangered (Federal, Idaho, Washington)

Limiting Factors: Predation, poaching, and collisions with vehicles (Bergerud 1978; Caughley and Sinclair 1994; USFWS 1994).

Strategies:

- Reduce predator impacts to caribou through habitat manipulation, where feasible.
- Secure adequate habitat and prevent human-caused mortality.
- Continue monitoring radio-collared caribou to determine population dynamics, seasonal habitat use, and population survival and document population trends.
- Implement herd augmentation whenever the caribou population is documented at less than 50 animals.

Objective 2: Maintain bald eagle populations at or above present levels.

Status: Endangered (Idaho); Threatened (Federal, Washington)

Limiting Factors: Loss of nesting and winter roost sites and disturbance from development and other anthropogenic activities (USFWS 1986).

Strategies:

- Protect bald eagle nesting and winter roost sites by securing existing and potential nesting/roosting areas (including a 400 m to 800 m radius buffer around nests).
- Identify and map winter roosting habitats.
- Monitor and/or research water quality, and prey abundance and production.
- Maintain high quality fish and waterfowl habitat for prey species.

Objective 3: Restore a self-sustaining population of grizzly bears in the Selkirk Recovery Zone that meets the *Grizzly Bear Recovery Plan* goals (USFWS objective) (Table 16).

Table 16. Grizzly Bear Recovery Plan goals

Criterion	Targets (achieved for three consecutive years)
Females with cubs	At least 6 females with young observed per year
Mortality Limit	Maximum of 0.50 bears killed per year
Female Mortality Limit	Maximum of 0.15 female bears killed per year
Distribution of females with young	Females with young observed in at least 7 of 10 Bear Management Units

Status: Endangered (Washington); Threatened (Federal, Idaho)

Limiting Factors: The illegal shooting or killing of bears in self-defense (Knick and Kasworm 1989, McLellan *et al.* 1999).

Strategies:

- Cooperate and coordinate with the Interagency Grizzly Bear Committee (IGBC 1995).
- Assess distribution of grizzlies in the subbasin though trapping/radio-marking and hair-snagging surveys.
- Monitor bear populations to determine progress towards ESA de-listing criteria.
- Provide funding for information/education patrols to make contacts with people, especially hunters, recreating in grizzly bear habitat within the subbasin.
- Expand information and education efforts to improve grizzly bear survival through completion and distribution of bear identification, clean camping brochures, and video, and through funding brochures, signs, and other informational materials.
- Augment efforts to de-commission or close roads to meet access criteria to improve grizzly bear survival.
- Develop a strategic conservation plan that includes provisions for grizzly bear population monitoring and an information and education program that emphasizes the needs of grizzly bears by ensuring that increased demands for human recreation within the Selkirk Zone are compatible with grizzly bear recovery.
- Develop habitat parameters for recovery and incorporate those parameters in forest and land use plans.
- Provide enforcement to deter and pursue grizzly bear poaching and provide a preventative presence in the subbasin.
- Pursue protection of important seasonal grizzly bear range within the Selkirk Grizzly Bear Recovery Zone, particularly low-elevation spring range, through conservation easement or fee-title acquisition.
- Investigate protection of grizzly bear movement corridors through conservation easement or fee-title acquisition.

Objective 4: Restore and maintain viable lynx populations in the subbasin.

Status: Threatened (Federal, Washington); Species of Special Concern (Idaho).

Limiting Factors: Winter prey base, forest management practices, habitat fragmentation, wildfires, fire suppression, insect epidemics, and lynx harvest management (Stinson 2000).

Strategies:

- Determine distribution abundance, population trend, and limiting factors for lynx in the subbasin based on reviews of literature, habitat modeling, and direct investigation.
- Coordinate survey, monitoring, and management activities with affected land management agencies to assist in lynx recovery.
- Conduct intensive telemetry studies of lynx populations to better evaluate limiting factors.

- Conduct prey species research (snowshoe hare and red squirrels) to evaluate prey base limitations on lynx populations.
- Investigate lynx habitat use and travel patterns in relation to snowmobile, cross-country and downhill ski trails, and other anthropogenic activities.
- Conduct investigations of potential competition between lynx and other carnivores and the possible role of anthropogenic-induced habitat changes.

Objective 5: Restore and sustain state and tribal species of special concern, federal candidate species, BLM sensitive species, and USFS indicator species, including the following: wolverine, fisher, otter, northern flying squirrels, northern bog lemmings, pygmy shrew, Townsend's big-eared bat, common loons, pygmy nuthatch, flammulated owls, boreal owls, black-backed owls, great gray owls, northern pygmy owls, three-toed woodpeckers, upland sandpipers, northern alligator lizard, ring-necked snake, rough-skinned newts, wood frog, and Coeur d'Alene salamanders.

Limiting Factors: Unknown

Strategies:
- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Address limiting factors through appropriate methods.

Objective 6: Protect, restore, enhance, and sustain populations of big game species such as black bear, elk, mountain goat, moose, mountain lion, mule deer, and white-tailed deer.

Limiting Factors: The lack of low elevation stands of old-growth forest is likely limiting for white-tailed deer in the Priest River subbasin (Secord 1994). Predation is an important factor in the population dynamics of white-tailed deer in the subbasin (Hayden and Spicer 1995) and is possibly limiting. Wildlife habitat is threatened by development of summer and year-round homes at low elevations, by extensive thinning and removal of closed-canopy, low-elevation winter ranges, fire suppression in middle and upper elevations, recreation on key winter ranges, and other land-use practices.

Strategies:
- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Identify priority zones for habitat protection, restoration, and enhancement activities with a priority on areas affected by development.
- Protect, enhance, and maintain critical habitats from development and other land use threats.
- Enhance an average of 400 ha annually through habitat burns or other forest management practices.

- Protect, enhance, and maintain winter range with an emphasis on maintaining blocks of low-elevation, closed canopy forest cover.
- Determine how predators, hunting, and inter-specific competition from sympatric species impact ungulate populations in the subbasin by 2010.
- Encourage management of mid- and upper-elevation portions of the forest toward the more natural, open mature stands that favor moose and mule deer.
- Provide funds to develop fire plans and implement activities on high elevation habitats controlled by the USFS and/or owned by private individuals/timber companies.
- Ensure linkage between mountain ranges is protected, and allow for large and small animal movement.
- Reduce impacts of highways and railways on wildlife.
- Restore a population of 195 mountain goats in the Selkirk Mountain Range through augmentation of 10 goats to be released by 2005 and burning of habitat adjacent to cliff complexes occupied by mountain goats.

Objective 7: Protect, restore, enhance, and sustain populations of waterfowl, upland game, and furbearers under traditional levels of recreational and subsistence use.

Limiting Factors: Unknown

Strategies:
- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Address limiting factors through appropriate methods.
- Coordinate subbasin activities with appropriate agencies and organizations in adjacent subbasins, including the British Columbia Ministry of the Environment.
- Identify priority zones for habitat protection, restoration, and enhancement activities with a priority on areas affected by development.
- Protect, enhance, and maintain critical habitats from development and other land use threats.

Objective 8: Maintain or enhance neo-tropical migrant bird populations at current levels within present use areas and identify limiting factors for these populations within the subbasin.

Limiting Factors: Unknown

Strategies:
- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Identify limiting factors associated with different neo-tropical bird species.
- Identify priority zones, such as riparian, wetlands, and grasslands, for neo-tropical bird habitat protection, restoration, and enhancement activities.
- Protect, enhance, and maintain neo-tropical bird habitats.

- Augment existing broad-scale efforts to establish and analyze trends of neo-tropical birds through a system of breeding bird surveys.

Objective 9: Maintain or enhance amphibian and reptile populations at current levels within present use areas and identify limiting factors within the subbasin.

Limiting Factors: Unknown

Strategies:
- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Identify priority zones, such as riparian, wetlands, and grasslands, for amphibian and reptile habitat protection, restoration and enhancement activities.
- Protect, enhance, and maintain key amphibian and reptile habitats.

Objective 10: Maintain or enhance invertebrate populations at current levels within present use areas and identify limiting factors for these populations within the subbasin.

Limiting Factors: Unknown

Strategies:
- Determine distribution abundance, population trend, and limiting factors for these species based on reviews of literature, habitat modeling, and direct investigation.
- Identify and address limiting factors for invertebrates.

Goal 2: Protect, enhance, and restore native wildlife habitat function and performance to establish ecological security for native wildlife populations.

Objective 1: Restore the diversity, block size, and spatial arrangement of habitat types needed to sustain wildlife populations at ecologically sound levels.

Limiting Factors: Unknown. Major influences include hydropower operations, dike construction for flood control, agricultural draining, human development, livestock grazing, recreational activities, and forest management practices.

Strategies:
- Develop a consolidated habitat map for the subbasin, with special emphasis on wetland, riparian, old-growth, ponderosa pine, aspen, and white-bark pine communities. This may require searching existing databases, content, and researching knowledge gaps.
- Investigate and analyze historic losses of key habitat type, biological functions, and performance associated with changes in habitat diversity, block size, and spatial arrangement.
- Protect habitat through conservation easements, fee-title acquisition, long-term leases, and/or other landowner agreements.

- Coordinate efforts to develop comprehensive plans for protection, restoration, and enhancement of key habitat types in the subbasin.
- Cooperate and coordinate efforts to restore natural disturbance regimes in key habitats in the subbasin.
- Identify and address human impacts to key habitats and use adaptive management techniques to determine the best way to address those impacts.

Objective 2: Restore the connectivity of habitat types needed to sustain wildlife populations at the landscape level.

Limiting Factors: Unknown. Major impacts include human development, particularly adjacent to waterways; highway and railway activity, inundation of land, recreational activities, and forest management practices.

Strategies:

- Identify existing large-scale wildlife travel corridors in the subbasin and between subbasins.
- Secure management rights to travel corridors between blocks of habitat and across highways and railways.
- Construct overpasses, drift fences, and other structures to assist wildlife in crossing highway and railway obstacles.
- Secure management rights through conservation easements or fee-title acquisition to enhance habitat connectivity.

Research, Monitoring and Evaluation Activities

BPA Funded Research, Monitoring and Evaluation Activities

There are no BPA funded activities in the Priest River subbasin.

Non-BPA Funded Research, Monitoring and Evaluation Activities

Non-BPA funded activities include research by IDFG, funded by Sport Fish Restoration funds with matching funding from license and tag sales. Research has largely focused on bull trout, cutthroat trout, kokanee, and lake trout fisheries in Priest Lake and Upper Priest Lake. Some species abundance and distribution work was done on tributaries to the lakes and lower Priest River. Graduate students from the University of Idaho have investigated exotic species interactions with native trout and lake trout invasion of Upper Priest Lake through the Thorofare. Historic studies were completed on cutthroat trout and brook trout interactions in tributaries to Priest Lake. Funding from the USFWS through Section 6 of the ESA has focused on bull trout abundance and distribution in Upper Priest Lake and its tributaries and interactions with lake trout and brook trout. The USFS and IDL have conducted some fish population surveys associated with timber sale activities, but most of this work has been presence/absence surveys.

The Idaho Department of Environmental Quality (DEQ) is responsible for assessing waters of the state. The Clean Water Act and EPA regulations direct that the state monitor and assess the physical, chemical, and biological integrity of water bodies. To accomplish this, DEQ has developed the Beneficial Use Reconnaissance Project (BURP), and the Water Body Assessment

Guidance (WBAG) program. Waters identified as potentially impaired also undergo a more rigorous water quality Sub-basin Assessment that incorporates all available information and focuses on the cause and extent of impairments for development of a Total Maximum Daily Load (TMDL) if necessary.

The purpose of the BURP program is to consistently provide the physical, chemical, and biological data necessary to assess the integrity and quality of waters. It relies heavily on macroinvertebrate sampling, habitat evaluation and measurement, bacterial sampling, and fish sampling. The BURP protocol closely follows EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* (Plafkin et al. 1989). BURP data also documents existing uses, which must then be designated and protected under Idaho's water quality standards. It is the goal of the state to re-monitor water bodies on a rolling five year schedule.

The WBAG was designed to use BURP data to answer questions about stream integrity, water quality, and beneficial use support status. It originally consisted of multi-metric indexes for macroinvertibrates and habitat, qualitative and quantitative fisheries assessments, and evaluation of criteria exceedances. Assessments of BURP data collected from 1993 through 1996 were conducted to generate the 1998 list of impaired waters required under section 303(d) of the CWA. Revisions to the assessment methodology are currently underway that would allow the use of more types of data, revise the macroinvertebrate and habitat indexes, add a multi-metric fish index, revise the salmonid spawning beneficial use assessment, and add an interpretation of criteria exceedances in the assessments. The revised water body assessment methodology is expected to be completed in 2001 for use in the next 303(d) and 305(b) reporting cycles, and in ongoing TMDL subbasin assessments.

Statement of Fish and Wildlife Needs

Fisheries

- Gather additional information on exotic species abundance and distribution and tributary habitat condition to better define native species management options. Upper Priest Lake is well suited to the management of native trout and char due to its relative isolation (the lake is only accessible by boat or on foot) and relatively good tributary habitat conditions. However, expansion of brook trout in tributary streams and the colonization of Upper Priest Lake by lake trout threaten depressed bull trout and cutthroat trout populations.

- Remove exotic species.

- Define effective brook trout removal techniques and the funding to complete the job on priority tributaries.

- Identify the biological factors related to the feasibility of lake trout control in Upper Priest Lake. This needs to be joined with a fish passage engineering evaluation for the Thorofare to keep lake trout from entering Upper Priest Lake and eventual funding of a solution. Native fish restoration in the Upper Priest Lake watershed is the highest priority in the Priest River subbasin and could serve as a showcase for native species reclamation.

- Survey habitat restoration possibilities and prioritize where habitat restoration work would occur. Lake trout are much more firmly established in Priest Lake, both biologically and socially. Lake trout currently provide the only viable sport fishery, supporting most of the existing angler effort in Priest Lake. Tributary habitat conditions are considered degraded.

- Survey the distribution and abundance of brook trout before removal actions should be considered. Brook trout dominate most tributary streams. If habitat conditions are suitable, or if habitat could be restored, and if brook trout could successfully and permanently be excluded from priority streams, efforts to shift management away from lake trout and toward cutthroat trout and bull trout in Priest Lake would be made.

- Substantially and permanently reduce the lake trout population. Realistically, the lake trout fishery would need to be replaced with a harvest sport fishery because native cutthroat trout and bull trout are unlikely to provide any harvest opportunity. A kokanee fishery would provide the best hope of replacing the lake trout fishery with a fish that does not interfere with native fish management goals.

- Stock the lake with millions of kokanee fry to reestablish a kokanee population.

- Enhance shoreline kokanee spawning habitat so that kokanee become self-sustaining.

- Survey fish populations and habitat conditions in Priest River tributary streams to better define management options. Temperatures in Priest River appear to be too warm to support a year round trout fishery, possibly due to prioritizing Priest Lake summer pool management over instream flows in the Priest River. Solutions to providing better habitat conditions in the Priest River should be reconsidered.

- Investigate how Priest Lake Outlet Dam affects native fish connectivity. The dam is a fish passage barrier during portions of the year.

- Restore, protect, and maintain spawning and rearing habitat in tributary streams to improve survival of bull trout and westslope cutthroat trout.

- Conserve genetic diversity and provide opportunity for genetic exchange among local populations.

- Review operations of Albeni Falls Dam and Priest Lake Outlet Dam. When appropriate, provide recommendations through FERC relicensing process and/or federal consultation that minimize effects on fish, including fish passage, minimum flows, entrainment, stabilized flow regimes, and TDG.

- Complete westslope cutthroat trout and bull trout population inventories and habitat surveys in remaining unsurveyed tributaries to the Priest River subbasin. Identify limiting factors and threats to existence for native fish.

- Purchase critical watershed areas for protection and restoration of native fish species and their habitat.

- Improve conditions for spawning and rearing cutthroat and bull trout in the Priest River subbasin by reducing competition with brook trout.

- Determine stock status of game and non-game species within the Priest River subbasin.

- Minimize competition between lake trout and bull trout from Upper Priest Lake and by preventing reestablishment from Priest Lake by migration through the Thorofare.

Wildlife

- Construct a detailed, GIS-based wildlife habitat map for the entire subbasin. This includes providing personnel and equipment to search available databases for existing coverages, digitizing existing wildlife information currently not available as data layers, and identifying key habitat areas.

- Survey public attitudes during the subbasin assessment. Such human dimensions work is important to direct management priorities to achieve public acceptance and support.

- Research broad ecological relationships to identify limiting factors for focal species within the subbasin. Such animals include grizzly bears, aquatic predators, forest predators, mule deer, and mountain goats. Assess winter recreation impacts on lynx, wolverine, and ungulates.

- Establish techniques, surveys, and programs to assess the health and trend of wildlife and wildlife habitat in the subbasin.
  - Survey and map waterfowl use areas and winter distribution of ungulates. Initiate bird surveys across the subbasin.
  - Initiate assessment work for listed species or species likely to become listed as threatened or endangered by federal, state, or tribal governments. Existing wildlife management surveys are inadequate to assess distribution, establish abundance, or evaluate trends for most species at the subbasin level to allow BPA to evaluate progress towards goals stated in this summary.
- Protect known key habitats through conservation easement or fee-title acquisition, and implement enhancement activities such as burning transitional habitat for ungulates.

References

Anonymous. 1998. Black Bear Management Plan 2000 – 2015. Idaho Department of Fish and Game, Boise 83 pp.

Beecham, J. J. and J. Rohlman. 1994. A shadow in the forest, Idaho's black bear. Idaho Department of Fish and Game and the University of Idaho Press. Moscow. 245 pp.

Bergerud. 1978.

Bjornn, T. C. 1957. A survey of the fisheries resources of Priest and Upper Priest Lakes and their tributaries, Idaho. Idaho Department of Fish and Game, 1955-1957 Job Completion Report, F-24-R, Boise.

Bonner County. 1989. Priest Lake comprehensive plan, resource element. Bonner County Department of Planning, Sandpoint, Idaho.

Brandborg, S.M. 1955. Life History and Management of Mountain Goats in Idaho. Idaho Department of Fish and Game, Boise. 142 pp.

Buck, R. D. 1983. Earth Resources – Priest Lake area. *In*: Priest Lake preliminary environmental assessment. Prepared by Northwest Environmental Services for Diamond International Corp., Coeur d'Alene, Idaho, 274p.

Caughley and Sinclair. 1994.

Cowley, P. K. 1987. Potential for increasing abundance of cutthroat trout in streams by stocking fry and removal of brook trout. M.S. Thesis, University of Idaho, Moscow.

Davis, J. D., L. Nelson, and N. Horner. 2000. Regional Fisheries Management Investigations. Idaho Department of Fish and Game, 1994 Job Performance Report, F-71-R-19, Boise.

Dennis, B., P. L. Munholland and J. M. Scott. 1991. Estimation of growth and extinction parameters for endangered species. Ecological Monographs. 6:115-143.

Evans, H. Frank. 1960. A preliminary investigation of caribou in northwestern United States. M.S. Thesis, Montana State University, Missoula. 145 pp.

Finklin, A. I. 1983. Climate of Priest River Experimental Forest, Northern General Technical Report INT-159. U. S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah. 53p.

Flinn. 1956.

Fredenberg, W. 2000. Draft bull trout recovery plan for the Priest River basin. U. S. Fish and Wildlife Service, Kalispell, Montana.

Freddy, D. J. 1974. Status and management of the Selkirk caribou herd. M. S. Thesis. University of Idaho, Moscow. 132pp.

Fredericks, J., J. Davis, N. Horner and C. Corsi. 1997. Regional Fisheries Management Investigations. Idaho Department of Fish and Game, 1996 Job Performance Report, F-71-R-21, Boise.

Fredericks, J. 1999. Exotic fish species removal: Upper Priest and Lightning Creek drainages. Idaho Department of Fish and Game, Grant No. E-20, Segment No. 1, Boise.

Fredericks, J., M. Liter, N. Horner and C. Corsi. 2000. Regional fisheries management investigations. Idaho Department of Fish and Game, 1998 Job Performance Report, F-71-R-23, Boise (In Progress).

Fredericks, J. and J. Vernard. 2000. Bull trout exotic fish removal. Idaho Department of Fish and Game, 1999 Annual Performance Report, Project E-20-2, Boise.

Groves, C.R., B. Butterfield, A. Lippincott, B. Csuti, and J.M. Scott. 1997. Atlas of Idaho's Wildlife, integrating Gap Analysis and Natural Heritage Information. Idaho Department of Fish and Game, . Boise. 372 pp.

Hayden, J. and D. Spicer. 1995. White-tailed deer management – Panhandle. Pages 7 – 26 in White-tailed deer Surveys and Inventories. Idaho Department of Fish and Game, Pittman-Robinson Progress Report W-170-R-19. Boise. 65pp.

Horner, N. L. LaBolle and C. Robertson. 1987. Regional Fisheries Management Investigations. Idaho Department of Fish and Game, Job Performance Report, F-71-R-11, Boise.

Horner, N. 2000. Personal communication. Idaho Department of Fish and Game, Regional Fisheries Manager, Coeur d'Alene.

Hutto. 1995.

Idaho Department of Fish and Game. 1996. Fisheries Management Plan, 1996-2000. Boise.

Idaho Water Resources Board (IWRB). 1995. Comprehensive state water plan: Priest River Basin. Idaho Water Resource Board, Boise.

Irving, D. 1987. Cutthroat trout abundance, potential yield and interaction with brook trout in Priest Lake tributaries. M. S. Thesis, University of Idaho, Moscow.

Knick and Kasworm. 1989.

Mauser, G. 1986. Enhancement of trout in large north Idaho lakes. Idaho Department of Fish and Game, Job Performance Report, Project F-73-R-8, Boise.

Mauser, G., R. Vogelsang and C. Smith. 1988. Enhancement of trout in large north Idaho lakes. Idaho Department of Fish and Game, Job Performance Report, Project F-73-R-9, Boise.

McHale, D. P. 1995. Assessment of shoreline hydrology as related to wastewater disposal and land use practices at Priest Lake, Bonner County, Idaho. M. S. Thesis, University of Idaho, Moscow.

McLellan *et al.* 1999.

Miller, F. K. 1982. Preliminary geology map of the Priest Lake area. U. S. Department of the Interior, Geological Survey, Open-File Reports 82-1061, 82-1062 and 82-1063.

Milligan, J. H., R. A. Lyman, C. M. Falter, E. E. Krumpe and J. E. Carlson. 1983. Classification of Idaho's freshwater lakes. Idaho Water and Energy Resources Research Institute. University of Idaho, Moscow. 67p. plus appendices.

Mock. 1980.

Nussbaum *et al.* 1983.

Panhandle Bull Trout Technical Advisory Team (TAT). 1998a. Draft – Priest River Basin key watershed bull trout problem assessment. Idaho Department of Health and Welfare, Division of Environmental Quality, Coeur d'Alene.

Pauley. 1990.

Rieman, B. R., B. Bowler, J. Lukens and P. Hassemer. 1979. Priest Lake fishery investigation. Idaho Department of Fish and Game, Job Completion Report, Project F-73-R-1, Boise.

Rothrock, G. C. and D. T. Mosier. 1997. Phase 1 diagnostic analysis: Priest Lake – Bonner County, Idaho. Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, 199p.

Rothrock, G. C. 2000. Draft Priest River Subbasin Assessment. Idaho Department of Environmental Quality, Boise.

Ruediger *et al.* 2000.

Savage, C. N. 1965. Geologic history of Pend Oreille Lake region in north Idaho. Pamphlet 134, Idaho Bureau of Mines and Geology, Moscow.

Savage, C. N. 1967. Geology and mineral resources of Bonner County: County Report No. 6. Idaho Bureau of Mines and Geology, Moscow.

Secord. 1993.

Stebbins. 1985.

Stinson. 2000.

Strach and Bjornn. 1991.

Wakkinen, W. and B. K. Johnson. 2000. Selkirk Ecosystem Project. Idaho Department of Fish and Game, , Boise, . 37pp.

U.S. Fish and Wildlife Service. 1993. Grizzly bear recovery plan. Missoula, MT. 181 pp.

U.S. Forest Service. 1997. Priest Lake noxious weed control project. Final environmental impact statement. Idaho Panhandle National Forests. Bonner County, Idaho. 29pp.

Appendices

Appendix 1. Prioritized threats and their contributions to limiting bull trout populations in the Lake Pend Oreille Key Watershed

The first number indicates the priority of the threat and the number in parenthesis indicates what percent each threat is contributing to suppress the bull trout population. The high priority restoration watersheds have been ranked in order of probability of persistence (100 yr.) based upon redd count data. Lightning Creek and all its tributaries were evaluated as one watershed when assessing probability of persistence. In addition, probability of persistence was also evaluated independently for each tributary within the entire Lightning Creek Watershed.

Watershed name and rank based on highest probability of bull trout persistence	Priority for Restoration/ Protection	Habitat/ Watershed Condition	Potential to increase bull trout numbers	Threats									
				Timber Harvest	Roads	Agri-culture	Min-ing	Dams and Diver-sions	Urbaniza-tion/Recre-ation	Catastro-phic Fire	Fishing* Mortality	Exotic Species	Other **
Lake Pend Oreille 1	High	---	High	---	---	---	---	2(23)	4(10)	---	3(22)	1(45)	---
Trestle Creek 2	High	Good	Low	5(9)	3(12)	---	---	3(12)	1(55)	---	2(14)	---	---
Gold Creek 3	High	Fair	Low	4(5)	2(12)	---	1(70)	6(1)	6(1)	6(1)	5(4)	---	---
North Gold Creek 4	High	Good	Low	2(20)	4(2)	---	---	4(2)	1(60)	4(2)	3(13)	---	3(6) powerline
Granite Creek 5	High	Fair	Med	2(20)	2(20)	---	---	7(2)	1(43)	---	4(8)	5(4)	---
E. F. Lightning Creek 6-1	High	Poor	High	2(38)	1(40)	---	---	---	---	---	3(17)	4(5)	6(3) kok trap
Char Creek 6-2	High	Poor	High	2(28)	1(55)	---	---	---	---	---	3(17)	---	---
Willington Creek 6-3	High	Fair	High	2(25)	1(60)	---	---	---	---	---	3(10)	4(5)	---
Rattle Creek 6-4	High	Fair	High	2(20)	1(70)	---	---	---	---	---	3(10)	---	---
Lightning Creek 6-5	High	Poor	High	2(25)	1(55)	---	---	---	5(1)	---	3(14)	4(5)	---
Porcupine Creek 6-6	High	Poor	High	3(15)	1(40)	---	---	---	---	---	4(10)	1(40)	---
Savage Creek 6-7	High	Poor	High	2(27)	1(53)	---	---	---	---	---	4(5)	4(5)	---
Grouse Creek 7	High	Poor	High	1(31)	3(14)	4(13)	---	7(2)	2(24)	---	6(5)	5(11)	---
Johnson Creek 8	High	Fair	Med	2(30)	1(45)	---	---	3(13)	---	---	4(10)	5(2)	---
Pack River 9	High	Poor	High	3(12)	2(18)	3(12)	---		1(22)	3(12)	3(12)	3(12)	---
Twin Creek 10	Hi gh	Poor	Med	4(10)	2(15)	1(50)	---	---	---	---	4(10)	2(15)	---
Clark Fork River 11	High	Poor	High	5(1)	5(1)		---	1(91)	2(2)	---	2(2)	2(2)	---
Strong Creek 12	High	Good	High	3(10)	4(5)	---	---	1(65)	2(20)	---	---	---	---
West Fork Blue Creek	Medium	Good	?	3(1)	---	---	---	1(95)	---	3(1)	---	2(3)	---
Rapid Lightning Creek	Medium	Poor	?	4(10)	2(23)	5(7)	---	---	1(43)	---	---	3(17)	---
Spring Creek	Medium	Fair	?	6(5)	1(35)	---	---	2(20)	5(10)	---	---	3(15)	3(15)
Hell Roaring Creek	Medium	Poor	?	4(8)	3(15)	---	---	1(42)	2(30	---	---	5(5)	---
McCormick Creek	Medium	Poor	?	3(17)	2(20)	---	---	---	---	1(60)	---	---	4(3)

* Fishing mortality includes bull trout killed through illegal harvest and through catch and release practices

** See text for details on the type of threat that is occurring

Appendix 2. ESA listed plant species in the Lower Pend Oreille subbasin

Washington Natural Heritage Information System
Endangered, Threatened, and Sensitive Vascular Plants of Washington
January 1999
Pend Oreille County

Scientific Name	Common Name	State Status	Federal Status*	Historic Record**
Antennaria corymbosa	Meadow pussy-toes	Sensitive		
Astragalus microcystis	Least bladdery milk-vetch	Sensitive		
Botrychium ascendens	Triangular-lobed moonwort	Sensitive	SC	
Botrychium crenulatum	Crenulate moonwort	Sensitive	SC	
Botrychium lanceolatum	Lance-leaved grape-fern	Sensitive		
Botrychium minganense	Victorin's grape-fern	Review		
Botrychium paradoxum	Two-spiked moonwor	Sensitive	SC	
Botrychium pedunculosum	Stalked moonwort	Sensitive	SC	
Botrychium pinnatum	St. john's moonwort	Sensitive		
Botrychium simplex	Little grape-fern	Sensitive		
Carex buxbaumii	Buxbaum's sedge	Sensitive		
Carex comosa	Bristly sedge	Sensitive		
Carex flava	Yellow sedge	Sensitive		
Carex foenea	Bronze sedge	Sensitive		
Carex magellanica ssp irrigua	Poor sedge	Sensitive		
Carex rostrata	Beaked sedge	Sensitive		
Carex sychnocephala	Many-headed sedge	Sensitive		H
Cicuta bulbifera	Bulb-bearing water-hemlock	Sensitive		
Corydalis aurea	Golden corydalis	Review		H
Cryptogramma stelleri	Steller's rockbrake	Sensitive		H
Dryas drummondii	Yellow mountain-avens	Sensitive		
Dryopteris cristata	Crested shield-fern	Sensitive		
Eriophorum viridicarinatum	Green keeled cotton-grass	Sensitive		
Gaultheria hispidula	Creeping snowberry	Sensitive		
Geum rivale	Water avens	Sensitive		
Hypericum majus	Canadian st. john's-wort	Sensitive		H
Impatiens aurella	Orange balsam	Review		
Listera borealis	Northern twayblade	Sensitive		
Lycopodium dendroideum	Treelike clubmoss	Sensitive		
Muhlenbergia glomerata	Marsh muhly	Sensitive		
Salix candida	Hoary willow	Sensitive		
Salix maccalliana	Maccall's willow	Sensitive		
Sanicula marilandica	Black snake-root	Sensitive		
Sisyrinchium septentrionale	Blue-eyed grass	Sensitive		
Spartina pectinata	Prairie cordgrass	Sensitive		
Thalictrum dasycarpum	Purple meadowrue	Sensitive		
Utricularia intermedia	Flat-leaved bladderwort	Sensitive		
Utricularia minor	Lesser bladderwort	Review		

* LE = Listed Endangered, LT = Listed Threatened, PE = Proposed Endangered, PT = Proposed Threatened, C = Candidate for listing, SC = Species of Concern (an unofficial status)
** H = Known only from historic record

Appendix 3. Wildlife species occurrence and status for Lower Pend Oreille subbasin

Common Name	Population Status
American Badger	Stable
American Beaver	Stable
American Bittern	Unknown
American Coot	Unknown
American Crow	Increasing
American Dipper	Unknown
American Goldfinch	Stable
American Kestrel	Stable
American Marten	Decreasing
American Pika	Unknown
American Redstart	Unknown
American Robin	Stable
American Wigeon	Stable
Baird's Sandpiper	Unknown
Bank Swallow	Stable
Barn Swallow	Decreasing
Barred Owl	Increasing
Barrow's Goldeneye	Stable
Belted Kingfisher	Stable
Big Brown Bat	Stable
Black Bear	Increasing
Black Tern	Unknown
Black-backed Woodpecker	Unknown
Black-billed Magpie	Stable
Black-capped Chickadee	Stable
Black-chinned Hummingbird	Unknown
Black-headed Grosbeak	Increasing
Blue Grouse	Decreasing
Bobcat	Stable
Bobolink	Decreasing
Bohemian Waxwing	Unknown
Boreal Chickadee	Unknown
Boreal Owl	Unknown
Brewer's Blackbird	Decreasing
Brown Creeper	Unknown
Brown-headed Cowbird	Unknown
Bullfrog	Increasing
Bullock's Oriole	Stable
Bushy-tailed Woodrat	Stable
California Bighorn Sheep	Stable
California Myotis	Unknown
California Quail	Stable
Calliope Hummingbird	Decreasing
Cassin's Finch	Stable
Cassin's Vireo	Unknown
Cedar Waxwing	Stable

Chestnut-backed Chickadee	Stable
Chipping Sparrow	Decreasing
Cinnamon Teal	Stable
Clark's Nutcracker	Unknown
Cliff Swallow	Unknown
Columbia Spotted Frog	Unknown
Columbian Ground Squirrel	Stable
Columbian White-tailed Deer	Unknown
Common Garter Snake	Stable
Common Loon	Stable
Common Merganser	Stable
Common Nighthawk	Decreasing
Common Porcupine	Decreasing
Common Raven	Stable
Common Redpoll	Unknown
Common Snipe	Unknown
Common Yellowthroat	Increasing
Cooper's Hawk	Unknown
Cordilleran Flycatcher	Unknown
Coyote	Stable
Dark-eyed Junco	Unknown
Deer Mouse	Stable
Double-crested Cormorant	Increasing
Downy Woodpecker	Unknown
Dusky Flycatcher	Unknown
Eastern Kingbird	Stable
Ermine	Unknown
European Starling	Decreasing
Evening Grosbeak	Unknown
Fisher	Unknown
Flammulated Owl	Unknown
Fox Sparrow	Unknown
Fringed Myotis	Unknown
Golden-crowned Kinglet	Unknown
Golden-mantled Ground Squirrel	Stable
Gopher Snake	Stable
Gray Catbird	Unknown
Gray Jay	Stable
Gray Wolf	Unknown
Great Blue Heron	Unknown
Great Horned Owl	Stable
Greater Scaup	Unknown
Greater Yellowlegs	Unknown
Green-winged Teal	Unknown
Grizzly Bear	Decreasing
Hairy Woodpecker	Stable
Hammond's Flycatcher	Unknown
Harlequin Duck	Unknown
Heather Vole	Stable
Hermit Thrush	Unknown
Hoary Bat	Unknown

Hoary Marmot	Unknown
Hooded Merganser	Unknown
House Finch	Unknown
House Mouse	Increasing
House Sparrow	Decreasing
House Wren	Increasing
Killdeer	Unknown
Lazuli Bunting	Stable
Least Sandpiper	Unknown
Lesser Yellowlegs	Unknown
Lewis's Woodpecker	Unknown
Lincoln's Sparrow	Unknown
Little Brown Myotis	Stable
Long-billed Dowitcher	Unknown
Long-eared Myotis	Decreasing
Long-legged Myotis	Unknown
Long-tailed Vole	Stable
Long-tailed Weasel	Stable
Long-toed Salamander	Stable
Lynx	Decreasing
Macgillivray's Warbler	Stable
Mallard	Stable
Marsh Wren	Unknown
Masked Shrew	Stable
Meadow Vole	Unknown
Mink	Stable
Montane Shrew	Stable
Montane Vole	Stable
Moose	Increasing
Mountain Bluebird	Increasing
Mountain Caribou	Decreasing
Mountain Chickadee	Stable
Mountain Goat	Decreasing
Mountain Lion	Increasing
Mourning Dove	Decreasing
Mule Deer	Decreasing
Muskrat	Stable
Nashville Warbler	Unknown
Northern Alligator Lizard	Unknown
Northern Bog Lemming	Unknown
Northern Flicker	Stable
Northern Flying Squirrel	Stable
Northern Goshawk	Unknown
Northern Leopard Frog	Decreasing
Northern Pocket Gopher	Stable
Northern Pygmy-owl	Unknown
Northern River Otter	Unknown
Northern Rough-winged Swallow	Stable
Northern Saw-whet Owl	Stable
Northern Shoveler	Stable
Northern Shrike	Stable

Northern Waterthrush	Unknown
Northwestern Crow	Unknown
Olive-sided Flycatcher	Decreasing
Orange-crowned Warbler	Unknown
Osprey	Increasing
Pacific Chorus (Tree) Frog	Stable
Pacific-slope Flycatcher	Stable
Painted Turtle	Stable
Pectoral Sandpiper	Unknown
Pied-billed Grebe	Unknown
Pileated Woodpecker	Unknown
Pine Grosbeak	Unknown
Pine Siskin	Unknown
Pygmy Nuthatch	Unknown
Pygmy Shrew	Stable
Raccoon	Stable
Racer	Stable
Red Crossbill	Unknown
Red Fox	Stable
Red Squirrel	Stable
Red-breasted Nuthatch	Stable
Red-eyed Vireo	Stable
Red-naped Sapsucker	Unknown
Red-necked Grebe	Stable
Red-necked Phalarope	Unknown
Red-tailed Chipmunk	Unknown
Red-tailed Hawk	Increasing
Red-winged Blackbird	Stable
Ring-necked Duck	Stable
Ring-necked Pheasant	Decreasing
Rock Dove	Stable
Rocky Mountain Bighorn Sheep	Decreasing
Rocky Mountain Elk	Stable
Roosevelt Elk	Stable
Rough-legged Hawk	Unknown
Rubber Boa	Stable
Ruby-crowned Kinglet	Stable
Ruddy Duck	Stable
Ruffed Grouse	Stable
Rufous Hummingbird	Decreasing
Savannah Sparrow	Stable
Semipalmated Sandpiper	Stable
Sharp-shinned Hawk	Unknown
Silver-haired Bat	Stable
Snowshoe Hare	Stable
Solitary Sandpiper	Unknown
Song Sparrow	Stable
Sora	Unknown
Southern Red-backed Vole	Stable
Spotted Sandpiper	Unknown
Spotted Towhee	Unknown

Spruce Grouse	Decreasing
Steller's Jay	Unknown
Stilt Sandpiper	Unknown
Striped Skunk	Stable
Swainson's Thrush	Unknown
Three-toed Woodpecker	Unknown
Townsend's Big-eared Bat	Decreasing
Townsend's Solitaire	Increasing
Townsend's Warbler	Stable
Tree Swallow	Stable
Turkey Vulture	Stable
Vagrant Shrew	Stable
Varied Thrush	Unknown
Vaux's Swift	Unknown
Veery	Stable
Vesper Sparrow	Stable
Violet-green Swallow	Stable
Virginia Rail	Unknown
Warbling Vireo	Unknown
Water Shrew	Stable
Water Vole	Decreasing
Western Bluebird	Unknown
Western Jumping Mouse	Stable
Western Kingbird	Stable
Western Meadowlark	Decreasing
Western Sandpiper	Unknown
Western Screech-owl	Stable
Western Skink	Stable
Western Tanager	Unknown
Western Terrestrial Garter Snake	Stable
Western Toad	Unknown
Western Wood-pewee	Increasing
White-breasted Nuthatch	Unknown
White-crowned Sparrow	Unknown
White-tailed Deer (Eastside)	Increasing
White-winged Crossbill	Unknown
Willow Flycatcher	Unknown
Wilson's Phalarope	Unknown
Wilson's Warbler	Unknown
Winter Wren	Unknown
Wolverine	Unknown
Wood Duck	Stable
Yellow Warbler	Decreasing
Yellow-bellied Marmot	Stable
Yellow-headed Blackbird	Stable
Yellow-pine Chipmunk	Stable
Yellow-rumped Warbler	Stable
Yuma Myotis	Stable

Appendix 4. Species list of wildlife in the Priest River subbasin

Common Name	Scientific Name	Habitat	Successional Stage
Native Amphibians			
Long-toed Salamander	*Ambystoma macrodactylum*	LF	(e,s,p,em,m,og) wf
Tiger Salamander	*Ambystoma tigrinum*	LRWFA	(e,s,p,em,m,og) wf
Coeur d'Alene Salamander	*Plethodon idahoensis*	RW	
Idaho Giant Salamander	*Dicamptodon aterrimus*	LRF	(em,m,og) wf
Tailed Frog	*Ascaphus truei*	RF	(em,m,og) wf
Western Toad	*Bufo boreas*	LRWF	(e,s,p) wf
Pacific Chorus	*Pseudacris regilla*	WFA	(e,s,p,em,m,og) wf
Spotted Frog	*Rana pretiosa*	LRWF	(e,s,p,em,m,og) wf
Pacific Tree Frog	*Hyla regilla*	LRWF	(e,s,p,em,m,og) wf
Introduced Amphibians			
Bull Frog	*Rana catesbeiana*	L	
Native Reptiles			
Painted Turtle	*Chrysemys picta*	LRW	
Northern Alligator Lizard	*Elgaria coerulea*	RF	(e,s,p,em,m,og) df
Western Skink	*Eumeces skiltonianus*	RF	(e,s,p,em,m,og) df
Rubber Boa	*Charina bottae*	WF	(e,s,p,em,m,og) df
Racer	*Coluber constrictor*	WFA	(e,s)
Western Terrestrial Garter Snake	*Thamnophis elegans*	WA	
Common Garter Snake	*Thamnophis sirtalis*	WFA	(e,s,p,em,m,og) wf
Native Birds			
Pied-billed Grebe	*Podilymbus podiceps*	LW	
Red-necked Grebe	*Podiceps grisegena*	LRW	
American Bittern	*Botaurus lentiginosus*	LRW	
Great Blue Heron	*Ardea herodias*	LRW	
Canadian Goose	*Branta canadensis*	LRWA	
Wood Duck	*Aix sponsa*	LRW	
Green-winged Teal	*Anas crecca*	LRW	
Mallard	*Anas platyrhynchos*	LRWA	
Northern Pintail	*Anas acuta*	LRWA	
Blue-winged Teal	*Anas discors*	LRW	
Cinnamon Teal	*Anas cyanoptera*	LRW	
Northern Shoveler	*Anas clypeata*	LRW	
Gadwall	*Anas stepera*	LRW	
American Wigeon	*Anas americana*	LW	
Redhead	*Aythya americana*	LRW	
Harlequin Duck	*Histrionicus histrionicus*	R	
Hooded Merganser	*Lophodytes cucullatus*	LRW	
Common Merganser	*Mergus merganser*	LRW	
Turkey Vulture	*Cathartes aura*	F	(e,s,p,em,m,og)
Osprey	*Pandion haliaetus*	W	
Northern Harrier	*Circus cyaneus*	WA	
Sharp-shinned Hawk	*Accipiter striatus*	F	(p,em,m,og)
Cooper's Hawk	*Accipiter cooperii*	F	(m,og)
Northern Goshawk	*Accipiter gentilis*	WFA	(m,og)
Red-tailed Hawk	*Buteo jamaicensis*	FA	(e,s,p,em,m,og)
Swainson's Hawk	*Buteo swainsoni*	FA	e,s

American Kestrel	*Falco sparverius*	WFA	e,s
Spruce Grouse	*Dendragapus canadensis*	F	em,m,og
Blue Grouse	*Dendragapus obscurus*	F	em,m
Ruffed Grouse	*Bonasa umbellus*	W	em,m
Virginia Rail	*Rallus limicola*	W	
Sora	*Porzana carolina*	LRW	
American Coot	*Fulica americana*	W	
Sandhill Crane	*Grus canadensis*	LRWA	
Killdeer	*Charadrius vociferus*	LW	
Spotted Sandpiper	*Actitis macularia*	W	
Common Snipe	*Gallinago gallinago*	LRW	
Black Tern	*Chlidonias niger*	LRW	
Mourning Dove	*Zenaida macroura*	FA	e,s,p,em
Common Barn-owl	*Tyto alba*	A	
Western Screech Owl	*Otus kennicottii*	WF	e,s,p
Great Horned Owl	*Bubo virginianus*	WFA	e,s,p,em,m,og
Northern Pygmy-owl	*Glaucidium gnoma*	F	em,m,og
Barred Owl	*Strix varia*	WF	em,m,og
Great GrayOwl	*Strix nebulosa*	WFA	em,m,og
Long-eared Owl	*Asio otus*	WFA	e,s,p,em,m,og
Short-eared Owl	*Asio flammeus*	WA	
Northern Saw-whet Owl	*Aegolius acadicus*	WF	p,em,m,og
Common Nighthawk	*Chordeiles minor*	FA	e,s,p,em,m,og
Vaux's Swift	*Chaetura vauxi*	FW	em,m,og
Black-chinned Hummingbird	*Archilochus alexandri*	WF	e,s,p,em
Calliope Hummingbird	*Stellula calliope*	WF	s,p,em,m,og
Rufous Hummingbird	*Selasphorus rufus*	F	s,p,em,m,og
Belted Kingfisher	*Ceryle alcyon*	LRS	
Lewis' Woodpecker	*Melanerpes lewis*	WF	p,em,m,og
Red-naped Sapsucker	*Sphyrapicus nuchalis*	F	em,m,og
Downy Woodpecker	*Picoides pubescens*	WF	em,m,og
Hairy Woodpecker	*Picoides villosus*	WF	em,m,og
White-headed Woodpecker	*Picoides albolarvatus*	F	m,og
Northern Flicker	*Colaptes auratus*	WF	m,og
Pileated Woodpecker	*Dryocopus pileatus*	F	m,og
Olive-sided Flycatcher	*Contopus borealis*	WF	m,og
Western wood-pewee	*Contopus sordidulus*	WF	m,og
Willow Flycatcher	*Empidonax traillii*	WF	e,s,p,em,m,og
Hammond's Flycatcher	*Empidonax hammondii*	F	m,og
Dusky Flycatcher	*Empidonax oberholseri*	WF	e,s,p,em
Cordilleran Flycatcher	*Empidonax occidentalis*	F	p,em,m,og
Say's Phoebe	*Sayornis saya*	A	
Western Kingbird	*Tyrannus verticalis*	A	
Eastern Kingbird	*Tyrannus tyrannus*	WFA	e,s,p,em,m
Horned Lark	*Eremophila alpestris*	A	
Tree Swallow	*Tachycineta bicolor*	WA	
Violet-green Swallow	*Tachycineta thalassina*	WFA	p,em,m
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	W	
Bank Swallow	*Riparia riparia*	W	
Cliff Swallow	*Hirundo pyrrhonota*	W	
Barn Swallow	*Hirundo rustica*	WA	
Gray Jay	*Perisoreus canadensis*	WF	e,s,p,em,m,og
Steller's Jay	*Cyanocitta stelleri*	F	e,s,p,em,m,og
Black-billed Magpie	*Pica pica*	WFA	e,s
American Crow	*Corvus brachyrhynchos*	WA	
Common Raven	*Corvus corax*	FA	e,s,p,em,m,og

Black-capped Chickadee	*Parus atricapillus*	F	em,m,og
Mountain Chickadee	*Parus gambeli*	WF	p,em,m,og
Chestnut-backed Chickadee	*Parus rufescens*	F	m,og
Red-breasted Nuthatch	*Sitta canadensis*	WF	em,m,og
Brown Creeper	*Certhia americana*	WF	m,og
House Wren	*Troglodytes aedon*	FA	e,s,p,em
Winter Wren	*Troglodytes troglodytes*	F	m,og
American Dipper	*Cinclus mexicanus*	WF	riparian deciduous
Golden-crowned Kinglet	*Regulus satrapa*	F	m,og
Ruby-crowned Kinglet	*Regulus calendula*	FA	em,m,og
Western Bluebird	*Sialia mexicana*	WA	riparian deciduous
Mountain Bluebird	*Sialia currucoides*	FA	e,s,p,em
Townsend's Solitaire	*Myadestes townsendi*	WF	p,em,m
Veery	*Catharus fuscescens*	W	
Swainson's Thrush	*Swainson's Thrush*	F	e,s,p,em
Hermit Thrush	*Catharus guttatus*	WF	m,og
American Robin	*Turdus migratorius*	WFA	e,s,p,em,m
Varied Thrush	*Ixoreus naevius*	F	m,og
Gray Catbird	*Dumetella carolinensis*	WF	riparian deciduous
Cedar Waxwing	*Bombycilla cedrorum*	WF	e,s,p,em
Plumbeus Vireo	*Vireo plumbeus*	F	e,s,p,em
Warbling Vireo	*Vireo gilvus*	F	riparian deciduous
Red-eyed Vireo	*Vireo olivaceus*	WF	riparian deciduous
Orange-crowned Warbler	*Vermivora celata*	WFA	e,s,p,em
Nashville Warbler	*Vermivora ruficapilla*	WF	e,s,p,em,m,og
Yellow Warbler	*Dendroica petechia*	WFA	riparian deciduous
Yellow-rumped Warbler	*Dendroica coronata*	FA	e,s,p,em
Townsend's Warbler	*Dendroica townsenddi*	F	em,m,og
American Redstart	*Setophaga ruticilla*	FA	riparian deciduous
Northern Waterthrush	*Seiurus noveboracensis*	WF	riparian deciduous
MacGillivray's Warbler	*Oporornis tolmiei*	WF	e,s,p,em
Common Yellowthroat	*Geothlypis trichas*	WF	riparian diciduous
Wilson's Warbler	*Wilsonia pusilla*	WF	p,em,m,og
Yellow-breasted Chat	*Icteria virens*	WFA	riparian deciduous
Western Tanager	*Piranga ludoviciana*	F	e,s,p,em,m,og
Black-headed Grosbeak	*Pheucticus melanocephalus*	WF	e,s,p,em
Lazuli Bunting	*Passerina amoena*	WF	e,s,p
Spotted Towhee	*Pipilo maculatus*	WF	e,s,p,em
Chipping Sparrow	*Spizella passerina*	WFA	s,p,em
Lark Sparrow	*Chondestes grammacus*	A	
Grasshopper Sparrow	*Ammodramus savannarum*	A	
Fox Sparrow	*Passerella iliaca*	WF	e,s,p,em
Song Sparrow	*Melospiza melodia*	WF	riparian deciduous
Lincoln's sparrow	*Melospiza lincolnii*	WF	e,s,p
Dark-eyed Junco	*Junco hyemalis*	FA	e,s,p,em,m,og
Bobolink	*Dolichonyx oryzivorus*	WA	
Red-winged Blackbird	*Agelaius phoeniceus*	WA	
Western Meadowlark	*Sturnella neglecta*	A	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	WA	
Brewer's Blackbird	*Euphagus cyanocephalus*	WA	
Brown-headed Cowbird	*Molothrus ater*	FA	e,s,p,em,m,og
Bullock's Oriole	*Icterus bullockii*	WFA	riparian deciduous
Cassin's Finch	*Carpodacus cassinii*	F	e,s,p,em,m,og
House Finch	*Carpodacus mexicanus*	FA	urban woodlands
Red Crossbill	*Loxia curvirostra*	F	e,s,p,em,m,og
Pine Siskin	*Carduelis pinus*	FA	e,s,p,em,m,og

American Goldfinch	*Carduelis tristis*	WFA	e,s,p,em
Evening Grosbeak	*Coccothraustes vespertinus*	F	e,s,p,em,m,og
Introduced Game Birds			
Wild Turkey	*Meleagris gallopavo*	FA	e,s,p,em
Native Mammals			
Masked Shrew	*Sorex cinereus*	F	e,s,p,em,m,og
Vagrant Shrew	*Sorex vagrans*	WF	e,s,p,em,m,og
Dusky Shrew	*Sorex monticolus*	WF	e,s,p,em,m,og
Water Shrew	*Sorex palustris*	W	
Little Brown Myotis	*Myotis lucifugus*	F	m,og
Yuma Myotis	*Myotis yumanensis*	WF	e,s,p,em,m,og
Long-eared Myotis	*Myotis evotis*	WF	e,s,p,em,m,og
Long-legged Myotis	*Myotis volans*	F	em,m,og
Silver-haired Bat	*Lasionycteris noctevagans*	WF	em,m,og
Big Brown Bat	*Eptesicus fuscus*	F	em,m,og
Hoary Bat	*Lasiurus cinereus*	F	em,m,og
Townsend's Big-eared Bat	*Plecotus townsendii*	F	e,s,p,em,m,og
American Pika	*Ochotona princeps*	talus/meadow	
Snowshoe Hare	*Lepus americanus*	WF	p,em,m,og
Yellow Pine Chipmunk	*Tamias amoenus*	F	e,s,p,em,m
Red-tailed Chipmunk	*Tamias ruficaudus*	F	em,m,og
Yellow-bellied Marmot	*Marmota flaviventris*	talus/rock	
Columbia Ground Squirrel	*Spermophilus columbianus*	WF	e,s,p,em
Golden-mantled Ground Squirrel	*Spermophilus lateralis*	F	e,s,p,em
Red Squirrel	*Tamiasciurus hudsonicus*	WF	p,em,m,og
Northern Flying Squirrel	*Glaucomys sabrinus*	WF	em,m,og
Northern Pocket Gopher	*Thomomys talpoides*	WA	
American Beaver	*Castor canadensis*	RWF	e,s,p,em,m,og
Deer Mouse	*Peromyscus maniculatus*	WFA	e,s,p,em,m,og
Bushy-tailed Woodrat	*Neotoma cinerea*	F	em,m,og
Southern Red-backed Vole	*Clethrionomys gapperi*	F	em,m,og
Heather Vole	*Phenacomys intermedius*	F	e,s,p,em,m,og
Meadow Vole	*Microtus pennsylvanicus*	WA	
Montane Vole	*Microtus montanus*	WA	
Long-tailed Vole	*Microtus longicaudus*	WF	e,s,p,em,m,og
Water Vole	*Microtus richardsoni*	WF	
Muskrat	*Ondatra zibethicus*	LRW	
Western Jumping Mouse	*Zapus princeps*	WF	e,s,p,em
Common Porcupine	*Erethizon dorsatum*	WF	p,em,m,og
Coyote	*Canis latrans*	F	e,s,p,em,m,og
Gray Wolf	*Canis lupus*	F	e,s,p,em,m,og
Red fox	*Vulpes vulpes*	FA	e,s
Black Bear	*Ursus americanus*	F	e,s,p,em
Grizzly or Brown Bear	*Ursus arctos*	F	e,s,p,em
Common Raccoon	*Procyon lotor*	W	
American Marten	*Martes americana*	F	em,m,og
Fisher	*Martes pennanti*	F	m,og
Ermine	*Mustela erminea*	WF	e,s,p,em,m,og
Long-tailed Weasel	*Mustela frenata*	WF	e,s,p,em,m,og
Mink	*Mustela vison*	WF	riparian
Wolverine	*Gulo gulo*	F	e,s,p,em,m,og
Northern Bog Lemming	*Synaptomys borealis*		
American Badger	*Taxidea taxus*	FA	e,s
Western Spotted Skunk	*Spilogale gracilis*	A	

Striped Skunk	*Mephitis mephitis*	WFA	e,s,p,em
Northern River Otter	*Lutra canadensis*	LRW	
Mountain Lion	*Felis concolor*	F	e,s,p,em,m,og
Lynx	*Lynx lynx*	WF	e,s,p,em,m,og
Bobcat	*Lynx rufus*	WF	e,s,p,em,m,og
Elk	*Cervus elaphus*	WF	e,s,p,em
Mule Deer	*Odocoileus hemionus*	FA	e,s,p,em
White-tailed Deer	*Odocoileus virginianus*	WFA	e,s,p,em
Moose	*Alces alces*	WF	e,s,p,em
Woodland Caribou	*Rangifer tarandus*	FW	m,og

Habitat: L = Lakes, R = Rivers and Streams, W = Wetlands, F = Forest Land, A = Agricultural