Draft

Lake Roosevelt Subbasin Summary

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Prepared for the
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Subbasin Description

General Location

Lake Roosevelt Subbasin (Figure 1) is located in northwest Washington and refers to the section of the Columbia River mainstem that is bound by Grand Coulee Dam (river mile (RM) 596.6) and extends to the Canadian Border as well as the tributaries to the reservoir and adjacent closed basin lakes.

Drainage Area

The 74,000 square mile subbasin includes waters within the Colville and Spokane Indian Reservations, and Stevens, Spokane, Lincoln, Ferry, Okanogan, and Grant counties in Washington (Delorme 1988). Included in the subbasin is the lower 29 miles of the Spokane River (below Little Falls Dam), the Colville Watershed, Kettle River Watershed, Banks Lake, and Moses Lake.

The Lake Roosevelt subbasin incorporates the following five Water Resource Inventory Areas (WRIA) as designated by Washington Department of Ecology (WDOE):

1. WRIA 53 Lower Lake Roosevelt
2. WRIA 58 Middle Lake Roosevelt
3. WRIA 59 Colville
4. WRIA 60 Kettle
5. WRIA 61 Upper Lake Roosevelt

Lake Roosevelt

Grand Coulee Dam regulates Lake Roosevelt water levels between 1,208 msle (minimum pool) to 1,290 msle (full pool). At full pool, the reservoir is 151 miles long, covers 82,300 acres, and stores approximately 9,562,000 acre-ft of water. When the reservoir was initially filled to full pool, over 70,000 acres of land was inundated (Merker 1993). The watershed area that comprises the subbasin is approximately 2,411 square miles and includes 226 tributaries to the Reservoir (excluding the Spokane River Basin, Sanpoil River Basin, Colville River Basin and Kettle River Basin).

Banks Lake/Moses Lake

Banks Lake and Moses Lake are hydrologically outside of the Lake Roosevelt Subbasin boundaries, however they are administratively included in the subbasin for two main reasons: 1.) The water source for these lakes is Lake Roosevelt and 2.) Fisheries projects on these lakes are partial substitution for lost anadromous fish due to construction of Grand Coulee Dam. Only the respective lakes are included in the subbasin, not associated watersheds. Banks Lake currently covers 27,000 acres and inundates 91 miles of shoreline. Moses Lake currently covers 6,800 acres, inundates 120 miles of shoreline, and is 16 miles long.

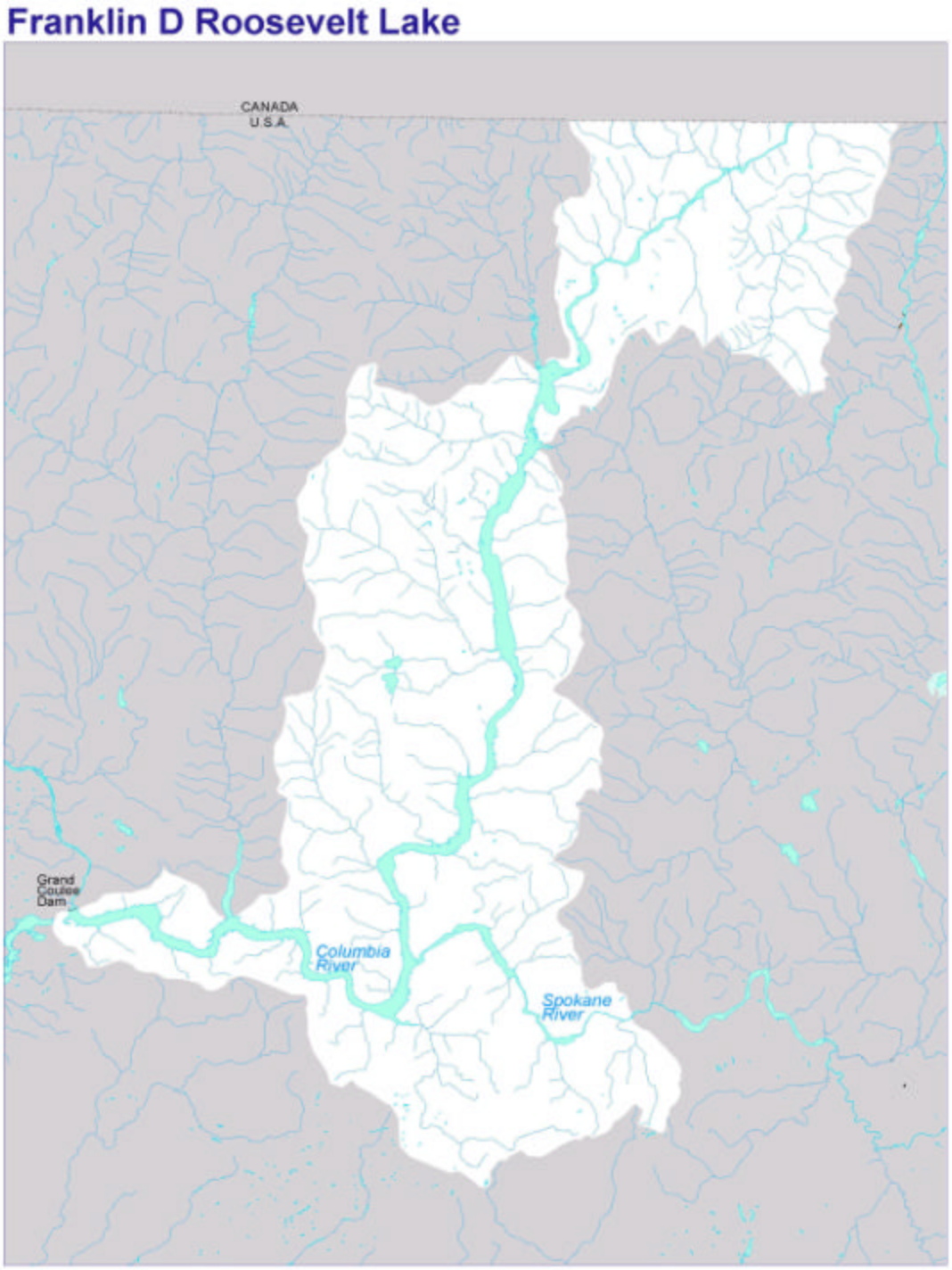

Figure 1. Lake Roosevelt watershed excluding the Sanpoil Basin, Spokane Basin, Kettle Basin, and Colville Basin

Kettle River

The Kettle River winds its way through the Okanogan Mountains of Washington and British Columbia in an easterly direction, turning south and entering Washington at Laurier. From Laurier it flows south and joins Lake Roosevelt at RM 706. The Kettle River drains an area of 948 square miles and has a mean annual flow of 12,000 cubic feet per second (EPA 2000). A waterfall at RM 25 was a natural migration barrier to anadromous fish and is currently a migration barrier to adfluvial resident fish.

Colville River

The Colville River, which flows south through a wide valley dominated by agriculture practices, enters Lake Roosevelt at RM 699.5, just south of Kettle Falls. The Colville drains an area of 1,010 square miles with a mean annual flow of 429 cubic feet per second (EPA 2000). As a result of agriculture land uses, the aquatic and riparian habitat has been severely impacted. Meyers Falls at approximately RM 4 was a barrier to migrating anadromous fish and is currently a barrier to adfluvial resident fish species. The Colville has two main population centers on it, Chewelah and Colville, Washington.

Climate

The subbasin has a continental climate that is influenced by maritime air masses from the Pacific coast. The average annual temperature is 45 F, with July being the warmest month and January being the coldest. The annual precipitation for the area is 18 inches with approximately 46 inches of snowfall. (Weather underground 2000)

Topography/geomorphological (Geology/Soils)

The Lake Roosevelt Subbasin lies on four geologic provinces. The first is the old North American continent, comprising most of the Colville watershed. It is the oldest geologic province and is represented by a small part of the Rocky Mountains in the northeast corner of Washington (Alt and Hyndman 1984). The ancient rocks of the continental crust are made up of granite, gneiss, and schist (Alt and Hyndman 1984). The second province is the old coastal plain that was at one time part of the western margin of North America. These layers of rock were pushed into tight folds, which are now seen as the Kootenay Arc (Alt and Hyndman 1984). Most of Lake Roosevelt exists throughout this province. It is a belt of sedimentary rocks, tightly folded and littered with granite intrusions. West of the Kootenay Arc is the Okanogan subcontinent, which dominates the Kettle River Watershed. It was an island about the size of California pushed against the sedimentary rock of the Kootenay Arc (Alt and Hyndman 1984). The southern portions of all three provinces disappear beneath the Miocene basalt flows of the Columbia Plateau. It lies between the Cascade and Rocky Mountains and south of the Okanogan highlands. This area was built up by volcanic lava flows. The lava is made up of black fine-grained basalt. No place on earth has there been basalt eruptions comparable in volume. (Alt and Hyndman 1984)

When describing soils, Lake Roosevelt and its tributaries (i.e.,Colville and Kettle rivers) lie on two separate distinct provinces. The first province in the north is the Okanogan Highlands. In this area, the soil pattern is closely tied with elevation. In mountainous areas, soils are derived from a granite parent material (Franklin and Dyrness 1988). The soils have a texture of gravelly sandy loam to silt loam and a depth of one meter or less. A substantial amount of these high elevation soils have a considerable

amount of volcanic ash (Franklin and Dyrness 1988). At low elevation at the margins of river valleys, the most abundant parent material is glacial till. Textures of these soils are usually sandy loam to loam, and are moderately dark. (Franklin and Dyrness 1988). The second province is the Columbia Basin Soil Province. The predominate soils here are derived from loess. These soils usually have a moderately thick brown silt loam horizon over a light-brown silt loam horizon with a prismatic structure beginning to appear. (Franklin and Dyrness 1988).

Vegetation

Vegetation throughout the subbasin represents the diverse habitats and conditions. Vegetation assemblages transition from sage/steppe communities in lower elevation areas, to pine savannahs in mid elevation areas, and alpine communities in high elevations in adjacent mountain ranges.

Land uses

Many different land uses exist throughout the boundaries of the subbasin. In the low elevation sage/steppe habitats adjacent to Lake Roosevelt, cattle grazing is the dominant agriculture practice. These areas are vast open spaces with little precipitation and are sensitive to soil compaction, vegetation removal, and instream habitat degradation. Mid and high elevations are typically associated with Colville and Kettle River Watersheds are largely managed forests that consist of second and third growth stands. These management practices promote fragmentation and inhibit natural succession of forest communities. Small grain (wheat) and hay crops dominate the Colville River Valley. Farming practices have removed riparian communities by farming to the edge of the stream bank.

Fish and Wildlife Status

Fish

General description/background

Construction of Grand Coulee Dams blocked anadromous and resident fish migration to the Upper Columbia River Basin. Prior to hydropower development, the Upper Columbia River supported a diverse fish assemblage, which included 11 anadromous salmonid stocks (Scholz et al. 1985). However, construction of Grand Coulee Dam caused the complete extirpation of those stocks above the dam, reducing the native salmonid species assemblage by 64%. Loss of salmon and the change from a fluvial to a lacustrine environment negatively impacted the ecosystem and forever changed the ecological structure of the area above the dam. The current fish assemblage is a result of anthropogenic actions that have created an unbalanced, ever shifting, pertubated lotic/lentic hybrid reservoir-based ecosystem. The absence of anadromous fish in this subbasin for more than 60 years has allowed people to forget that anadromous fish dominated the native fish assemblage and were a keystone component to the ecosystem (Lichatowich 1999; Willson and Halupka 1995; Cederholm et al. 1989; Kline et al. 1989; and Mills et al. 1993).

Scholz et al. (1985) estimated total salmon and steelhead escapement above the current Grand Coulee Dam location was between 1.1 and 1.9 million fish annually, three

times the average total return for the entire Columbia River Basin above Bonneville Dam (578,683) over the last 10 years (USACOE, Columbia River DART website). Species that historically ascended into the upper Columbia River included chinook salmon *Oncorhynchus tshawytscha*, sockeye *O. nerka*, coho salmon *O. kisutch*, pink salmon *O gorbuscha*, chum salmon *O. keta*, steelhead *O. mykis* (Ray 1954), and pacific lamprey *Lampetra tridentatus.* In addition to salmon and steelhead, pacific lamprey was an anadromous species that migrated to the Blocked Area. Chinook were the most plentiful and typically ran from June through September, peaking in mid to late June and again in August, (Scholz et al. 1985) however, salmon were available from May through November and steelhead were harvested between March and July (Ray 1954).

Resident fish species were also impacted through habitat alteration (inundation), lost productivity (absence of marine derived nutrients), habitat degradation relating to land-use practices (agriculture, grazing, logging, hydroelectric development, and municipal development) and altered aquatic communities (exotic introductions) attributable to Euroamerican settlement.

The resident fish assemblage of the Lake Roosevelt Subbasin has little resemblance to the pre-impoundment assemblage. Currently, bull trout, westslope cutthroat trout, and redband trout are rarely encountered in Lake Roosevelt (Cichosz et al. 1999; Underwood and Shields 1995). Moreover, tributaries of the Lake Roosevelt contain limited populations of adfluvial stocks. As a result, a majority of the salmonid assemblage consists of coastal rainbow trout, brook trout, and brown trout. The non-salmonid community and abundance structure has changed from an assemblage/abundance of mostly white sturgeon, lamprey, and burbot to that of walleye, and smallmouth bass. In addition, mountain whitefish populations have been displaced by lake whitefish (Cichosz et al. 1999). Since impoundment, white sturgeon populations have declined to unhealthy levels, with the only known spawning location just below the confluence with the Pend Oreille River in British Columbia.

Lake Roosevelt

General description

The fish assemblage in Lake Roosevelt contains native and non-native species. Management of the Lake Roosevelt fishery consists of guidance by the Washington State Wild Salmonid Policy (WDFW 1997). Goals of these documents, as they apply to Lake Roosevelt, are to maximize recreational and subsistence harvest opportunities and minimize negative impacts to other wild native populations. Due to the severely altered ecosystem, such goals are difficult to achieve.

Based on 1997/1998 sampling (Devore et al. 2000; Cichosz et al. 1999), 24 fish species are know to occur throughout the reservoir. In 1997, kokanee salmon, rainbow trout, and walleye comprised 97% of the harvested fish in the reservoir, smallmouth bass comprised 2.4% of the harvest, and all other species combined to comprise <1% of the harvest (Cichosz et al. 1999. In all, the Lake Roosevelt fishery accounts for 140,000 - 300,000 angler trips annually and has an annual economic worth of between $5 and $10 million (Table 1) (Cichosz et al. 1999; Underwood and Shields 1995).

Table 1. Summary of angler trips, number of fish caught, number harvested, catch per unit effort (CPUE), harvest per unit effort (HPUE), and mean lengths of kokanee salmon, rainbow trout and walleye observed during creel surveys of Lake Roosevelt from 1990 through 1998

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Economic Value (millions)	$5.3	$12.8	$9.7	$20.7	$19.1	$8.7	$6.9	$5.8	$8.0
Angler Trips	171,725	398,408	291,380	594,508	469,998	232,202	176,769	146,264	196,775
No. Caught									
Kokanee salmon	17,756	31,651	8,146	13,986	16,567	32,353	1,265	588	10,188
Rainbow trout	81,560	81,529	167,156	402,277	499,460	125,958	76,915	5,356	233,036
Walleye	116,473	231,813	163,995	337,413	123,612	73,667	142,873	147,316	133,241
No. Harvested									
Kokanee salmon	17,515	31,651	8,021	13,960	16,567	32,353	1,265	588	9,980
Rainbow trout	79,683	73,777	140,609	398,943	499,293	122,939	76,782	5,356	226,809
Walleye	82,284	168,736	118,863	307,663	53,589	40,185	104,055	87,515	119,346
CPUE (per hr)									
Kokanee salmon	0.03	0.06	0.03	0.01	<0.01	0.02	<0.01	<0.01	0.02
Rainbow trout	0.13	0.20	0.22	0.17	0.21	0.08	0.10	0.01	0.18
Walleye	0.11	0.11	0.15	0.12	0.08	0.13	0.30	0.34	0.10
HPUE (per hr)									
Kokanee salmon	0.02	0.06	0.03	0.01	<0.01	0.02	<0.01	<0.01	0.02
Rainbow trout	0.12	0.20	0.18	0.16	0.21	0.08	0.10	0.01	0.18
Walleye	0.08	0.08	0.11	0.08	0.05	0.06	0.16	0.17	0.09
Mean Length (mm)									
Kokanee salmon	391	361	436	486	481	467	438	338	356
Rainbow trout	346	348	422	471	473	410	363	395	364
Walleye	376	397	361	382	385	370	372	372	352

Food web interactions of the Lake Roosevelt fish assemblage have been analyzed as well. Diet of 16 different fish species were examined by Cichosz et al. (1999) who examined diets of 16 fish species and found that each species exhibited substantial diet overlap (>0.70) with at least one other species. Rainbow trout exhibited substantial dietary overlap with kokanee and lake whitefish. Kokanee and lake whitefish exhibited substantial diet overlap as did walleye and burbot and peamouth chub and pumpkinseed, and longnose sucker/largescale sucker/mountain whitefish. Cladocerans were the most frequently consumed prey by kokanee, rainbow trout, and lake whitefish. Although cladocerans were observed in stomach analyses from burbot and walleye, fish were the most frequently observed prey. Results suggested that the zooplankton populations in Lake Roosevelt were not substantially utilized by planktivorous fishes as evidenced by the large number of zooplankton species and their size ranges.

Despite the healthy zooplankton population, benthic macroinvertebrates in Lake Roosevelt are limited due to annual changes in lake elevation, minimal macrophyte production, and substrate types. As a result, the primary consumer trophic level of Lake Roosevelt is consists mostly of zooplankton. In recent years, zooplankton does not appear to be a limiting recruitment of planktivorous fishes. However, the benthic macroinvertebrate population does appear to be limiting recruitment of fish inhabiting littoral habitats of Lake Roosevelt.

Kokanee

Fish and wildlife management entities began to monitor the Lake Roosevelt kokanee fishery in the late 1980's. From 1988-1990, 750,000 Lake Whatcom stock kokanee fry reared at the Ford Hatchery (WDFW) were stocked annually into Sherman Creek (Curt Vail, WDFW Area Fish Biologist, personal communication) and 100,000 were stocked annually into the Spokane River at Little Falls. The Spokane Tribal Hatchery was operational in 1990 and by 1991 kokanee were being reared and stocked in Lake Roosevelt (Underwood and Shields 1995). In 1992, kokanee release from the Sherman Creek Hatchery was initiated (Underwood and Shields 1995). The original production goal for the Spokane Tribal and Sherman Creek hatcheries was to release 8 million kokanee fry. However, due to a limited water supply, production was approximately 2.5 million kokanee fry (Underwood and Shields 1995).

Problems with the kokanee fishery began to arise when poor adult returns to egg collection and release sites were realized between 1991 and 1994. Poor returns prompted investigations to determine and eventually correct the reason for poor adult returns. Investigations revealed that because kokanee undergo smoltification and residualization similar to anadromous salmonids, fish were being lost downstream due to entrainment over Grand Coulee Dam (Scholz et al. 1993, 1992; Tilson et al. 1995, 1994). Results from these investigations led hatchery managers to begin releasing kokanee as residualized smolts rather than fry. Changed release strategies resulted in improved adult recoveries (99% of recovered adults were released as smolts) and a more successful fishery. The number of kokanee harvested increased from 8,021 in 1992 to a high of 32,323 in 1995 (Underwood and Shields 1995). However, a significant decline was observed in 1996 and 1997 when only 588 and 1,265 fish, respectively, were harvested (Cichosz et al. 1999)

Despite the success of the kokanee fishery, the harvest objective of 300,000 fish has not been realized. Creel, net, and electrofishing surveys have revealed the presence of kokanee with intact adipose fins which may suggest wild production or that fish are emigrating from other waters. Preliminary genetic analyses do not support the hypothesis that fish are emigratting from other waters (LeCaire 1999). Questions regarding the genetic compatibility of Lake Whatcom stock have arisen and managers are recommending a more thorough genetic inventory of Lake Roosevelt kokanee. New research will focus on using microsatellite rather than allozymes to provide more definitive answers to the origin of fish in Lake Roosevelt.

An adfluvial population of kokanee migrates annually up the Sanpoil River and other Lake Roosevelt tributaries to spawn. Since monitoring began in 1995, escapements have been at critically low levels (LeCaire 1999). Fish are identified as wild or hatchery origin fish by the presence or absence of an adipose fin. Preliminary allozyme data suggest that the wild population is genetically unique and possibly of native origin (LeCaire 1999). Until evidence suggests otherwise, the population is considered to be critically depressed. Thus, management efforts are aimed at conserving the genetic structure of the native population.

Rainbow trout

In 1986, the Lake Roosevelt Development Association (LRDA) began a rainbow trout net pen program to supplement the rainbow trout fishery in Lake Roosevelt. Until this program

began, angler effort and success for rainbow trout was limited (Underwood and Shields 1995). The Spokane Hatchery donated 50,000 rainbow trout fry during the first several years of the program. Since 1991, the Spokane Tribal Hatchery has annually hatched and reared, to fingerling stage, 500,000 rainbow trout. Upon reaching fingerling length, the fish are moved to net-pens until they are catchable yearlings at which time, usually late-spring or early summer, they are released into the reservoir.

Hatchery production combined with the rainbow trout net pens has resulted in increased angler participation and harvest. Prior to this program, angler interest and success were low, as reflected by the less than 1,000 rainbow trout being harvested annually from Lake Roosevelt. Despite the increase in rainbow trout harvest, annual harvest estimates exhibit large fluctuations, likely associated with reservoir operations (Cichosz et al. 1999; Underwood and Shields 1995). The harvest of rainbow trout increased to a high of over 140,000 (Underwood and Shields 1995) in 1992 and declined to a low of 5,366 fish in 1997 (Cichosz et al. 1999). Although wild fish are present in the subbasin, they comprise little of the total harvest.

An adfluvial rainbow trout population that spawns in the Sanpoil River and other minor Lake Roosevelt tributaries (e.g., Sheep Creek) exists at reduced levels. Preliminary genetic analyses suggest that the adfluvial rainbow population is introgressed between coastal rainbow trout and redband trout (Kirk Truscott, Colville Fish and Wildlife Division Fish Biologist, personal communication). Prior to the construction of Grand Coulee Dam, the Sanpoil River and other minor tributaries to Lake Roosevelt supported large populations of summer run steelhead. Therefore, it is likely that adfluvial populations contain genetic material of the native steelhead stock. The significance of maintaining these populations, aside from native species conservation is that these stocks may serve as native donor stocks for anadromous reintroduction. The extent of this population entrainment through Grand Coulee Dam is unknown.

White sturgeon

In 1998, a stock-indexing project (Devore et al. 2000) found that only 1.5% of the captured white sturgeon were juveniles (<110 cm Fork Length), suggesting poor recruitment. Furthermore, of the 204 fish captured, only three were captured in experimental gill nets (deployed for the purpose of catching juvenile sturgeon) and length at age assignments reveals an age structure of 12 to 96 year old fish (Devore et al. 2000). The conclusion made by Devore et al. (2000) of severe recruitment limitations supports conclusions of research conducted in the Canadian Reach of the Columbia River (R.L. & L Environmental Services Ltd. 1996). Devore et al. (2000) found that the relative weight (Wr) of 91% for white sturgeon collected from Lake Roosevelt during the study was significantly less than other populations. To date, this is the lowest recorded Wr for any Columbia River Basin white sturgeon population.

Banks Lake

General description

Washington Department of Fish and Wildlife stocking records for Banks Lake date back to 1959. Species previously stocked into the lake include kokanee, rainbow trout, cutthroat trout, coho salmon, and walleye. Since 1990 stocking has been mainly concentrated on rainbow trout, kokanee, and walleye (Table 2). Rainbow trout have been stocked every

year since 1990 at an average of over 188,373 annually. Average kokanee stocking between 1990 and 1999, excluding 1991 (no stocking), was 917,608 fish annually. Walleye were stocked in 1992, 1995, 1996,1997, and 1998 at an average of 124,743 fish annually. Very limited information on creel, current assemblage, and habitat exist for Banks Lake, however it is known to provide a very popular sport fishery.

Table 2. Banks Lake Stocking Records 1990-1999

Year	Species	# released
90	Rainbow	92,041
90	Kokanee	986,656
91	Rainbow	125,240
92	Rainbow	124021
92	Kokanee	548,000
92	Walleye	365,863
92	Summer Steelhead	90,000
93	Rainbow	149,766
93	Kokanee	696,734
94	Rainbow	217,760
94	Kokanee	1,228,459
95	Walleye	7,000
95	Rainbow	126,987
95	Kokanee	1,116,960
96	Kokanee	159,400
96	Walleye	94,473
96	Rainbow	305,040
97	Rainbow	292,208
97	Kokanee	1,432,715
97	Walleye	4,927
98	Rainbow	318,578
98	Walleye	151,453
98	Kokanee	1,678,437
99	Rainbow	132,090
99	Kokanee	411,115

Kokanee

A noted kokanee fishery first developed in the early -1950's when these fish entrained to Bank's Lake from Lake Roosevelt. About one million kokanee were stocked annually in Banks Lake from the mid-1950's through the mid-1960's (WDFW 1996). In addition, there was evidence that natural shoreline spawning was extensive, though the contribution to the population was not estimated. Banks Lake was still a fairly young, fertile reservoir, and even though the kokanee stocked were small (4-6,000/lb.) and planting mortality sometimes quite high, the fishery flourished (WDFW 1996). Stocking was sporadic from 1965 to 1989. The kokanee fishery began to decline in the late 1970's, and by the mid-1980's was almost nonexistent.

Current management calls for stocking Banks Lake with one million kokanee annually as part of the Columbia River Fish and Wildlife Mitigation Program. The kokanee fishery has failed to develop during the 1990's despite stocking 600,000 to 1.2 million kokanee annually since 1989 (no kokanee were available for Banks Lake in 1991) (WDFW 1996). In comparison to the years when Banks Lake held notoriety as a kokanee fishery, the kokanee currently stocked have been somewhat fewer but considerably larger than those stocked during the 1950's and 60's.

Moses Lake

General description

Moses Lake is the third largest natural lake in Washington and represents an invaluable asset for wildlife and fisheries propagation and recreational interest. It is part of the Crab Creek drainage to the Columbia River and was connected to the Columbia Basin Reclamation Project in the 1950's. Moses Lake is heavily influenced by irrigation transport and return flows and has been slightly enlarged and stabilized by the construction of outlet control structures. Fisheries projects within Moses Lake are currently funded to mitigate for anadromous fish losses above Grand Coulee Dam (substitution project).

Moses Lake was once the premier fishery for resident fish species in central Washington. The US Fish and Wildlife Service (USFWS) initially stocked fish in the lake during the 1930's and 1940's, and fisheries for black crappie, bluegill, and yellow perch were quickly established (Groves 1951). Crappie began to dominate the fishery by the mid-1960's and continued until the early 1980's. Surveys during the mid to late 1970's indicated declines in the total harvest of crappie and bluegill (Zook 1976, 1977, 1978). By 1983, crappie and bluegill harvest together was only one-third of the catch, and perch and trout contributed equally to the remaining harvest (Jackson 1985). While total angling effort had doubled since 1974, total harvest only increased 2%, and almost half of the angling effort was now focused on trout. Largemouth and smallmouth bass consistently provided a low density fishery in all surveys (Table 3). No trends for increases or decreases in numbers of largemouth and smallmouth bass were noted in any WDFW surveys. Walleye harvest was documented for the first time during the creel survey in 1983 (Figure 2). Walleye, which had not been stocked in Moses Lake previous to this survey, likely entered the lake through the irrigation system from the Columbia River.

Surveys through the 1980's continued to document declines in the black crappie and bluegill populations (Chadwich, et al 1985; Walton 1988). By the end of the decade and early- 1990's, even yellow perch and rainbow trout were contributing little to the fishery (Eads, et al 1991; Korth, 1992). Carp and bullheads were noted as the lake’s dominant inhabitants. Walleye continued to increase in numbers during the early to mid 1990's and were eventually established as the dominant predatory species in Moses Lake (Korth, 1992-1998). Clearly, the face of the Moses Lake fishery has changed. The coveted panfish fisheries are gone and rainbow trout survival is severely limited. The expanding walleye fishery has failed to account for even a small portion of the former harvest or recreational opportunity that these other fisheries produced, as would be expected from a predator-dominated fishery.

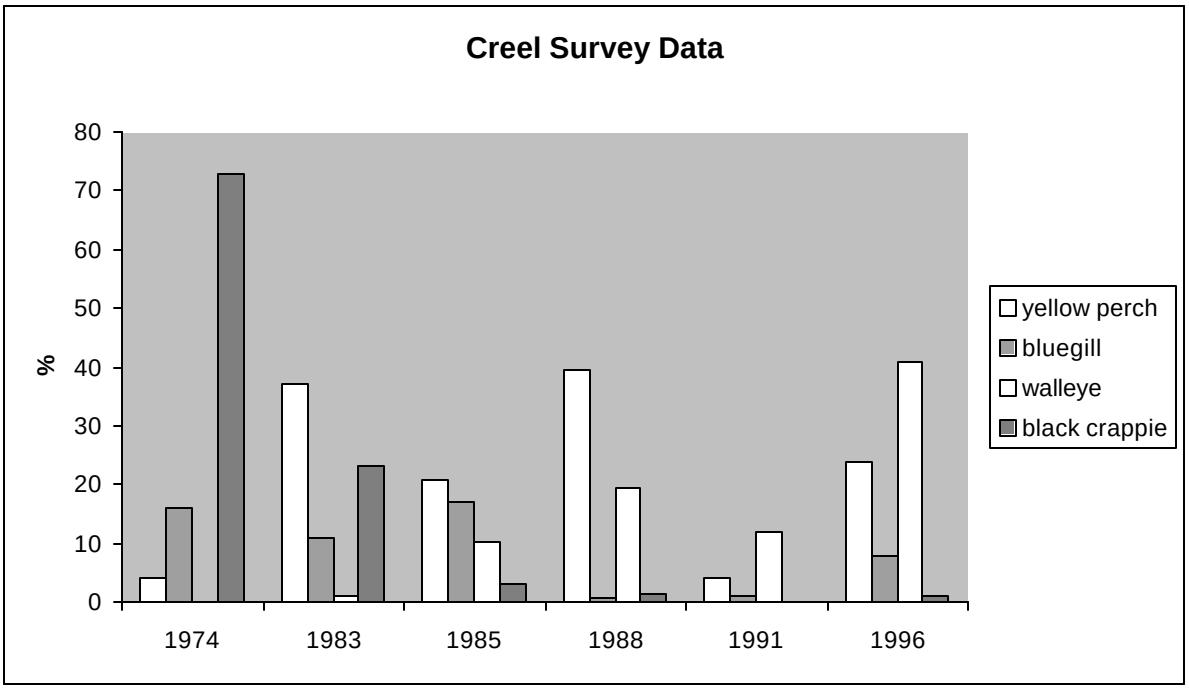

Figure 2. Washington Department of Fish and Wildlife Creel Survey for Moses Lake

Table 3. Washington Department of Fish and Wildlife Species Composition Data for Moses Lake

Type of Fish	(kg)	(%W)	(#)	(%n)	Min	Max
black crappie	33.04	2.128670	369	5.402635	111	342
bluegill	56.343	3.630015	800	11.71303	82	300
brown bullhead	47.51254	3.061094	156	2.284040	101	409
burbot	0.875	0.056373	1	0.014641	528	528
carp	572.737	36.89977	154	2.254758	350	845
lake whitefish	15.31	0.986378	11	0.161054	221	554
largemouth bass	53.36403	3.438088	438	6.412884	111	501
largescale sucker	7.765	0.500276	5	0.073206	273	582
longnose sucker	32.9959	2.125829	33	0.483162	105	521
northern pike-minnow	0.609	0.039236	7	0.102489	173	250
Pumpkin seed sunfish	0.134	0.008633	5	0.073206	91	124
rainbow trout	59.39	3.826324	80	1.171303	306	501
sculpin	0.04204	0.002708	6	0.087847	45	114
smallmouth bass	45.3896	2.924319	287	4.202049	101	376
walleye	449.5384	28.96244	659	9.648609	191	796
yellow perch	177.0968	11.40983	3819	55.91508	101	341
TOTALS	1552.142	100	6830	100		

**Young of the year excluded

Between 1990 and the present, stocking strategies have been limited to rainbow trout, white crappie, black crappie, bluegill, and walleye (Table 4). Attempts to establish panfish and rainbow trout fisheries from 1990 to the present have been unsuccessful. The inability to reestablish fish populations resembling what historically existed in Moses Lake provides impetus to creating a Moses Lake Recreational Fishery Restoration Project, with the objective of recovering a popular and productive sport fishery.

Table 4. Washington Department of Fish and Wildlife stocking records for Moses Lake from 1990-1999

Year	Rainbow	White Crappie	Black Crappie	Bluegill	Walleye
1990	188939				
1991	174879				
1992	112208				
1993	81169				
1994	205249			15	
1995	93976		221		
1996	83016		1817		105154
1997	156917	853	1593		358346
1998	125957				121000
1999	156664				90000

The Moses Lake Fishery Restoration Project, initiated in July 1999, compiled and analyzed historic water quality and biological data. The project has also continued with a standardized warmwater sampling strategy developed by WDFW to develop a current baseline biological database for analysis.

Initial investigation of water quality data using trend analysis did not indicate any profound changes in water quality that would limit the production of a panfish fishery.

Kettle River

Rainbow trout

The salmonid fish assemblage in the Kettle River Subbasin mainly consists of a native redband trout population. Investigations in the early 1990's suggested a declining population of native redband trout throughout the system (Curt Vail, WDFW Area Biologist, personal communication). The Washington Department of Fish and Wildlife began supplementing the native population in 1996 by rearing fish in the Colville Hatchery. Hatchery releases into the Kettle River have been 25,000 fish annually (Curt Vail, WDFW Area Biologist, personal communication). Additionally, fishing regulations changed from a year round season, 5 fish/day limits, and no lure or bait restrictions to selective fishery regulations that include a June 1 through October 31 season, artificial single barbless hooks, and a two fish >12"/day limit. Since the beginning of the stocking program and changed regulations the fishery has begun to recover. Hook and line sampling in 1999 resulted in 2.5 rainbow trout/per angler hour. Of the fish collected in 1999, only 25% of the catch was of hatchery origin (identified by adipose fin clips), thus, possibly indicating that the wild population is rebounding (Curt Vail, WDFW Area Biologist, personal communication).

Colville River

General description

The sport fishery in the Colville River consists mainly of rainbow, brown trout, and brook trout, however, very little information is available (Curt Vail, WDFW Area Biologist, personal communication). Inventory projects in some of the tributaries reveal that native populations of westslope cutthroat trout are extremely limited and in many areas are not detectable. Substantial populations of introduced brook trout are present throughout the entire subbasin.

Other Waters

General description

Fourteen lakes and streams on the Colville Reservation, included in this subbasin, are stocked annually with fish originating in the Colville Tribal Hatchery (Truscott 1997). Stocking density from the Colville Tribal Hatchery in reservation waters of the Lake Roosevelt Subbasin averages over 812,000 fish with an average weight of 38,298 pounds (Truscott 1997). This stocking program has been very successful at providing subsistence and recreational opportunities. For example: creel surveys on North and South Twin Lakes between 1991 and 1997 reveal that anglers harvested rainbow trout at a rate of 0.446 fish per angler hour and maintained an average fish condition factor of 132×10^{-7} (Truscott 1997). During the same time period anglers harvested at a 0.11 fish per angler hour rate, while maintaining an average fish condition factor of 129.6×10^{-7} (Truscott 1997). However, the brook trout fishery in the two lakes is usually conducted in the spring and fall months in the littoral zone of the lakes. The creel survey was conducted from April through October and likely is the reason for the low catch rate for brook trout. A monthly break down of catch would likely reveal a more accurate description of the fishery.

Three lakes on the Spokane Indian Reservation are stocked annually with 28,000 fingerling rainbow trout and 1,000 kokanee salmon. Stocked fish originate in the Spokane Tribal Hatchery.

The Washington Department of Fish and Wildlife stocks over 430,000 fish throughout waters of the subbasin (Curt Vail, WDFW Area Biologist, personal communication). The majority of the fish stocked originate in the Colville Hatchery including westslope cutthroat trout (Kings Lake Stock), native redband trout (Phalen Lake Stock), and non-native rainbow trout (Spokane stock). Fish originating in the Colville Hatchery provide an estimated 320,000 angler days at an economic value of between $6.5 and $11 million annually.

Lakes within this subbasin that are maintained by WDFW provide angling opportunities for rainbow trout (native and non-native stock), westslope cutthroat, brook trout, brown trout, kokanee, lake trout, and a variety of warmwater fish such as largemouth bass and crappie.

The majority of the headwater tributaries in this subbasin exist on the Colville National Forest and the Colville Indian Reservation. The fish communities in these tributaries generally exhibit non-migratory resident life histories. Historic stocking of non-native species and non-native stocks of native species is evident throughout these tributaries (Tom Shuhda, Colville National Forest Fish Biologist, personal

communication). In many cases these non-native introductions have maximized degraded habitat conditions and in some cases displaced populations to the point of extinction. Salmonid species inhabiting these tributaries include; rainbow trout (native redband populations and non-native stocks), westslope cutthroat trout, bull trout, brook trout, and brown trout (Tom Shuhda, Colville National Forest Fish Biologist, personal communication). It is critical to note that all bull trout captured in Lake Roosevelt tributaries were captured below impassable falls. (Tom Shuhda, Colville National Forest Fish Biologist, personal communication).

Wildlife

Lake Roosevelt Subbasin is home to a diverse assemblage of large and small mammals and birds. Since mammalian species are highly mobile, they tend to range throughout multiple subbasins. Table 5 illustrates the target and listed species identified for the Lake Roosevelt Subbasin. Where information is available, population status/information is provided for each respective category (large mammals, small mammals and birds).

Mule deer and white-tailed deer

Mule deer and white-tailed deer populations are increasing in Game Management Unit (GMU) 133 in the southern part of the subbasin. The overall health of bucks, plus an increase in age of the herd, is improving as a result of implementation of a 3 pt. minimum season. The change also resulted in shifting the harvest to white-tailed deer. White-tailed deer populations are also stable to increasing. Deer habitat is improving as a result of private land going into the CRP program (G.W. Hickman, WDFW, Region 1 Wildlife Biologist, personal communication).

GMU 133: Buck:Doe:Fawn ratios post season : Mule deer	1996	23:100:83
	1997	25:100:120
White-tailed deer	1996	21:100:108
	1997	29:100:105

In other GMUs in the subbasin, mule deer populations are exhibiting long-term declines likely attributable to habitat changes and fragmentation of the habitat and human encroachment on winter and spring range. The doe to fawn ratios in GMU 101 for mule deer, at spring green-up, indicate an increase in production. However, improvement in mule deer recruitment may be limited to western Ferry County. For other GMUs in the subbasin, not previously referenced, the white-tailed deer population is considered stable, even with EHD affecting some locale populations (WDFW, 1999 Game Status and Trend Report).

Table 5. Target wildlife species (* denotes Washington State listed/sensitive species)

Large Mammals	Small Mammals	Birds	Amphibians
Mule deer (Odocoileus hemionus)	Bobcat (Lynx rufus)	Sage grouse (Centrocercus urophasianus)	*Columbia spotted frog (Rana luteiventris)
White-tailed deer (Odocoileus virginianus)	Weasel (Mustela vison)	Sahrp-tailed grouse (Tympanuchus phasianellus)	*Northern leopard frog (Rana pipiens)
Moose (Alces alces)	Marten (Martes americana)	Spruce grouse (Dendragapus canadensis)	*Western toad (Bufo boreas)
Elk (Cervus elaphus)	Badger (Taxidea taxus)	Ruffed grouse (Bonasa umbellus)	
Black bear (Ursus americanus)	Beaver (Castor canadensis)	Blue grouse (Dendragapus obscurus)	
Bighorn sheep (Ovis canadensis)	Muskrat (Ondatra zibethicus)	Turkey (Meleagris gallopavo)	
*Gray Wolf (Canis lupus)	Coyote (Canis latrans)	California quail (Colinus spp.)	
*Grizzly bear (Ursus arctos)	Pygmy rabbit (Sylvilagus idahoensis)	Ring-necked pheasant (Phasianus colchicus)	
	White-tailed jackrabbit (Lepus townsendii)	Gray partridge (Perdix perdix)	
	Cougar (Felis concolor)	Chukar (Alectoris chukar)	
	*Townsend's big-eared bat (Plecotus townsendii)	Mourning dove (Senaida macroura)	
	*Fisher (Martes pennanti)	Ducks	
	*Lynx (Lynx lynx)	Geese	
	*Wolverine (Gulo gulo)	Swans	
	*Merriam's shrew (Sorex merriami)	*Golden eagle (Aquila chrysaetos)	
		*Merlin (Falco columbarius)	
		*Northern goshawk (Accipitergentilis)	
		Peregrine Falcon (Falco peregrinus)	
		Sharp-tailed grouse (Tympanuchus phasianellus)	
		*Sandhill crane (Grus canadensis)	
		*Burrowing owl (Athene cunicularia)	
		*Flammulated owl (Otus flammeolus)	
		*Vaux's swift (Chaetura vauxi)	
		*Black-backed woodpecker (Picoides articus)	
		Downy woodpecker (Picooides pubescens)	
		*Lewis woodpecker (Melanerpes	

Large Mammals	Small Mammals	Birds	Amphibians
		lewis)	
		*Pileated woodpecker (Dryocopus pileatus)	
		*Whitehead woodpecker (Picoides allbolarvatus)	
		*Loggerheaded shrike (lanius ludovicianus)	
		*Sage sparrow (amphispiza belli)	
		*Sage thrasher (Oreoscoptes montanus)	
		*Common loon (Gavia immer)	
		*American white pelican (Pelecanus erythrorhynchus	
		*Bald eagle (Haliaeetus leucocephalus)	
		Neotropical migrants	

GMU 101 Mule Deer Fawn:Doe Ratio: (Spring green up)	1999	61F:100D
	1998	39F:100D
White-tailed deer Buck:Doe:Fawn (Late Fall)	1998	21:100:60
	1997	29:100:105

GMU 101 Mule Deer Fawn:Doe Ratio: (Spring green up)	1999	61F:100D
	1998	39F:100D
White-tailed Deer Buck:Doe:Fawn: (Late Fall)	1998	21:100:60:
GMU 105 Mule Deer Fawn:Doe Ratio: (Spring green up)	1999	28F:100D
	1998	20F:100D

On the Colville Indian Reservation, the late fall Hellsgate deer count from 1989-1998 vacillates around gradual declining regression line in fawns per hundred does and a more accelerated decline in bucks per hundred does. Deer counted are primarily mule deer (Murphy and Judd 1999). The declining trend in mule deer populations is similar to that found in State GMUs.

Buck:Doe:Fawn ratios 1989 = 38:100:33
1996 = 17:100:44
1997 = 24:100:23
1998 = 16:100:21

Aerial trend count data collected by the Confederated Tribes of the Colville Reservation in February 2000 indicate a marked decline in mule deer and white-tail deer populations (Steve Judd, Colville Confederated Tribes, Wildlife Biologist, personal communication).

The Spokane Tribal Wildlife Program has four years of aerial survey data relevant to fawn:doe ratios, over a period of 14 years, on the Spokane Indian Reservation,

beginning in 1986 and ending in 2000 (B.J. Keiffer, personal communication). The data seems to indicate consistently low fawn production.

White-tailed deer	1986 = 29F:100D
	1989 = 14F:100D
	1997 = 29F:100D
	2000 = 19F:100D
Mule deer	1986 = 30F:100D
	1989 = 28F:100D
	1997 = 27F:100D
	2000 = 28F:100D

Elk

General observations indicate elk populations to be stable to increasing particularly in the Huckleberry Mountains. Forage habitat has increased, however mature timber cover areas are declining and thermal cover on summer and winter ranges may be a problem in the future (WDFW, 1999 Status and Trend Report). The elk population on the Colville Indian Reservation is considered to be stable, however, their seasonal distribution may be changing as a result of weather influences, timber harvest and increased road access. Calves per 100 cows from 1995-1997 were 35, 35, and 34, respectively (Murphy and Judd, 1998).

California Bighorn Sheep

California bighorn sheep occur in two areas of the subbasin: Lincoln Cliffs and Vulcan Mountain. The Lincoln Cliffs steppe habitat is in excellent condition and no competition from, or interaction with, domestic livestock currently exists. The bighorn population is in good health, and is productive, since starting with 11 animals in 1989. The majority of land is in private ownership; excluding 120 acres managed by the BLM and a few state sections. In 1999, 10 pregnant ewes were removed from this herd for transplanting in the Lake Chelan area(WDFW, 1999 Status and Trend Report; personal communication with G.J. Hickman)

The Vulcan herd has declined dramatically, with recruitment at or near zero for 1998-99. Remnants of this herd appear to be in a state of chronic poor health and there is extremely poor lamb production. Parasites and/ or disease may be wholly, or in part, responsible for the decline.

Lincoln Cliffs:	Year	Herd size	Ram:ewe:lamb Ratios	
	1993	26	45:100:54	
	1994	35	46:100:57	
	1995	45	52:100:52	
	1996	65	46:100:48	5 added to herd
	1997	90	56:100:60	
	1998	102	32:100:76	
	1999	76	56:100:41	

Vulcan Mountain:	1990	107	53:100:49
	1991	71	30:100:67
	1992	56	34:100:41
	1993	54	22:100:24
	1994	69	44:100:24
	1995	61	38:100:104
	1996	43	09:100:86
	1997	52	16:100:158
	1998	24	00:100:200

Lynx

Lynx are listed as both a Federal and State Threatened species. The Kettle Crest, Wedge, and Little Pend-Oreille are Lynx analysis units (LAUs) that are all or partially located in the subbasin in areas above 4,000 ft (WDFW, Washington Lynx Update, April 1999). Suitable Lynx habitat also occurs in cold air drainages, adjacent to the Kettle Crest LAU, in the lodgepole pine zone within the reservation boundary (CCT - IRMP Phase I, Wildlife 1998). Cursory field reviews indicate that foraging habitat has not fully developed in previous cutovers and burned areas, and that denning habitat is lacking on the reservation, in the Lake Roosevelt subbasin. Prior to the federal listing, industrial forest landowners in the Wedge and Little Pend-Oreille LAUs worked with State of Washington agencies on 5-year lynx management plans for their lands.

Forest Grouse

Forest grouse (ruffed and blue grouse) are representative species for riparian shrub/tree and forested habitats occurring within the subbasin. Currently, state wide, population levels are considered healthy and sufficient to meet hunter demand, however, production is influenced by weather (WDFW, 1999 Status and Trend Report) and carrying capacity by habitat availability. The CTCR also reports stable to upward trends in ruffed grouse populations for this subbasin on the reservation (Murphy and Judd, 1999).

Recent declines of sharp-tailed grouse appear to be linked to the dramatic losses of native grassland habitats and degradation of nesting and brood rearing habitat. Additionally, considerable critical low elevation riparian habitat, used as winter habitat by sharp-tail grouse was lost due to inundation. The CTCR, the Spokane Tribe of Indians, and the WDFW, have been acquiring lands in this subbasin to manage and protect habitats capable and suitable to support sharp-tailed grouse. Continued habitat loss, and small isolated subpopulations of this grouse, have led to the birds decline in the subbasin and the state.

Bald Eagle

The number of bald eagle nesting territories has increased in the subbasin. On the Colville Indian Reservation, nesting levels appear to be expanding due to a buildup of breeding adults produced in previous years. About 14 of the 17 active nests on the Reservation are located in the subbasin (Murphy and Judd, 1999). The National Park Service, tribes, and WDFW cooperate with bald eagle nesting surveys in the subbasin along the Columbia River.

Habitat Areas and Quality

Fish

Lake Roosevelt

Grand Coulee Dam inundated 151 miles of habitat in the Columbia River mainstem from the dam to the and Canadian Border, 28 miles of the lower Spokane River, 12 miles of the Sanpoil River, and 15 miles of the Kettle River. What had been a shallow, free-flowing river was converted into a deep reservoir. Native westslope cutthroat trout, rainbow trout, bull trout, and mountain whitefish that were adapted to a fluvial environment were probably selected against following impoundment. Selection against existing fish populations combined with fish entrainment, have resulted in declining native fish populations. Furthermore, resident fish species were impacted through lost productivity (i.e., absence of marine derived nutrients from anadromous fish) and habitat degradation related to land-use practices (e.g., agriculture, grazing, logging, and municipal development).

The lacustrine habitats of Lake Roosevelt do not exhibit physical characteristics normally associated with such environments. Full pool in Lake Roosevelt is 1,290 MSL and minimum operating pool is 1,208 MSL. In high water years, when the spring freshet is anticipated to be large, reservoir levels have been drawn down more than 80 feet and refilled over the span of three to five months. These drawdowns decrease invertebrate productivity (Cichosz et al. 1999; Underwood and Shields 1995; Griffith and Scholz 1991) and likely result in fish entrainment (LeCaire 1999). Lake Roosevelt, which is a relatively deep reservoir, does not stratify (Keith Underwood, Spokane Tribal Fish Biologist, personal communication). The implications of non-stratification for fish are that there is limited thermal refuge during the summer when water temperatures are warmest. The variable habitat conditions exhibited by Lake Roosevelt are due to the operations of Grand Coulee Dam for flood control and downstream flow augmentation. As a result, the practice severely impacts resident fish populations and limits the manager's ability to achieve goals.

With the extirpation of anadromous fish, marine derived nutrients were eliminated from the Lake Roosevelt Subbasin. Studies have suggested that marine derived nutrients are an important component of the nutrient cycle for fish health and survival. Due to the elimination of marine derived nutrients, primary and secondary productivity has likely been affected. As a result, changes in productivity could result in conditions such as factors for fish species. A possible example may be the low relative weight and condition of the Lake Roosevelt white sturgeon (Devore et al. 2000). It is the hope of the Lake Roosevelt fish and wildlife managers that a thriving kokanee population will provide a keystone nutrient source similar to historic anadromous fish functions.

Colville River

Nearly all 53 miles of the Colville River in Northeast Washington are severely degraded. In most areas, pasture or croplands extend to the edge of eroding banks. Ditching and tiling have drained wetlands. Most of the riparian vegetation has been removed and in many areas livestock have direct access to the river. Many of the lower sections of tributaries are in a similar condition. These degradations have resulted in, among other things, a large suspended sediment load that creates excessive turbidity. The public perception is that the Colville River is a "dirty" river (Tom Shuhda, Colville National Forest Fish Biologist,

personal communication). Channelization and diking of the Colville have decreased complexity and increased embeddedness; severely limiting habitats necessary for native salmonids at virtually every life stage.

The Colville River is listed in Section 303(d) of the Federal Clean Water Act for temperature, fecal coliform bacteria, dissolved oxygen, chloride, pH, and ammonia-N. Tributaries of the Colville River in Section 303(d) of the Federal Clean Water Act include: Blue Creek (dissolved oxygen and fecal coliform), Chewelah Creek (fecal coliform, dissolved oxygen, pH, and temperature), Cottonwood Creek (fecal coliform and temperature), Haller Creek (fecal coliform), Huckleberry Creek (fecal coliform), Jump off Joe Creek (fecal coliform) Little Pend Orielle River (fecal coliform), Mill Creek (fecal coliform and pH), Sheep Creek (dissolved oxygen and fecal coliform), Sherwood Creek (fecal coliform), Stensgar Creek (dissolved oxygen, fecal coliform and temperature), Stranger Creek (fecal coliform).

Other Waters

Tributary habitat on National Forest Service (NFS) lands ranges from poor to very good depending upon past and present level of activities within the subwatersheds. In general, where habitat is poor to fair, road densities are high and many roads are located within the riparian areas of these tributaries. In addition, stream habitat is degraded where the riparian habitat is also easily accessible to livestock and, in many cases, the vegetation is overgrazed (Tom Shuhda, Colville National Forest Fish Biologist, personal communication).

Habitat in good to very good condition has adequate overhead shade, overwintering pool habitat, cover in the form of large instream wood and suitable spawning substrate. The streambed substrate has low embeddedness with adequate spawning habitat.

Habitat in poor to fair condition lacks overhead shade, overwintering pool habitat, cover in the form of large instream wood, and suitable spawning substrate. The streambed substrate tends to be highly embedded with a scarcity of suitable spawning habitat. The bankfull width/depth ratio is higher than expected of the valley form and channel type, causing wider and shallower reaches. This high ratio combined with scarcity of shade have increased stream temperatures which are marginal for salmonids during the hot summer months (Tom Shuhda, Colville National Forest Fish Biologist, personal communication).

Seven lakes on the Colville Indian Reservation are located in the Lake Roosevelt Subbasin and are closed basin lakes with Chara Bench traits and limnological conditions characteristic of eutrophic or meso-eutrophic productivity status. These characteristics, combined with hot arid climatic conditions, create habitat conditions that are not optimal salmonid habitat. As early as May, lake epilimnions comprise up to 10 meters of the water column, reaching temperatures of over 20^0C. Hypolimnion areas are generally separated from the epilimnion by a definite thermocline of up to a 15^0C temperature change in 2 meters of water. The hypolimnion areas are reduced and have low dissolved oxygen (DO) levels (<5 mg/l) due to the relatively high Biological Oxygen Demand (BOD) associated with Chara Bench lakes, nutrient loading and nutrient cycling.

Lotic environments on the Colville Indian Reservation in the Lake Roosevelt Subbasin closely resemble those outside the reservation. Habitats are generally low elevation, exhibit warm water temperatures (15^0C-21^0C), intermittent flows, dramatic peak

spring freshet and high fines deposition resulting in increased embeddedness of the stream substrates .

Wildlife

Construction of Grand Coulee Dam inundated over 70,000 acres (Merker 1993) along the mainstem of the Columbia River, Spokane River, and Kettle River. Mule deer and sharp-tailed grouse winter range was lost by the inundation, as well as habitats used by other wildlife species, reducing the potential carrying capacity for this subbasin by species dependent on low elevation riparian/riverine habitats for all or part of the year.

Watershed Assessment (Limnological studies)

Colville National Forest. 1998. Lone-Deer Ecosystem Analysis at the watershed scale. Republic Ranger District. Republic, WA.

Colville National Forest. 1996. Tonata-Bamber Watershed Analysis Report (Kettle River Watershed). Republic Ranger District. Republic, WA.

Colville National Forest. 1996. Sheep Creek Watershed Assessment. Kettle Ranger District. Kettle Falls, WA.

Fish habitat and passage evaluations were conducted in the Sanpoil River Basin and other tributaries of the mainstem (LeCaire, 1991). In addition, two (2) Integrated Watershed Management Plans have been developed on the Colville Reservation (Six-Mile IRMP Watershed Plan and Owhi Lake IRMP Watershed Plan), which integrate land use activities with fish and wildlife needs.

Limiting Factors

Identifying limiting factors for fish and wildlife populations depends largely on the composition of the target species and/or assemblage. In the Lake Roosevelt Subbasin, many different management strategies are designed to address the various habitats. Therefore, assuming that limiting factors will only address native fish populations in the subbasin may not always be appropriate. Of course, native species recovery is a priority in areas where such efforts are feasible; however, providing subsistence and recreational fisheries in severely altered habitats may be accomplished using non-native species/stocks. It must be recognized that the extirpation of anadromous fish from the subbasin has severely limited the fishery and until anadromous fish can feasibly be recovered in the subbasin, on-site and off-site resident fish projects will be used to partially mitigate for anadromous losses.

Lake Roosevelt

The most significant limiting factor to fish populations managed in Lake Roosevelt is hydro-operations. In 1999, collection reports from the Rock Island Dam bypass facility confirmed the presence of 986 kokanee and 234 Floy-tagged rainbow trout that were released behind Grand Coulee Dam in 1998 and 1999 (LeCaire 1999). Entrainment of fish,

specifically rainbow trout and kokanee salmon severely limits the fishery in Lake Roosevelt.

In addition to increased emigration, many other habitat related parameters are limited by Grand Coulee Dam and upriver project (outside of the Intermountain Province) operations, thus, likely limiting fish populations. Spilling at upriver projects creates total dissolved gas (TDG) levels in Lake Roosevelt that exceed clean water standards. It is hypothesized that these elevated levels are causing significant mortality to certain fish species throughout the reservoir. Furthermore, drastic fluctuation of reservoir elevation frequently changes the littoral zone, thus limiting productivity. The lack of stable littoral habitats in the lake has resulted in virtually no macrophyte communities and a severely depressed benthic macroinvertebrate assemblage. Ultimately, the lack of littoral habitat limits fish communities that occupy such habitats. Impoundment also eliminated salmonid spawning and rearing habitat by replacing rapids and gravel bars with deep zero velocity lacustrine environments and sand substrate, thus limiting natural salmonid production.

Since Lake Roosevelt has short water retention times (8-65 days), the reservoir lacks dimictic traits characteristic of deep lacustrine environments in eastern Washington. Lack of stratification during the summer creates uniform water temperatures throughout the water column that often exceed the thermal maximum for native salmonids. As a result, the uniform temperature regime creates a limited refuge of a suitable temperature (Cichosz et al. 1999).

Data presented in Cichosz et al. (1999) suggests that periphyton growth/ colonization in Lake Roosevelt appeared to be inhibited during summer drawdowns and was benefited during refill conditions in the lake. Efforts to model zooplankton density and biomass to environmental variables (chlorophyll a, secchi depth, daily WRT, daily temperature, reservoir inflow, reservoir outflow, and reservoir elevation) were generally unsuccessful using simple regression analyses (Cichosz et al. 1999). On the other hand, Underwood and Shields (1995) were able to show that zooplankton density generally decreased as water retention time decreased below 30 days. Zooplankton is the primary food source for kokanee, rainbow trout, suckers, whitefish and fry fishes of all species (Cichosz et al. 1999). Thus, hydro-operations, which reduce water retention time reduces food availability for fish, also reduces fish caring capacity of the lake. Currently, kokanee salmon harvest goals are ten fold greater than that currently realized. Zooplankton abundance (fish food availability) does not appear to be an overriding limiting factor, evidenced by current growth rates of kokanee. However, if mitigation actions builds a kokanee population to the size necessary to achieves an annual harvest goal of 300,000 kokanee, food production will most likely be a limiting factor resulting reduced fish growth and perhaps survival (Cichosz et al 1999). Continued monitoring of the zooplankton community is imperative to determine fish food availability and identify actions, which enhance zooplankton densities.

Complete understanding of the genetic composition of kokanee inhabiting Lake Roosevelt has not been achieved. The many upriver stocks consist of native and non-native stocks. Entrainment of kokanee into Lake Roosevelt from upriver areas (Arrow Lakes, Kootenay Lake, Lake Pend Oreille, Flathead Lake, Lake Coeur d' Alene, and Little Spokane River Chain Lakes) is widely accepted as fact, however, magnitude is unknown. The problem is that potentially native populations occur at such low densities that getting enough samples to conduct a statistically significant analysis has not occurred (LeCaire

1999). All kokanee released into Lake Roosevelt via the Sherman Creek and Spokane Tribal hatcheries have adipose fin clips. However, a large number of fish recovered in creel and sampling activities possess full adipose fins (LeCaire 1999). Managers and researchers are unclear on the origin of kokanee with intact adipose fins although current data does not support the hypothesis of emigrants from other waters (LeCaire 1999). To evaluate the genetic structure of the kokanee population, a study was initiated in 2000 is utilizing microsatellite DNA.

Lake Roosevelt salmonid fish production is limited by tributary spawning/rearing habitat (Beckman et al. 1985). Furthermore, natural recruitment of kokanee in Lake Roosevelt is limited, since annual drawdowns expose shoreline redds (Stober et al. 1981). As a result, hatchery and net pen production are used to overcome the production limitation.

Another limiting factor includes finding hatchery stocks and/or rearing conditions, which maximize fish performance in the lake. An example is kokanee salmon precocity. The Spokane Tribal Hatchery experimented with rearing kokanee brood stock as a means to develop a self-sufficient egg source. The goal was to hold kokanee salmon for three years in the hatchery and take eggs from three-year-old fish. During that experiment, 40 - 60% of the two year old fish were precocious (Tim Peone, personnel communication). The implication is that since the hatchery programs rear kokanee salmon to a post-smolt (age 1+) stage, 40-60% of the fish released in June return three months later as precocious fish (both jacks and jills). In 2000, a study was conducted to determine the percent of precocious kokanee salmon prior to release as a post-smolt. Preliminary results suggest precocity for some stocks of kokanee salmon was as high as 75% (Keith Underwood, Personal Communication).

A significant limiting factor for fisheries managers is understanding relationships among the native and non-native species in the lake and determining methods to inhibit one species for the benefit of another. This job is especially difficult, in light of the fact that Lake Roosevelt is a dynamic system with a myriad of native and non-native habitats constantly disrupted by hydro-operations. For example, walleye are an apex predator of Lake Roosevelt. This species is not native and has had a significant effect on the prey base of the lake. Walleye feed heavily on fry fishes and limit recruitment of native and non-native species (Cichosz et al. 1999).

Banks Lake

Kokanee

One or more of the factors listed above may be affecting the kokanee fishery in Banks Lake. Since the availability of kokanee eggs has been insufficient to meet requests statewide, planting more fish is not as possible. The best course of action would seem to be raising larger fish before planting. Larger fish at stocking might address the possible entrainment, predation, and even food availability problems. Currently, kokanee stocked in Banks Lake are six to eight months old. Kokanee reared in net pens and released at one and a half years of age have created successful returns to the fishery and hatchery at nearby Lake Roosevelt.

Lack of hatchery space and water to retain the kokanee through the summer, until lake water temperatures are cool enough, preclude implementing the net pen-rearing plan

at Banks Lake. Either additional hatchery space must be constructed and water developed, or existing facilities reprogrammed to meet this need.

Moses Lake

General description

Initial analysis of historical and current biological data did not indicate any glaring deficiencies that would lead the project to identifying what is currently limiting panfish production. Analysis of biological data involved the use of indices, including:

1. Species composition
2. Proportional stock densities
3. Age and growth analysis
4. Length and age frequency distributions
5. Relative weights
6. ANOVA of fish lengths and weights

Compilation of historic water quality and biological data, and recently collected data has lead to the formulation of initial hypotheses that will lead in the design of a study to determine limiting factors for panfish recruitment to the sport fishery.
The lack of specific reasons indicated through data analysis for the poor recruitment of panfish highlighted that predation, primary productivity, species interactions, and habitat quality and quantity need to be investigated to determine reasons for the depressed panfish populations.

Historic occurrences or conditions may have affected the fishery in Moses Lake. It is irrelevant to seek what initially caused the decline of the fishery, but rather through a methodical investigation determine what factors continue to depress the fishery and what possible management actions can be taken to correct these factors.

The State's ability to provide angling opportunity for native fishes has continued to decline, in large part due to the changing face of the habitats in which those fishes reside. Besides lost opportunities in the blocked area, anglers are currently faced with the loss of fisheries on the upper Columbia River associated with the ESA mandated listings or potential listings of other species including steelhead, spring chinook, bull trout. As these species are listed or their status is scrutinized, other associated fisheries are also lost due to their proximity to the listed populations and the potential for anglers to impact the listed populations. Those waters and habitats which are best suited to the propagation of non-native fisheries and where those non-native fishes have little or no impact on native fish resources should be developed as a substitute for those native natural resources. The non-native fisheries also act as a buffer to continued angling pressure on unlisted native stocks.

Kettle/Colville Rivers

Timber production, grazing, road construction, water diversions and recreational uses, have all lead to a decrease in habitat quality. These activities have increased sediment loads, altered seasonal water regimes and destabilized streambanks; resulting in simplification of stream habitats and an overall decrease in water quality. These impacts, combined with stocking of exotic species, have resulted in the elimination of bull trout and a significant

reduction in the ranges of the redband and cutthroat trout. These impacts are similar to those experienced throughout the entire Kettle River Subbasin.

Other waters

Poor to fair habitat conditions in headwater tributaries are primarily due to livestock overgrazing of the riparian vegetation, the use of the streambanks by recreationists and livestock that have compacted certain segments of streambank, and the elimination or reduction of riparian vegetation along the streambanks and floodplain by the imprint of road prisms. Streambank erosion and soil movement from the county and forest road system are constant sources of sediment that affect habitat quality and the streams' abilities to handle flows.

Limnology of the lakes on the Colville Indian Reservation limit the feasibility of wild self-sustaining populations of salmonids. Most of the lakes are closed basin lakes with Chara Bench traits and or limnological conditions characteristic of eutrophic or meso-eutrophic productivity status. These characteristics, combined with hot arid climatic conditions create habitat conditions that are not optimum salmonid habitat. As early as May, lake epilimnions comprise up to 10 meters of the water column, reaching temperatures of over 20^0C. Hypolimnion areas are generally separated from the epilimnion by a definite thermocline of up to a 15^0C temperature change in 2 meters of water. The hypolimnion areas are reduced and have low DO levels (<5 mg/l) due to the relatively high BOD associated with Chara Bench lakes, nutrient loading and nutrient cycling.The affect on salmonids, particularly in summer months, is that epilimnion temperatures exceed thermal maximums and hypolimnions are lacking DO. Additionally, lotic environments (including tributaries to lacustrine habitats are poor, exhibiting warm water temperatures (15^0C-21^0C), intermittent flows, dramatic peak spring freshet and high fines deposition resulting in increased embeddedness of the stream substrates. Due to the existing habitats natural production is limited in lacustrine and lotic habitats separately or in combination, Thus, the need for artificial production projects are necessary to sustain subsistence and recreational fisheries in these lakes and streams.

Wildlife

Available information on the limiting factors for wildlife are described for the representative species within the broad categories of large mammals, small mammals, and birds.

Large mammal limiting factors

White-tailed deer: Epizootic Hemorrhagic Disease (EDH), Loss of winter range and other critical habitat to development (human encroachment), extreme winter weather, overharvest, and predation.

Mule deer: Aerial surveys and harvest trends have shown a steep decine in mule deer numbers over the last 10 years on the Colville Reservation side of the Lake Roosevelt Subbasin , as well as adjacent subbasins (CCT, WDFW unpublished file data). Although the reasons for depressed mule deer numbers are unknown, reductions in deer habitat and forage quality and alteration of seral plant communities resulting from livestock grazing

(78 percent of shrub-steppe is in a declining state), forest management practices, new road construction, and other anthropogenic factors have been hypothesized as causes for reduced deer numbers (Anderson, Bowden, and Medin 1972/1990, Bartman 1984, Griffith and Peek 1989).

Predation of adult and juvenile mule deer by cougars, coyotes, and black bear has also been identified as a potential limiting factor. Certainly all these factors can and do affect mule deer numbers, as can subsistence/recreational hunting (Hamlin, Riley, Pyrah, Dood, and Mackie 1984, Unsworth, Pac, White, and Bartmann 1999, Whittaker and Lindzey 1999). Unfortunately, without additional investigations and research to identify/verify specific reasons for declines in mule deer numbers, the causes for decline will remain only speculative.

Elk: Cover (thermal/security) and/or forage may be limiting to elk, particularly on winter ranges or calving habitats. Proper size and spacing of forage areas permits full utilization, assuming disturbance is minimal. Open road densities that exceed 1.5 miles per square mile will reduce elk habitat effectiveness.

Big horn sheep: Parasites (Parelaphostrongylus larvae) and disease (scours); collisions with motor vehicles; interactions with domestic livestock; rural subdivision.

Small mammal limiting factors

Lynx are limited by the availability of a winter prey base, primarily snowshoe hare, and its preferred habitats. Denning habitat is declining as a result of logging practices and the primary prey base for lynx, the snowshoe hare, has declined due to forest succession. The US Forest Service / Bureau of Land Management Biological Assessment of the effects of forest and land use plans on lynx (Hickenbottem et al. 1999) identified the following eight risk factors, in the Northern Rockies geographic area, that limit the continued existence of the lynx:

- Timber harvest [including salvage logging] and pre-commercial thinning that reduce denning or foraging habitat or converts habitat to less desirable tree species
- Fire exclusion that changes the vegetation mosaic maintained by natural disturbance processes
- Grazing by domestic livestock that reduces forage for lynx prey
- Roads and winter recreation trails that facilitate access to historical lynx habitat by competitors
- Legal and [or] incidental trapping and shooting
- Predation
- Being hit by vehicles
- Obstructions to lynx movements such as highways and private land development

Bird limiting factors

Ruffed and blue grouse are affected by forest practices that use regeneration techniques that include extensive broad leaf tree and shrub control, reduced stocking rates and cover

density through thinning and pruning, and replanting with tree species that provide less habitat benefit, short harvest rotations that don't produce large down logs for drumming or result in future production of large limbed trees suitable for winter roosting and foraging (WDFW, 1999 Status and Trend Report). They are affected by intensive grazing of open lowland forests that reduces the quantity and quality of breeding and brood rearing habitat (WDFW, Management Recommendations for Washington's Priority Habitats and Species, 1991).

Sharp-tailed grouse have been extirpated from the Columbia River mainstem shrub-steppe habitats. The loss of wintering habitat, and the fragmentation of habitats as a result of inundation from the construction of Grand Coulee Dam, may have isolated local grouse populations. Also contributing to the demise of local grouse populations are, vegetative changes associated with livestock grazing and conversions of rangeland to irrigated agricultural cropland; a result of water/groundwater availability for pumping, attributable to Lake Roosevelt and Grand Coulee Dam. Occupation and conversion of low elevation shrub-steppe habitat to rural residence is also limiting the opportunity for sharp-tailed grouse to occupy historical use areas.

Bald eagles are limited by prey availability, temporal disturbances from human activities, and the availability of suitable nesting and roosting habitat (WDFW 1991). Reduction in suitable nesting and roosting habitat can occur as a result of forest practices, rural subdivision, and natural attrition of large limbed trees suitable for nesting.

Artificial Production

See attached Hatchery and Genetic Management Plans (appendices). HGMPs that are incomplete will have final versions available in August as a component of the project proposals.

Existing and Past Efforts

Fish

The three management agencies with fisheries management responsibility within the subbasin have initiated numerous projects through the Northwest Power Planning Council’s Fish and Wildlife Program to partially mitigate for the loss of anadromous fish due to the federal hydropower system utilizing resident fish (resident fish substitution). These projects have enhanced the resident fishery (both native and non-native) in the "blocked area" through habitat/passage improvements (Lake Roosevelt Rainbow Trout Habitat/Passage Improvement project, #9001800); stock assessment activities, (Habitat/Passage Improvement project,#9001800, Chief Joseph Kokanee Enhancement Project, #9501100 and Lake Roosevelt Fisheries Monitoring Program, #944300); artificial production enhancement activities (Colville Tribal Fish Hatchery, #8503800, Spokane Tribal Hatchery, #9104600, Sherman Creek Hatchery, #9104700 and Lake Roosevelt Rainbow Trout Net Pens, #9500900) and cooperative resource management (Resident Fish Stock Status Above Chief Joseph and Grand Coulee Dams, #9700400).

Currently, hatchery production programs are being monitored to evaluate their contribution to existing fisheries in the subbasin. Habitat improvement projects are

currently being monitored/evaluated for effectiveness, while existing habitat and fish stock/population evaluations are proceeding throughout the basin.

Colville Tribal Hatchery (#8503800)

Operations began at the hatchery in 1990 and have continued to the present time. Originally the project was production goal oriented (1990-1994). However, in 1995 more fisheries-related goals and objectives were developed for the program to assess the program impact on subsistence and recreational fisheries (Truscott 1995). Objectives include short-term (i.e., annual production objectives and administrative objectives) and long-term (e.g., average creel size fish, catch per unit efforts, average fish condition factor in creel, increases in natural production fishery component, maintenance and development of free-ranging brood stock sources, monitoring and evaluation and development of comprehensive fishery management plans) fishery related objectives. Reports and technical papers developed during this period include annual operating plans and reports.

Fourteen lakes and streams of the Colville Reservation, included in the Lake Roosevelt Subbasin, are stocked annually with fish originating in the Colville Tribal Hatchery (Truscott 1997). Stocking density from the Colville Tribal Hatchery in reservation waters of the Lake Roosevelt Subbasin averages over 812,000 fish with an average weight of 38,298 pounds (Truscott 1997). This stocking program has been successful at providing subsistence and recreational opportunities. For example, creel surveys on North and South Twin Lakes between 1991 and 1997 estimate that anglers harvested rainbow trout at a rate of 0.446 fish per angler hour and maintained a average fish condition factor of 132×10^{-7}. (Truscott 1997). During the same period, anglers harvested brook trout at a 0.11 fish per angler hour rate, while maintaining an average fish condition factor of 129.6×10^{-7}(Truscott 1997). However, the brook trout fishery in the two lakes was conducted in the spring and fall months in the littoral zone of the lakes. The creel survey was conducted from April through October and likely was the reason for the low catch rate for brook trout. A monthly evaluation of the catch would likely reveal a more accurate description of the fishery.

Spokane Tribal Hatchery (#9104600)

The Spokane Tribal Hatchery (managed by the Spokane Tribe) rears kokanee salmon and rainbow trout for release into Lake Roosevelt, Lake Roosevelt tributaries, and Banks Lake. The hatchery was constructed in 1991 and began releasing fish in 1992. This hatchery was designed to raise 8 million fry kokanee, but due to limited water supply and limited survival of fry fish in Lake Roosevelt, the hatchery now rears 500,000 kokanee to yearling age. Currently, the kokanee reared in the Spokane Tribal Hatchery are Lake Watcom stock. However, the program goal is to develop a self-sustaining egg source from Lake Roosevelt. As a result, alternative kokanee stocks are being tested (e.g.. Kootenay Lake). The hatchery also rears approximately 500,000 rainbow trout annually. The rainbow eggs are provided by the Spokane Hatchery, which is managed by the WDFW.

Sherman Creek Hatchery (#9104700)

The Sherman Creek Hatchery (managed by WDFW) serves two functions. The hatchery is an acclimation and rearing facility for kokanee and rainbow trout, and is a kokanee egg collection facility. Sherman Creek hatchery was built and began releasing fish in 1992. The

Spokane Tribal Hatchery transfers 250,000 kokanee to Sherman Creek in April of each year. The kokanee acclimate to Sherman Creek water until July and then are released into Lake Roosevelt. At age three or four, kokanee released from Sherman Creek return to spawn. Sherman Creek Hatchery is outfitted with a fish ladder to collect returning spawners for spawning purposes. Fertilized kokanee eggs are transported to the Spokane Tribal Hatchery for rearing. Sherman Creek Hatchery also acclimates rainbow trout and additional kokanee during the summer months depending on fish availability and water temperatures.

Colville Hatchery (WDFW)

The WDFW Colville Trout Hatchery manages a locally adapted native rainbow trout broodstock currently being used to augment Lake Roosevelt tributary populations (Phalon Lake #5513300). In addition, it is providing fish to the Lake Roosevelt Net Pen Project to evaluate this stocks' ability to resist entrainment at Grand Coulee Dam, while providing an enhanced recreational fishery.

Lake Roosevelt Rainbow Trout Net Pen Project (#9500900)

The Lake Roosevelt Net Pen Project is a grass roots, community based, effort to enhance rainbow trout harvest opportunities. This project began in the 1980's with local anglers looking for a method to enhance the Lake Roosevelt fishery. In 1996, BPA provided a coordinator to assure this program continued. The project has grown to nine net pen sites, which in total rear 500,000 rainbow trout. The Spokane Tribal Hatchery rears the rainbow trout from eggs in November to fry in September. The hatchery then transfers the fish to the net pens in September, where they are reared to catchable size by June. The rainbow trout are released ideally in June, but in years of deep drawdown, physical limitations require earlier releases. The net pen program produces the most successful fishery in the lake. Over 95% of all rainbow trout captured in the lake are from the net pens.

Chief Joseph Kokanee Enhancement Project (#9501100)

The Goal of the Chief Joseph Kokanee Enhancement Project is to protect and enhance the natural production of kokanee stocks above Chief Joseph and Grand Coulee dams to provide successful subsistence and recreational fisheries and provide a broodstock source for artificial production in Lake Roosevelt.

Field activities began during in the fall of 1995 and continue today. Activities include: (1) Spawning escapement monitoring and enumeration of adult kokanee present Lake Roosevelt and Rufus Woods Reservoir tributaries (i.e., SanPoil River, Big Sheep Creek, Deep Creek, Onion Creek, Ora-Pa-Ken Creek and Nespelem River respectively), (2) Collection of genetic material from adult tributary spawning populations in the aforementioned streams and free-ranging kokanee in Lake Roosevelt kokanee, (3) Collection of kokanee "swim-up" from redds and monitoring fry emigration from the SanPoil River to Lake Roosevelt, (4) Hydroacoustic monitoring of fish entrainment through Grand Coulee Dam.

A critical accomplishment achieved through this project has been the identification of a potentially unique stock of kokanee. Genetic evaluations have resulted in the collection of information that may characterize a free-ranging kokanee population in Lake Roosevelt. Rapid declines of the adult tributary spawning population have been

documented through adult spawning escapement and redd surveys from 1995-1997. This population has been identified as critically depressed and declining. Additional important achievements related to this project include the identification of spawning locations in the SanPoil River and Barnaby Creek, seasonal adult run-timing, and potential limiting factors to tributary production such as abnormal peak late-winter / early-spring flows, bedload movement and passage barriers relating to reservoir operations. The project has documented substantial entrainment related to Grand Coulee Dam. Important data have and continue to be collected to access entrainment characteristics related to project operations (i.e. flood control draft, power draft, power peaking, spring flow augmentation and summer flow augmentation).

Lake Roosevelt Rainbow Trout Habitat/Passage Improvement Project (#9001800)

The goal of the project is to contribute to subsistence and recreational fisheries by protecting and enhancing the production of adfluvial rainbow trout populations through improvement to fish passage and in-stream habitat in Lake Roosevelt tributaries.

Early fisheries investigations (Scholz et al. 1986) indicated that the lack of high quality spawning and rearing habitat was a limiting factor to adfluvial rainbow trout production in Lake Roosevelt. Limited stream surveys also identified fish passage barriers (improper culvert installation and intermittent flows) as limiting production.

Twenty-seven streams were examined during 1990-1991 to assess fish habitat, fish population estimates and potential limiting factors to adfluvial rainbow trout production. Five streams were selected for planning and implementation of passage / habitat improvements based upon presence of adfluvial rainbow trout, limiting factors, and potential for improved production.

Design and implementation of habitat and passage improvement actions on the five selected streams began in 1992 and continued through 1995. Implementation actions affected 20.9 miles of stream course. Specific actions included, reinstallation of six (6) culverts, 500 meters of channel reconstruction (meanders) installed in previously channeled stream courses and 125 in-stream structures installed in efforts to improve passage and improve habitat quality. Riparian improvements included placing 14,500 riparian plants/shrubs/trees and livestock exclusion fence along 4.5 miles of stream course. Habitat quantity was increased by 11% through passage improvement alone.

Monitoring of the effectiveness of implementation actions began in 1995 and is expected to continue through 2001. Specific accomplishments related to the monitoring phase. Specific outcomes of the program are uncertain at this time. Definitive results and evaluation will be available in post-2001. However, interim accomplishments realized during the monitoring activities include trend information related to adult spawning year-class strength, adult run-timing, juvenile outmigration timing, juvenile population densities, and longevity/function of instream structures and channel reconfiguration.

Lake Roosevelt Monitoring Program (#944300)

This program has two primary goals. The first is to monitor and evaluate the performance of fish released into Lake Roosevelt by the Spokane Tribal and Sherman Creek hatcheries. The second goal is to develop a fisheries management plan, which prescribes mitigation actions and hydro operations that will maximize ecosystem diversity, complexity, and sustainablity. In order to develop an achievable fisheries management plan, a better

understanding of this unique non-native Lake Roosevelt ecosystem is required. As a result, a model is being developed to predict the effect of single actions on the ecosystem and fishery of the lake.

Restore Moses Lake Recreational Fishery (#9502800)

Activity for this project started in April 1999. By November 1999, a full-time staff consisting of three biologists was in place. Analysis of historical and current data is currently ongoing. Development of testable hypotheses and study design will be completed by the fall of 2000. Implementation of the study design and development of a lake management plan will be completed by 2003. Monitoring and evaluation will be conducted in 2003 and 2004.

This project seeks to improve the recreational sport fishery of Moses Lake to historic levels. During the 1970's, up to and exceeding 200,000 panfish (black crappie, bluegill and yellow perch) were harvested from the lake. Undetermined factors adversely affected the production of warmwater fish in the lake. Eventually the fish population shifted from a prey dominated to predator dominated system. Angler use and harvest use declined during the 1980' and 1990's. Currently, the most sought after gamefish in Moses Lake is walleye. Walleye are a highly specialized fishery and do not afford the angler interest or harvest levels historically experienced on Moses Lake.

Primary goals for the project include: 1. Develop a Moses Lake management plan, with prescriptions for establishing a balanced and productive warmwater fishery. 2. Increase and sustain the harvest of panfish and the amount of angler use hours on Moses Lake.

Resident Fish Stock Status Above Chief Joseph and Grand Coulee Dams (#9700400)

The Joint Stock Assessment Project (JSAP) area (blocked area) is composed of 32 unique water bodies covering 9.3 million acres. The project boundary is defined as all water bodies upstream of Chief Joseph Dam within the State of Washington. Prior to hydropower development, the area was a productive, stable ecosystem (Scholz et al. 1985) which contained healthy, native, self-sustaining populations of resident fish, wildlife, and anadromous fish.

The present the fish assemblage is drastically different than pre-dam development. Anadromous fish have been extirpated due to the construction of Grand Coulee Dam. Thirty-nine resident fish species are known to exist in the blocked area, the majority of which are not native. This largely non-native assemblage is, in part, the product of authorized and unauthorized introductions. Dynamics of the current system have been developing over the last five decades, and have not reached equilibrium. Managers today are unclear of simple ecological aspects of the system such as distribution and range of the 39 fish species.

The JSAP has been designed to function as a tool for fish managers in the blocked area. This tool will focus on understanding the dynamics of fish and their habitats throughout the area and recommend management actions based on the best available science and the condition of the entire areas' ecosystem. The JSAP allows managers to view the Blocked Area as a system by compiling previously collected data, organizing available data, identifying areas needing data, performing necessary research, and recommending management actions. Managers acknowledge that to effectively manage the fisheries, information such as species present and relative densities are required at a

minimum. It is important to realize that this project has been set up to centrally accommodate all managers avoiding effort duplication, and ensuring Area wide coordination at achieving the stated vision

In 1993, managers identified a need for a coordinated approach to fish management in theblocked area. This coordinated approach included a baseline stock inventory of the resident fish species inhabiting the area and is the basis for measure 10.8B.26. This need was also recognized by the Independent Science Review Panel (ISRP) in their 1998 report. Recommendations made by the ISRP are very similar to the way in which the JSAP has been set up.

The JSAP is centered around the concept in the Council's program that management actions should be based upon and supported by the best available scientific knowledge [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 implementing projects addressing specific Council Program measures will use this information, success of the JSAP increases the likelihood of other project success.

Wildlife

The following programs/projects are being implemented by local, state, tribal, and federal agencies towards meeting their various wildlife goals and objectives:

The Foundation for North American Wild Sheep

The foundation funded "Sheep Crossing" signs along the Kettle River county road which were installed by Ferry County Public Works to address the limiting factor of mortality caused by vehicle collisions.

U.S. Forest Service

The USFS planned and coordinated (WDFW & Ferry County Weed Board) a weed spray project on critical sheep habitat. Weed spraying reduces the interspecific competition of forage vegetation and non-forage vegetation, thus increasing the forage base.

Spring/summer range enhancement project

About 20 acres of remote meadow were fertilized to enhance ewe and lamb spring/summer range with help from the Spokane Chapter of Safari Club International.

Game Management Unit 133 enhancement

In GMU 133, the CRP program, State/Landowner/NIRCS cooperation, planting mix and management plans and planting crews; aids game as well as non-game species. Increases in mule deer population and distribution attributed to this program.

Cooperative Mule Deer Study

A cooperative 5-year mule deer study has been initiated and includes Okanogan, Ferry, Stevens and Lincoln counties in the Lake Roosevelt subbasin. Cooperators include WDFW (Lead), Colville Confederated Tribes, Chelan PUD, Northwest Wildlife Council, and US Forest Service.

Land Acquisition, Protection/Enhancement Project

The Spokane Tribe of Indians have acquired 1,863.5 acres of land through mitigation, since 1993, for the protection and enhancement of habitats lost from construction of Grand Coulee Dam. Baseline habitat assessments and site-specific management plans, emphasizing mule deer, white-tailed deer, ruffed grouse and sharp-tailed grouse habitat enhancement and protection have been completed (B.J. Keiffer, Spokane Tribal Wildlife Biologist, personal communication).

The Confederated Tribes of the Colville Reservation (CCT) acquired approximately 9,569 acres of land through mitigation since, since 1993, for the protection and enhancements of habitats lost from the Construction of Grand Coulee and Chief Joseph Dams in this subbasin. Baseline habitat assessments and site-specific management plans, emphasizing management and protection of mule and white-tailed deer and ruffed and sharp-tailed grouse habitats, have been completed on the acquired lands (Matthew Berger, Colville Tribal Wildlife Biologist, personal communication). Other CCT activities include preparation of a Draft Integrated Resource Management Plan (Boyce et al. 1998), and use of prescribed fire to maintain and enhance deer and elk habitat.

The Sherman Creek Wildlife Area Management Plan (WDFW), Working Draft, was published in May 1997 on the 9,064 acre Wildlife Area. Forest management practices, including use of prescribed fire coordinated with adjacent USFS burns, have been implemented to maintain and/or improve wildlife habitat.

The Chesaw Wildlife Area was acquired specifically for sharp-tailed grouse with the assistance of BPA mitigation funds. The Chesaw Wildlife Area contained approximately 2,480 acres, however 1,000 to 1,500 acres may have been added since 1995 (Ron Freeze, WDFW Region 2 non-game wildlife biologist. personal communication).

Rocky Mountain Elk Foundation (RMEF), WDFW, and USFS

Project involving burning of 1,200 acres and seeding 300 acres of roads over a three year period in the Cliff Ridge - Addy Mountain area began in 1999 (WDFW 1999).

Bald eagle productivity and prey utilization study

A two year Bald eagle productivity and prey utilization study, contracted by the Bureau of Reclamation to Science Applications International Corporation (SAIC), with assistance from the Colville Tribes and the WDFW.

USDA Forest Service, Pacific Northwest Research Station

The project developed a draft technical report (March, 2000) for the Interior Columbia Basin called: "Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-Scale Trends and Management Implications.

Subbasin Management

Goals, Objectives, and Strategies

The overall subbasin goal is to provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, which include the many area lakes and their subbasins used to achieve on and off-site mitigation for the loss of anadromous fish.

The Upper Columbia United Tribes' (UCUT) short-term goal is to develop sustainable resident fish populations, their habitats and mitigate for the loss of wildlife habitat to a level that allows for harvest at near historical pre-dam levels. The UCUT long-term goal is to restore native anadromous salmonid-based fish and wildlife communities above Chief Joseph and Grand Coulee dams to meet societal needs.

The National Forest Service (NFS) overarching goal is to maintain viable native vertebrate populations under the National Forest Management Act. The Colville National Forest Land and Resource Management Plan, as amended by the Inland Native Fish Strategy, directs the NFS to protect native fish by reducing the risk of loss of populations and reducing potential negative impacts to aquatic habitat of resident fishes. Further, the Colville National Forest fisheries goal is the restoration of degraded riparian and instream habitat on NFS lands.

Fish Objectives and Strategies

I. Lake Roosevelt and Tributaries

A. Kokanee salmon and rainbow trout (hatchery reared stocks)

Objective

Create and maintain a high quality sport and subsistence kokanee salmon and rainbow trout fishery as substitution for the loss of anadromous fish above Grand Coulee Dam (see

Table 6).

Table 6. Lake Roosevelt Resident Fish Substitution Objectives for Lost Anadromous Fish Harvest and Escapement Goals

Species	Stock	Harvest (number)	Escapement (number)	Total (number)	Adults (pounds)	Year
kokanee	hatchery	290,000	10,000	300,000	2.0	2010
	wild	120,000	60,000	180,000	2.0	U
Rainbow trout	net pen	190,000	NA	190,000	1.5	1997
	wild	12,000	6,000	18,000	2.0	2005[i]
	wild	150,000	74,000	224,000	2.0	final[t]
sturgeon	wild	100[i]	U	U	U	2010[i]
Burbot	wild	50,000[i]	U	U	U	2005[i]
lake whitefish	wild	U	U	U	U	U
mt. whitefish	wild	U	U	U	U	U
Walleye	wild	131,000	U	131,000	1.5	1996
sm. mouth. bass	wild	30,000[i]	U	U	U	U

[1] Biological objectives adopted by the NWPPC with post adoption revisions, i = interim, also includes SanPoil River, NA = not applicable, U = unknown at the present time, will be determined during the subbasin assessments, t = target date will be determined after interim goal is achieved.

Strategies

1. Produce 1,000,000 yearling kokanee and 500,000 catchable rainbow trout among the Spokane Tribal Hatchery, Sherman Creek Hatchery, Colville Hatchery (Phalon Lake Project #551330), Ford Hatchery and the Lake Roosevelt Net Pen Program for release in June, annually
2. Trap and spawn adult wild rainbow trout broodstock at Phalon Lake to obtain 500,000 eggs annually for the rainbow trout stocking program in Lake Roosevelt and tributaries.
3. Develop self-sustaining populations of kokanee salmon and rainbow trout by collecting eggs of hatchery origin, lake grown kokanee salmon and rainbow trout at Sherman Creek, Spokane Tribe Fish trap and other egg collection facilities.
4. Stock hatchery kokanee salmon and rainbow trout that demonstrate strong performance in the Lake Roosevelt fishery and is closely related to native stocks.
5. Reduce entrainment of hatchery fish over Grand Coulee Dam with devise(s) designed to divert fish upstream away from the dam.
6. Create complex littoral habitats consistent with salmonid needs.
7. Increase lower trophic level production by increasing nutrient loads and revegetating littoral zones.
8. Operate the Columbia River System to minimizes Lake Roosevelt drawdowns and maximizes water retention time as prescribe by the 1995 NWPPC's Fish and Wildlife Program.
9. Research, model, monitor and evaluate abiotic and biotic factors in the hatchery and lake which are limiting hatchery fish performance while limiting impacts to native species and provide recommendation for improvement.

10. Develop a fisheries management plan with public involvement that recommends specific lake operations and management actions to improve the fisheries of Lake Roosevelt.
11. Enforcement to prevent illegal harvest.

Objective

Develop self-sustaining wild populations of kokanee salmon and rainbow trout with hatchery origin fish in a minimum of five tributaries that do not presently contain native kokanee salmon or rainbow trout by 2010.

Strategies

1. Identify candidate tributaries and inventory stream habitat, fish presence, fish genetic character and water quality.
2. Develop and implement stocking plans, habitat improvement plans, harvest regulation plans and M&E plans.
3. Reduce entrainment of wild fish over Grand Coulee Dam with devise(s) designed to divert fish upstream away from the dam.
4. Adaptively manage stocking, harvest and habitat improvements based on results from a monitoring and evaluation program able to measures the performance of stocked fish in the fishery, wild reproduction and recruitment.
5. Develop a fisheries management plan with public involvement that recommends specific lake operations and management actions to improve the fisheries of Lake Roosevelt.
6. Enforcement to prevent illegal harvest.

B. Rainbow trout, kokanee salmon and cutthroat trout (native, wild stocks)

Objective

Manage native wild rainbow trout population to provide an annual tribal subsistence and recreational harvest of 12,000 adult fish with an escapement of 6,000 adults by the year 2010 and an annual harvest of 150,000 fish with an escapement of 75,000 as the ultimate objective. Also, manage the native-wild kokanee salmon subsistence and recreational fishery that produces an annual harvest of 120,000 adult fish with an escapement of 60,000 adults as the ultimate goal, see

Table 6.

Strategies

1. Conduct stock assessments and population inventories (both adult and juvenile) in tributaries of Lake Roosevelt to identify the presence of native wild stocks, population dynamics and limiting factors.
2. Protect unique tributary wild, native rainbow trout and kokanee salmon by not stocking such tributaries with hatchery reared rainbow trout and kokanee salmon of different genetic origin.
3. Improve adfluvial and resident salmonid habitats and monitor the effectiveness of improvements.
4. Increase the complexity of aquatic habitat by increasing, where inadequate, the numbers of pools and large instream wood per mile to increase cover and spawning and rearing habitat with instream structure placement.
5. Reconnect habitat where impassable culverts presently block fish passage, unless there is valid reason where blockages are beneficial to native fish populations.
6. Improve the capability of riparian vegetation to adequately act as a filter for soil movement, a source of future large instream wood recruitment, a shading component to reduce summer water temperatures, a source of detritus for macroinvertebrates and as a source of stability for the streambanks by fencing out livestock and enforcing logging buffers.
7. Improve road maintenance to reduce soil movement off the road and entering the streams. Road closures have eliminated or reduced the impact of those roads located within the riparian areas.
8. Operate fish weirs on spawning tributaries to assess adult escapement and prevent potential introgression of hatchery fish into the spawning population.
9. Operate Lake Roosevelt consistent with guidelines identified in the 1995 NWPPC's Fish and Wildlife Program.
10. Reduce entrainment of native wild fish over Grand Coulee Dam with devise(s) designed to divert fish upstream away from the dam.
11. Adaptively manage harvest regulations and habitat improvements based on results from a monitoring and evaluation program able to measures the performance of native, wild fish in the fishery, recruitment and escapement.
12. Enforcement to prevent illegal harvest.
13. Develop a fisheries management plan with public involvement that recommends specific lake operations and management actions to improve the fisheries of Lake Roosevelt.

C. Sturgeon, burbot, mountain whitefish and lake whitefish

Objective

Create and maintain a substantial, high quality sport and subsistence fishery for sturgeon, burbot, lake whitefish and mountain whitefish, see

Table 6**.**

Strategies

1. Determine carrying capacity of each species in Lake Roosevelt, appropriate harvest goals, limiting factors and enhancement plan.
2. Operate Lake Roosevelt consistent with guidelines identified in the 1995 NWPPC's Fish and Wildlife Program.
3. Reduce entrainment of native wild fish over Grand Coulee Dam with devise(s) designed to divert fish upstream away from the dam.
4. Adaptively manage harvest regulations and habitat improvements based on results from a monitoring and evaluation program able to measures the performance of native, wild fish in the fishery, recruitment and escapement.
5. Use artificial production as needed to enhance populations.
6. Monitor and evaluate abiotic and biotic factors in the hatchery and lake which are limiting fish performance while limiting impacts to other native species and provide recommendation for improvement.
7. Develop a fisheries management plan with public involvement that recommends specific lake operations and management actions to improve the fisheries of Lake Roosevelt.
8. Enforcement to prevent illegal harvest.

D. Warmwater species (walleye, small mouth bass, perch, etc.)

Objective

Create, maintain and enhance a self-sustaining substantial, high quality sport and subsistence fishery for wild walleye, small mouth bass, see

Table 6**.**

Strategies

1. Estimate natural lake production of wild warmwater species, food availability and proactively set harvest regulations to balance predator and prey.
2. Reduce entrainment of warmwater fish over Grand Coulee Dam with devise(s) designed to divert fish upstream away from the dam.
3. Create complex littoral habitats consistent with warmwater fish needs.
4. Increase lower trophic level production by increasing nutrient loads, revegetating littoral zones and placement of artificial structures.
5. Operate the Columbia River System to minimize Lake Roosevelt drawdowns and maximizes water retention time as prescribed by the 1995 NWPPC's Fish and Wildlife Program.
6. Research, model, monitor and evaluate abiotic and biotic factors in the lake which are limiting fish performance while limiting impacts to native species and providing recommendation for improvement.
7. Enforcement to prevent illegal harvest.
8. Develop a fisheries management plan with public involvement that recommends specific lake operations and management actions to improve the fisheries of Lake Roosevelt.

E. Anadromous Fish

Objective

Restore a self-sustaining anadromous fish population above Grand Coulee Dam, which provides a harvestable surplus adequate to meet traditional harvest levels by 2100 (see Table 7).

Strategies

1. Investigate the feasibility of providing anadromous fish passage (adult and juvenile) above Grand Coulee Dam (i.e., truck and haul, fish ladder, etc.) by 2005.
2. Identify potential anadromous species and sources of donor stocks capable of migrating to the Upper Columbia River and develop a propagation plan by 2010.
3. Conduct activities necessary based on fish passage and propagation plans to have anadromous fish runs above Grand Coulee Dam by 2025.
4. Immediately begin enhancing tributary and mainstem anadromous fish habitat by promoting appropriate land management activities and increasing habitat rehabilitation activities.

II. Area Lake (Off-Site Mitigation Objectives and Strategies)

Table 7. Colville Tribe Reservation - Area Lake Hatchery Production and Harvest Objectives

		Hatchery production		Fishery goals		
				CPUE	Avg. FL	Condition
Species	Size	(lb.)	(number)	(fish/hr)	(in)	KFL

Species	Size	Hatchery production (lb.)	(number)	Fishery goals CPUE (fish/hr)	Avg. FL (in)	Condition KFL
Rainbow trout	fingerling	2,500	200,000			
	subcatchable	13,000	300,000			
	catchable	15,000	81,000	>1a-0.8b	13.5	1.0
Brook trout	fingerling	2,200	176,000			
	subcatchable	13,200	300,000			
	catchable			>1a-0.8b	12.0	1.0
Combined		45,900		>1a-0.8b		

A. Rainbow trout (coastal hatchery origin stock)

Objective

Annually enhance and maintain a successful subsistence fishery for Colville Tribal members as well as non-member sport fishery with hatchery-reared rainbow trout in lakes and streams of the Colville Reservation with catch rates of 0.5-1 fish/hour, an average condition factor of >125xE-7 and an average length of 340mm.

Strategies

1. Continue to stock rainbow trout into Bourgeau, Elbow, Nicolas, North Twin, South Twin, LaFleur and Sugar Lakes, as well as Hall, Stranger and Wilmont Creeks.
2. Develop a "free-ranging" rainbow trout source of rainbow trout eggs as the basis for hatchery production in Colville Reservation waters (130,000 eggs per year by the year 2003) and continue to obtain eggs from WDFW or other sources until local broodstock sources are developed.
3. Adaptively manage stocking densities and harvest regulations to meet rainbow trout objectives through monitoring and evaluation programs (i.e. conduct stock assessments, population inventories, and angler surveys to estimate population strength, population dynamics, and fishery quality over time).
4. Operate recreational rainbow trout fishery consistent with wild fish management.
5. Plant fish capable of survival and reproduction to increase natural production.
6. Enforcement to prevent illegal harvest.
7. Maintain functioning littoral and pelagic habitats.
8. Initiate watershed management with a holistic management approach to maintain or improve rainbow trout spawning/rearing habitat in Bourgeau, Elbow, Nicolas, North Twin, South Twin, LaFleur and Sugar Lakes, as well as Hall, Stranger and Wilmont Creeks.

B. Brook trout

Objective

Annually enhance and maintain a successful subsistence brook trout fishery for the Colville Tribal members as well as a sport fishery for non-members on the Colville

Tribe Reservation with catch rates of 0.5 - 1 fish/hour, an average condition factor of >125xE-7, and an average total length of 305mm

Strategies

1. Annually stock brook trout into in North Twin, South Twin, Round, and Simpson Lakes Colville Reservation waters.
2. Use eggs collected from "free-ranging" brook trout adults in Owhi Lake as the basis for hatchery production for Colville Reservation waters.
3. Adaptively manage stocking and harvest regulations to meet objectives through monitoring and evaluation programs (i.e. conduct stock assessments, population inventories, and angler surveys to estimate population strength, population dynamics, and fishery quality over time).
4. Enforcement to prevent illegal harvest.
5. Manage brook trout fishery consistent with wild fish management.
6. Initiate watershed management with a holistic management approach to maintain or improve brook trout spawning/rearing habitat in North Twin, South Twin, Round, and Simpson Lakes.
7. Maintain brook trout brood lake (Owhi Lake) in a mesotrophic condition.
8. Maximize survival of brook trout by limiting bass in select lakes.
9. Maintain/improve functioning littoral and pelagic habitats.

Objective

Where feasible, restore, enhance, and maintain wild/native salmonid populations on the Colville Indian Reservation at harvestable levels.

Strategies

1. Where feasible, establish/improve habitat conditions consistent with native species production.
2. Initiate watershed management with a holistic management approach to improve water quality and quantify in streams and lakes.
3. Minimize incidental harvest of wild salmonids in hatchery based fishery.
4. Curtail non-native species/stock management emphasis as habitats are improved and provide conditions consistent with native species production at harvestable levels.
5. Utilize existing native stocks, when they exist, to enhance populations either through natural production, supplementation or other artificial production application.

Objective

Provide a successful subsistence fishery for the Spokane Tribal Members with rainbow trout and kokanee salmon in three reservation lakes (Table 8).

Strategies

1. Twice a year stock 4,000 catchable rainbow trout and 500 catchable kokanee salmon into Benjamin, Turtle and McCoy Lakes.

2. Adaptively manage stocking and harvest regulations to meet objective through monitoring and evaluation program (i.e. conduct stock assessments, population inventories, and angler surveys to estimate population strength, population dynamics, and fishery quality over time).
3. Enforcement to prevent illegal harvest.

Objective

Maximize rainbow trout and kokanee habitat is Spokane Tribe Reservation lakes.

Strategies

1. Determine current caring capacity of Benjamin, McCoy, Turtle and McCoy Lakes.
2. Identify limiting factors by reviewing historical limnological and fisheries data, collect new data as needed, and develop a plan to minimize limitations.
3. Implement habitat improvement, which are cost effective and have a high probability of improving fish productivity and ecosystem integrity.

Table 8. Spokane Tribe Reservation - Area Lake Mitigation Objectives

				Fishery goals		
		Hatchery production		CPUE	Avg. FL	Condition
Species	Size	(lb.)	(number)	(fish/hr)	(in)	KFL
Rainbow trout	catchable	8,000	28,000	1.0	13.5	1.0-1.1
Kokanee Salmon	catchable	300	1,000	0.8	13.5	1.0-1.1
Combined		8,300	29,000	1.0	13.5	1.0.1.1
Bluegill			25,000			1.0-1.5
Largemouth bass			1,000			1.0-1.5
Smallmouth bass			2,000			1.0-.15
walleye			7,000			1.0-1.5
Yellow perch			35,000			1.0-1.5
Other Waters						
Rainbow trout	catchables	500,000	500,000		1.0	
Kokanee salmon	fingerlings	500,000	500,000			

1 = All objectives are subject to change during the subbasin assessments,
i = interim objective, f = final objective.

III. Moses Lake – Warmwater fish species

Objective

Maintain and enhance a balanced productive Moses Lake warmwater recreational fishery to near historical records as off-site resident fish substitution for the loss of anadromous fish above Chief Joseph and Grand Coulee Dams (Table 9).

Table 9. Washington State - Area Lake Mitigation Objectives[1]

Species	Size	Harvest number	Hatchery product (number)	Fishery goal CPUE (fish/hr)
Banks Lake				
Rainbow trout	catchable	200,000	200,000[i]	1.0
	catchable	560,000	560,000[f]	1.5
Kokanee salmon	fingerling	U	1million[i]	0.5
	fingerling	U	U	
	catchable	U	U	
Moses Lake				
Black crappie		30,000		1.0-1.5

1 = All objectives are subject to change during the subbasin assessments

Strategies

1. Estimate (qualitative and quantitative) populations of fish species in Moses Lake.
2. Assess warmwater fish species diets seasonally and annually.
3. Quantify warmwater fish growth and maturation rates.
4. Conduct creel surveys to quantify angler harvest and fish species preference.
5. Investigate angling and natural mortality for warmwater fish species in Moses Lake.
6. Assess impact of non-gamefish population densities and diet on production and recruitment of warmwater fish species.
7. Measure primary productivity and water quality seasonally and annually.
8. Estimate spawning and rearing production of warmwater fish species in Moses Lake.
9. Determine recruitment success of warmwater fish species in Moses Lake.
10. Assess impacts of seasonal changes in lake elevation in regards to production of warmwater fish species.
11. Determine affects of inter and intra-specific interactions of fish in Moses Lake.
12. Quantify rates of entrainment of fish out of Moses Lake.
13. Inventory habitat quality and quantity for Moses Lake.
14. Use GIS to graphically represent habitat quality and quantity, fish distribution, density and habitat use.
15. Development of long-term data set and indices for management of the warmwater fishery.
16. Refine management objectives for selected warmwater fish species in Moses Lake.
17. Develop a management plan to achieve the identified biological objectives.

18. Monitor and evaluate implementation of the management plan.
19. Enforcement to prevent illegal harvest.

IV. Banks Lake

A. Rainbow trout and kokanee salmon

Objective

Create and maintain a high quality kokanee salmon and rainbow trout subsistence and recreational fishery as substitution for loss anadromous fish angling opportunity above Chief Joseph and Grand Coulee historical levels and current productivity assessment.

Strategies

1. Produce fingerling kokanee at the Spokane Tribal Hatchery and WDFW Spokane Hatchery, Ford Hatchery and Colville Hatchery for annual releases. Production (currently about 1 M, but as high as 5 M or 25% of hatchery production) based on past agreements between WDFW, Spokane Tribe, Colville Tribe, and BPA.
2. Develop net pen rearing capabilities for kokanee. Produce up to 200,000 rainbow trout fingerlings from the WDFW Spokane Hatchery, Ford Hatchery, and Colville Hatchery for winter and spring rearing at Coulee City and Electric City Net Pen Program for release in April - June each year.
3. Develop the means (probably net pen rearing) to increase rainbow yearling stocking levels to 20 per acre (approximately 560,000 RB) annually.
4. Assess salmonid populations (fingerling and yearling survival, age class structure, population densities, harvest - creel).
5. Identify and implement methods to reduce kokanee and rainbow entrainment.
6. Monitor the effect of lake elevation and water retention time on the kokanee and rainbow trout populations.
7. Enforcement to prevent illegal harvest.

B. Warmwater species (walleye, large and smallmouth bass, perch, etc.)

Objective

Create and maintain and enhance a self-sustaining substantial, high quality sport and subsistence fishery for wild walleye, large and smallmouth bass.

Strategies

1. Estimate natural lake production of wild warmwater species, food availability and proactively set harvest regulations to balance predator and prey.
2. Create complex littoral habitats consistent with warmwater fish needs.
3. Increase lower trophic level production through by increasing nutrient loads, revegetating littoral zones and placement of artificial structures.
4. Operate the Columbia River System to minimize Banks Lake drawdowns and maximizes water retention time.
5. Research, model, monitor and evaluate abiotic and biotic factors in the lake which are limiting fish performance and providing recommendation for improvement.

6. Enforcement to prevent illegal harvest.

V. Other Waters – Rainbow trout and kokanee salmon

Objective

Create and maintain a high quality rainbow trout and kokanee salmon fishery in 10 waters in the subbasin (to be determined) as substitution for lost fishing opportunity above Grand Coulee Dam.

Strategies

1. Produce catchable rainbow trout and fingerling salmon within the WDFW Spokane Hatchery Complex.
2. Develop additional rearing capacity at the WDFW Ford Hatchery with a new well water source and upgrade facility structure.
3. Monitor and evaluate for goal of 1 fish/hour harvest.
4. Enforce fishing regulations.

Wildlife Goals, Objectives, and Strategies

WDFW has identified generic wildlife/habitat goals, objectives, and strategies for Eastern Washington including areas encompassed by specific subbasins. Specific wildlife population goals and objectives, however, are not available but will be developed when species-specific management plans are completed.

Wildlife Goals

1. Fully mitigate for losses incurred from construction of Grand Coulee Dam (Table 10).
2. Maintain viable mule deer populations in the Lake Roosevelt Subbasin and throughout northeast Washington (Figure 3).
3. Maintain and enhance wildlife populations/communities to satisfy tribal and societal resource needs/demands.
4. Maintain viable sharp-tailed grouse populations in the Lake Roosevelt/Intermountain Province and throughout Northeast Washington.

Table 10. Lake Roosevelt Subbasin wildlife mitigation objectives.

Species	Total Habitat Units
Grand Coulee	
Sage Grouse	-2,746
Sharp-tailed Grouse	-32,723
Ruffed Grouse	-16,502
Mourning Dove	-9,316
Mule Deer	-27,133
White-tailed Deer	-21,362
Riparian Forest	-1,632

Riparian Shrub	-27
Canada Goose Nest Sites	-74
Total	-111,515

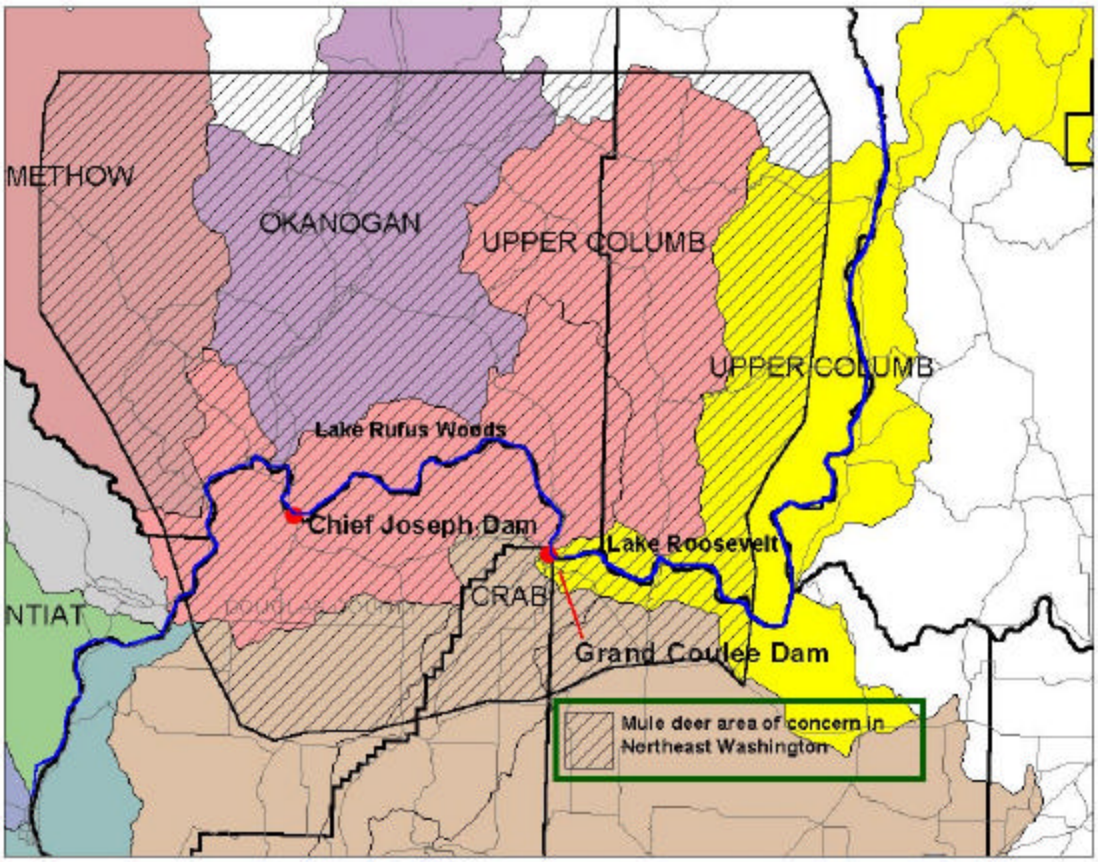

Figure 3. Mule deer area of concern in Northeast Washington.

Wildlife Objectives

Objective 1: Acquire land and/or management rights to 111,515 habitat units (HUs) by 2010.

Strategies

1.1 Purchase and maintain critical areas within priority watersheds to protect and/or restore terrestrial habitats for associated wildlife species/communities.

1.2 Coordinate efforts with other resource managers to maximize benefits to wildlife habitat, fish and wildlife populations, local communities, and Tribes.

1.3 Protect existing and newly acquired wildlife habitat through adequate long-term Operations and Maintenance (O&M) funding.

1.4 Conduct annual project monitoring and evaluation (M&E) and apply adaptive management principles as necessary to meet terrestrial resource goals.

Objective 2: Identify specific factors limiting/affecting mule deer populations in the Lake Roosevelt subbasin and adjacent subbasins/provinces by 2004 (Figure 3).

Strategies

2.1 Continue mule deer habitat quality/browse nutrition research project in cooperation with WDFW, CCT, Chelan county PUD, Colville National Forest, Okanogan National Forest, Wenatchee National Forest, Inland Northwest Wildlife Council, Northern Okanogan Sports Council, Washington State Universlty, University of Washington, and the University of Idaho.
2.2 Monitor doe/fawn ratios and hunter harvest annually.
2.3 Conduct mule deer winter counts annually.
2.4 Control non-native weedy vegetation on critical mule deer habitat and re-establish preferred mule deer forage plant species where practical.
2.5 Monitor livestock use and determine grazing impacts.
2.6 Develop restoration strategies for altered landscapes/habitat.
2.7 Monitor mule deer predation.

Objective 3: Enhance existing and available habitat to optimize conditions required to increase overall wildlife productivity of desired species assemblages (Table 5).

Strategies

3.1 Increase desired wildlife population numbers to harvestable levels as necessary to meet tribal and societal needs/demands.
3.2 Complete habitat and wildlife population inventories and analyze existing biological information in order to develop specific biological objectives, identify habitat enhancement opportunities, and to document existing limiting factors and data gaps.
3.3 Coordinate efforts with other resource managers to maximize benefits to wildlife habitat, fish and wildlife populations, local communities, and tribes.
3.4 Educate public and sportsmen groups regarding wildlife management issues.
3.5 Enforce all environmental/wildlife regulations, laws, and statutes.
3.6 Monitor and evaluate the effectiveness of projects and apply adaptive management principles as necessary to meet terrestrial resource goals.
3.7 Monitor population levels and habitat conditions. Develop target population goals and develop habitat/wildlife population trend indices.
3.8 Protect existing and newly acquired wildlife habitat through adequate long-term Operations and Maintenance (O&M) funding.
3.9 Educate land managers and user groups of new and innovative management techniques that reduce collateral impacts to other resources.

Wildlife Objective 4

Increase present sharp-tailed grouse populations within the Intermountain Province and associated subbasins to a minimum of 800 grouse by 2010.

Wildlife Strategies

4.1 Develop cooperative management agreements with private landowners and government agencies (NRCS, WDFW, CCT, STI, DNR, BLM, Conservation Districts etc.)
4.2 Acquire, protect, enhance, and maintain sharp-tailed grouse habitat.
4.3 Identify and document the locations of existing meta populations/population sinks.
4.4 Identify and map critical/potential habitat.
4.5 Conduct sharp-tailed grouse trap and transfer programs to increase genetic variation.
4.6 Monitor sharp-tailed grouse using radio telemetry, lek surveys, etc., to identify movement corridors and habitat use, and determine mortality factors.
4.7 Monitor habitat quality and develop strategies to improve habitat conditions based on monitoring results and species response to habitat changes.

Other existing planning documents/policies affecting fish and wildlife

The Colville National Forest Plan established Habitat Capability Objectives for wildlife. These include an increase of 20% for mule deer habitat; 18% increase for elk habitat; 10% increase for waterfowl habitat; 5% increase for beaver habitat. For snag dependent species, maintain 60% of the population potential where timber is harvested; 100% of potential on other NFS lands. For old growth dependent species, maintain sufficient suitable habitat to insure the viability of all species dependent upon these habitats and a diversity of climax ecosystems across the Forest. For caribou and grizzly bear, an objective of 30 and 12 animals respectively has been set. For bald eagles, an objective of four potential nesting territories is desired.

Stevens, Lincoln, and Ferry Counties have all conducted watershed planning processes through the WIRA process or other similar watershed approaches. Colville Confederated Tribes and Spokane Tribe of Indians are conducting point and non-point source water quality planning. Washington state has numerous agencies also approaching the issues of water quality and quantity in an effort to reduce fish and wildlife loss. Few resources are spent on fish and wildlife resource improvements due the limited number of Endangered or threatened species in the Lake Roosevelt Area. For example, fish and wildlife habitat improvement funds from Washington Department of Transportation are rarely awarded to this area because of its low priority.

The National Park Service (NPS), Bureau of Land Management (BLM) and the NFS are the three primary federal land manager within the Lake Roosevelt drainage. All three federal land managers enhance wildlife populations either actively with projects or passively through land use regulations. For example, the Colville Nation Forest is fencing riparian areas; closing, resurfacing or relocation of road segments that are adversely affecting riparian and instream habitat quality; stabilizing streambank through riparian planting and/or structure placement (particularly on Sherman and Boulder Creeks adjacent

to the state highways) and increasing instream habitat complexity through the introduction of instream wood and rock structure. Dialogue is continuing with the state highway department to continue the reduction of the state highway system impacts on NFS lands through analysis of its effects on riparian and stream habitat. Removal or modification of Growden Dam on Sherman Creek, which is presently a barrier to fish passage (and also a safety issue), is an example of the NFS and WDOT working together. Elimination or reduction of non-native fish species in the tributaries of all larger rivers and reintroduction of historic species such as bull, redband and westslope cutthroat trout will occur as habitat conditions improve. Continued prescribed burning of understory vegetation in the dry ponderosa pine and douglas fir to increase forage in mule deer winter range, control of noxious weeds to improve forage conditions for bighorn sheep, snag retention during timber harvest, protection and enhancement of wetlands, establishment of nesting platforms/boxes and road closures in key wildlife habitat.

Research, Monitoring and Evaluation Activities

Fish

Lake Roosevelt and its tributaries have a number of research, monitoring and evaluation (RM&E) activities. A primary RM&E program is the Lake Roosevelt Research, Monitoring, and Evaluation Program (#9404300). This project monitors and evaluates 1) hatchery rainbow trout and kokanee salmon performance in the fishery and the ecosystem, 2) monitors and evaluates the effect of hydro-operations and management actions on the fishery and ecosystem, 3) conducts limnological and population based research on aquatic primary, secondary and tertiary trophic levels in an attempt understand the lake ecology, 4) based on research and literature creates a model able to suggest the importance of various limiting factors and potential actions to surpass those limiting factors. 5) creates a fisheries and lake operation management plan, 6) adaptively manages Lake Roosevelt mitigation and RM&E as new information is discovered.

Chief Joseph Kokanee Enhancement Project (#9501100) also plays a large part in understanding entrainment of fish over Grand Coulee Dam, kokanee escapement into select tributaries of Lake Roosevelt and through genetic work identifying unique kokanee stocks in the lake. The Chief Joseph Kokanee Enhancement Project conducts RM&E activities vital to understanding fish emigration/mortality and wild kokanee population dynamics.

The Lake Roosevelt Rainbow Trout Habitat/Passage Improvement Project (#9001800) focuses its RM&E activities in streams of Lake Roosevelt that contain wild and possibly native rainbow trout and/or kokanee salmon. This project collects important stream habitat and fish population data. The information provided to the fish managers with the Chief Joseph Kokanee Enhancement Project and the Lake Roosevelt Research, Monitoring and Evaluation Program information allows for a full review of lake and tributary fish performance and the effects of limiting factors on various fishes and life stages.

Resident Fish Stock Status Above Chief Joseph and Grand Coulee Dam (#9700400) collects baseline fish and habitat data in tributaries and area lakes that have had little attention. This project also is compiling past and present data into a uniform database which informs fish manager as to where fish are present, what the species assemblage is and the state of the habitat in a given body of water. For Lake Roosevelt

and tributaries, this project provides a forum where data from other projects is compiled and this project provides important habitat and species assemblage information for tributaries not being studied by other projects.

Spokane Tribal Hatchery(#9104600), Sherman Creek Hatchery (#9104700), Lake Roosevelt Rainbow Trout Net Pen Project (#9500900)

For area lakes, the Colville Tribal Hatchery (#8503800) RM&E activities consist of screening the hatchery for disease, growth, size at release and mortality within the hatchery. Furthermore, creel and relative abundance surveys are performed on area lakes to identify the success of the fishery. The Colville Tribe also conducts RM&E activities associated with reservation lake water quality, limnology and preliminary trophic level investigations. The Spokane Tribe of Indians also hold annual derbies to evaluate the fishery in reservation lakes.

WDFW conducts annual full fisheries and limnological surveys on select area lakes including opening day creel surveys to assess fishery performance. The Restore Moses Lake Recreational Fishery (#9502800) is currently monitoring and evaluating the Moses Lake fishery and in the future will be recommending actions to restore the Moses Lake Fishery to near historic fisheries. The Phalon Lake Project (#5513300) has not been funded through BPA, but currently operates on a minimum budget. WDFW has conducted RM&E activities in the Kettle River and other water bodies to assess the performance of Phalon Lake rainbow trout.

Limiting factors

Fisheries

Hydro-operations related limiting factors include fish entrainment, habitat availability, nutrient retention (primary production), food (secondary production), and species interactions. Projects addressing limiting factors include the Chief Joseph Kokanee Enhancement Project (#9501100), and the Lake Roosevelt Fisheries Monitoring Program (#9404300).

Fish production related limiting factors include hatchery production, and lake/tributary spawning/rearing habitat. Projects addressing limiting factors include Sherman Creek Hatchery (#9104700), Spokane Tribal Hatchery(#9104600), Lake Roosevelt Net Pen Project(#9500900), Colville Tribal Hatchery(#8503800), Chief Joseph Kokanee Enhancement Project (#9501100), the Lake Roosevelt Fisheries Monitoring Program (#9404300), Lake Roosevelt Rainbow Trout Habitat/Passage Improvement Project (#9001800), Resident Fish Stock Status Above Chief Joseph and Grand Coulee Dam (#9700400) and the Mosses Lake Fisheries Enhancement Project (#9502800).

Fishery performance related limiting factors include food/habitat availability, hatchery/wild fish performance and species interactions. Projects addressing limiting factors include the Lake Roosevelt Fisheries Monitoring Program (#9404300), the Mosses Lake Fisheries Enhancement Project (#9502800), Lake Roosevelt Rainbow Trout Habitat/Passage Improvement Project (#9001800), the Chief Joseph Kokanee Enhancement Project (#9501100), and the Colville Tribal Hatchery(#8503800).

Present BPA Projects and limiting factors they address:

The following mitigation projects were acquired by BPA and/or WDFW to partially mitigate/compensate for wildlife habitat losses incurred by the construction of Grand Coulee Dam. Projects include: Sagebrush Flat Wildlife Area, Swanson Lakes Wildlife Area, Wenas Wildlife Area, Sunnyside Wildlife Area, and the Scotch Creek Wildlife Area. The primary limiting factors and primary species of interest, related to the Lake Roosevelt Subbasin, addressed by each project are described below:

Project	Limiting Factors/Primary Species of Interest	
	Cover Type/Limiting Factors	Wildlife Species
Sagebrush Flat	Shrub-steppe: habitat fragmentation; conversion to agricultural fields; livestock grazing	Pygmy rabbits, sage grouse, sharp-tailed grouse, and mule deer
Swanson Lakes	Shrub-steppe: habitat fragmentation; conversion to agricultural fields; livestock grazing	Sharp-tailed grouse, sage grouse, and mule deer
Wenas	Shrub-steppe, Riparian, Riparian Forest: habitat fragmentation; conversion to agricultural fields; livestock grazing; logging	Sage grouse, mule deer, elk, big horn sheep, ruffed grouse, burrowing owls, salmonids
Sunnyside	Shrub-steppe: habitat fragmentation; conversion to agricultural fields; livestock grazing:	Sage grouse, mule deer, salmonids, waterfowl
Scotch Creek	Shrub-steppe, Riparian, Riparian Forest: habitat fragmentation; conversion to agricultural fields; livestock grazing; logging	Sharp-tailed grouse, mule deer, white-tailed deer

Annual operation and maintenance activities must be funded in perpetuity to ensure that present and future habitat gains resulting from enhancement, protection, and maintenance measures are not lost. The following mitigation projects, activities, and/or strategies have occurred or are proposed by WDFW, Colville Confederated Tribes (CCT), Spokane Tribe of Indians (STOI), and the U. S. Forest Service respectively.

WDFW is mitigating (compensating) off-site for shrub-steppe and riparian habitat losses associated with Grand Coulee and Chief Joseph Dams (the Northwest Power Planning Council has designated shrub-steppe/riparian habitats as high priorities). The following projects are located within the Crab, Yakima, Okanogan , or Upper Columbia Subbasins, but are being credited against construction and inundation losses incurred in the Lake Roosevelt Subbasin.

The Sagebrush Flat Wildlife Area is comprised primarily of shrub-steppe habitat and includes the Sagebrush Flat, Dormaier, MJM, and Smith Units. The primary mitigation goal is to recover and manage self-sustaining pygmy rabbit, sharp-tailed grouse, and sage grouse populations on project lands. Restoration, enhancement, operation, maintenance, monitoring and evaluation activities must continue to ensure the continuance and accrual of wildlife habitat benefits.

Habitat enhancement, maintenance, and protection measures on the Sagebrush Flat Unit include: development of firebreaks and "green strips" (vegetation firebreaks), fence construction to prevent trespass livestock grazing, conversion of agricultural land to shrub-steppe habitat, and noxious weed control.

On the Dormaier Unit, sagebrush cover will be reduced on approximately 80 acres of abandoned agricultural land to improve habitat quality for pygmy rabbits (shrub cover will be reduced from 73% to less than 25%). Herbicides and mechanical means will be employed. Grass and forbs, now largely non-existent, will be planted using conventional farming methods and/or broadcast seeding techniques to improve herbaceous cover and composition.

A Habitat Evaluation Procedure was completed on the MJM (Chester Butte) and Smith (West Foster Creek) units in 1999. The MJM Unit was acquired primarily to protect shrub-steppe habitat for sage grouse, pygmy rabbits, and mule deer while the Smith Unit was purchased to protect primarily sharp-tailed grouse habitat. Habitat enhancement, maintenance, and protection measures are similar for both areas and include: shrub-steppe enhancements, weed control, grass seedings, shrub plantings, fence construction and repair, fire suppression measures, and riparian enhancements. The Sagebrush Flat Mitigation Plan will be updated to include enhancement measures for these two units.

Located approximately 18 miles south of the Lake Roosevelt Subbasin, the 19,785 acre Swanson Lakes Wildlife Area (Crab Subbasin) was purchased jointly by WDFW and BPA to protect shrub-steppe habitat for sharp-tailed grouse, sage grouse, mule deer and other endemic/obligate wildlife species. Habitat enhancement and maintenance measures include: shrub/tree plantings, fence repair and construction, conversion of agricultural fields to native-like vegetation, weed control, riparian enhancements, and road/trail improvements to name a few. Both wildlife and habitat monitoring and evaluation activities are also taking place. Swanson Lakes, as with all WDFW mitigation projects, will require annual operations and maintenance funds, in perpetuity, to protect present and future habitat values.

The 104,000± acre Wenas Wildlife Area, located in the Yakima Subbasin , is compensation primarily for losses incurred within the Lake Roosevelt Subbasin. Shrub-steppe habitat units are credited against Grand Coulee and Chief Joseph dams. Species of interest include elk, big horn sheep, mule deer, sage grouse, burrowing owls, neotropical birds, and salmonids to name a few. WDFW staff is currently reviewing a draft of the Wenas Wildlife Management plan. Habitat enhancement and maintenance measures

include, but are not limited to shrub/tree plantings, fence repair and construction, conversion of agricultural fields to native-like vegetation, weed control, riparian enhancements, and road/trail improvements.

Like the Wenas Wildlife Area, the 10,538 acre Sunnyside Wildlife Area mitigation project is located within the Yakima Subbasin and is partial compensation for shrub-steppe habitat losses associated with Grand Coulee Dam and the Lake Roosevelt Subbasin. The primary species of interest, relative to losses resulting from the construction of Grand Coulee Dam, are sage grouse and mule deer. Habitat enhancement and maintenance measures include, but are not limited to shrub/tree plantings, fence repair and construction, conversion of agricultural fields to native-like vegetation, and weed control.

The 15,469 acre Scotch Creek Wildlife Area, located in the Okanogan Subbasin, is partial mitigation for shrub-steppe and riparian habitat losses associated with Grand Coulee Dam and the Lake Roosevelt Subbasin. The primary species of interest are sharp-tailed grouse, mule deer, and white-tailed deer. Several successful sharp-tailed grouse relocation efforts have occurred at Scotch Creek. Additional sharp-tailed grouse relocations are needed along with remote monitoring of relocated grouse. Habitat enhancement and maintenance measures include, but are not limited to riparian/upland shrub and tree plantings, fence maintenance and construction, conversion of agricultural fields to native-like vegetation, weed control, and mule deer winter range improvement activities. Acquisition and enhancement of adjacent lands is needed to increase the survival potential of this sharp-tailed grouse meta population.

Colville Tribe

The Colville Tribes believe they may be approaching about a third of the needed land base. Their project is very long- ranged based in terms of protecting, managing, and enhancing the wildlife habitat on the project. They believe that it is imperative to press forward with efforts to achieve full mitigation as rapidly as possible. Opportunities to do meaningful mitigation within the region are dwindling at an alarming rate.

Spokane Tribe

The Spokane Tribe began habitat improvements in spring 1999 and will continue through Fall 2001. Lands acquired that were once shrub-steppe and converted to agriculture will be converted back to shrub-steppe. All lands are being monitored to determine effectiveness of enhancement practices. Species response studies will occur once enhancement activities are completed. Also, additional acreage must be acquired to fully mitigate for the loss of wildlife habitat.

Forest Service

The Colville National Forest plans to improve degraded fish and wildlife habitat within NFS lands in the subbasin in the near term. Depending upon available funding, the recommendations from the final South Deep and North Kettle watershed analyses for fish and wildlife enhancement should be implemented in the next one to three years. This may include prescribed burning of deer winter range, fencing of riparian vegetation, culvert removal, road realignment, replacement and/or closure.

A complete inventory of culverts will be completed in 2001 and planning design and implementation of fish passage at road crossings (where none presently exists) should

take place over several years, depending upon the number of impassable culverts and available funding.

A great deal more remains to be done for wildlife mitigation than what has been accomplished thus far. Future needs are described below.

Statement of Fish and Wildlife Needs

Lake Roosevelt, Tributaries, and Area Lake

1. Continue all current ongoing BPA funded projects identified in the NWPPC's 1995 Fish and Wildlife Program and within the Lake Roosevelt Subbasin.
2. Begin all unfunded projects identified in the NWPPC's 1995 Fish and Wildlife Program and within the Lake Roosevelt Subbasin.
3 Identify specific limiting factors, such as habitat quality, reproductive performance, and mortality factors affecting mule deer populations within the Lake Roosevelt Subbasin and adjacent Subbasins/Provinces.
4 Continue to acquire mitigation lands.
5 Continue in perpetuity and expand operation and maintenance activities on all current and future mitigation/compensation projects.
6 Monitor and evaluate wildlife response to habitat acquisition, protection and enhancement measures.
7 Conduct wildlife habitat assessments to determine current status and trends.
8 Monitor habitat response to enhancement, protection, and maintenance measures.
9 Continue stocking rainbow trout, kokanee salmon, and brook trout from hatcheries and net pen programs.
10 Expand hatchery programs to include locally derived salmonid stocks.
11 Expand research, monitoring and evaluation programs to all waters receiving hatchery fish and/or considered mitigation for loss of anadromous fish above Grand Coulee Dam.
12 Conduct baseline species and habitat inventories of streams and lakes with limited current fish data.
13 Increase littoral habitat of Lake Roosevelt with vegetative plantings, structure placement and nutrient additions.
14 Increase stream habitat with appropriate instream, riparian and upland management actions.
15 Conduct genetic studies to identify unique native stocks of fish.
16 Follow the 1995 NWPPC's hydro-operation recommendations for Lake Roosevelt until the Lake Roosevelt Hydro-Operations and Fisheries Management plan is completed.
17 Complete Lake Roosevelt research and modeling exercise in order to complete the Lake Roosevelt Hydro-Operations and Fisheries Management plan.
18 Conduct all studies and actions necessary to expand anadromous and adfluvial salmonids ranges to include Lake Roosevelt, Lake Roosevelt tributaries, and area lakes.
19 Limit fish entrainment over Grand Coulee Dam through adjusting hydro-operations, and creating structures to divert fish upstream away from the dam.
20 Enforce federal, state, and tribal regulations and laws to minimize over harvest, and habitat degradation.
21 Conduct studies sufficient to determine carrying capacity of target species, and identify limiting factors to refine harvest/mitigation objectives.

References

Anderson, A. E., Bowden, D. C., and Medin, D. E. 1972. Mule deer numbers and shrub yield-utilization on winter range. J. Wildl. Manage. 36: 571-578.

Anderson, A. E., Bowden, D. C., and Medin, D. E. 1990. Indexing the annual fat cycle in a mule deer population. J. Wildl. Manage. 54: 550-556.

Bartmann, R. M. 1984. Estimating mule deer winter mortality in Colorado. J. Wildl. Manage 48: 262-267.

Beckman, L.G., J.F. Novotny, W.R. Parsons, and T.T. Tarrrell. 1985. Assessment of the fisheries and limnology in Lake F.D. Roosevelt 1980-83. U.S. Fish and Wildlife Service. Final Report to U.S. Bureau of Reclamation. Contract No. WPRS-0-07-10X0216; FWS-14-06-009-904, May 1985

Boyce, R., M. Clark, B. Dumas, R. Fleenor, C. Hruska, W. Hunner, C. Jones, J. St. Pierre, and D. Tonasket. 1998. Phase II Draft Integrated Resources Management Plan (IRMP): goals, objectives, standards, and guidelines. Confederated Tribes of the Colville Reservation, Fish and Wildlife Division. Nespelem, WA.

Cederholm**,** C.J., D.B. Houston, D.B. Cole, and W.J. Scarlett. 1989. Fate of coho salmon (*Oncorhynchus kisutch*) carcasses in spawning streams. Canadian Journal of Fisheries and Aquatic Sciences. 46:1347-1355.

Chadwick, Patrick A. Jr., Brian J. Davies, Tammy K. flowers, James Walton and Will Wirt. 1985. Moses Lake fish population analysis. Peninsula College. Port Angeles, Washington.

Cichosz, T.A., J.P. Shields, and K. Underwood. 1999. Lake Roosevelt monitoring/data collection program: 1997 annual report. Report to U.S. Department of Energy, Bonneville Power Administration. Division of Fish and Wildlife, Portland, OR. Contract number 88-63.

DeVore, J.D., B.W. James, D.R. Gilliland, and B.J. Cady. 2000. Draft Report B in D.W. Ward, editor. White sturgeon mitigation and restoration in the Columbia and Snake rivers upstream from Bonneville Dam. Annual Progress Report. Bonneville Power Administration, Contract DE-AI79-86BP63584. Portland, OR.

Duff, Raymond L. 1976. A year's survey of the Moses Lake fishery. Washington Department of Game. Olympia, Washington.

Eads, Rex, Tom Sibley, Rafael Ponce and Vivian Peterson. 1991. Economic impact and environmental assessment of the decline of fishing, Moses Lake and Potholes Reservoir. Big Bend Economic Council. Ephrata, Washington.

Fletcher, Doug, Molly Hallock and Kurt Perry. 1987-1993. 7 vol.. Warmwater fishing contests in Washington. Washington Department of Wildlife. Olympia, Washington.

Griffith, B. and Peek, J. M. 1989. Mule deer use of seral stage and habitat type in bitterbrush communities. J. Wildl. Manage 53: 636-642.

Griffith, J.R. and A.T. Scholz. 1991. Lake Roosevelt fisheries monitoring program. Annual report 1990. Bonneville Power Administration. Portland, OR. Project number 88-63.

Groves, Kenneth E. 1951. Fishes of Moses Lake, Washington. Walla Walla College. College Place, Washington.

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.

Hickenbottom, J.R., B. Summerfield, J. Aardahl, G. Halekas, M. Hilliard, L. Jackson, D. Prevedel, and J. Rupe. 1999. Biological assessment of the effects of national forest lands and resource management plans and Bureau of Land Management land use plans on Canadian lynx. Northern Region. 149 pp.

Jackson, Stephan Y. 1985. 1983 Moses Lake creel census. Washington Department of Game. Olympia, Washington.

Kline, T.C. Jr., J.J. Goering, O.A. Mathisen, P.H. Poe, and P.L. Parker. 1990. Recycling of elements transported upstream by runs of pacific salmon: evidence in Sashin Creek, southeastern Alaska. Canadian Journal of Fisheries and Aquatic Sciences. 47:136-144.

Korth, Jeffrey W. 1992. 1991 Moses Lake creel census. Washington Department of Fish and Wildlife. Olympia, Washington.

Korth, Jeffrey W. 1993-1998. 6 vol.. Fisheries management annual report. Washington Department of Fish and Wildlife. Olympia, Washington.

LeCaire, R. 1999. Draft Chief Joseph kokanee enhancement project: 1999 annual report and final report on entrainment. Report to U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project number: 9501100.

Lichatowich, J. 1999. Salmon without rivers: a history of the pacific salmon crisis. Island Press. Washington D.C.

Merker, C. 1993. Wildlife mitigationand restoration for Grand Coulee Dam: Blue Creek Project phase 1. Report to U.S. Depatment of Energy. Bonneville Power Admonistration Division of Fish and Wildlife. Contract No. DE-B179-91BP20291.

Mills, L.S., M.E. Soule, and D.F. Doak. 1993 The keystone-species concept in ecology and conservation. BioScience 43:219-224.

Murphy, M. and S. Judd. 1998. Final Report FY 96-97, Contract Number 1450CTP03T10123, Wildlife Division, Game Management Program. Colville Confederated Tribes.

Ray, V.F. 1954. The Sanpoil and Nespelem: Salishan peoples of northeastern Washington. Reprinted by Human Relations Area Files, New Haven.

R.L.& L. Environmental Services Ltd. 1996. Columbia River white sturgeon investigations. 1995 study results. Report prepared for B.C. Hydro, Kootenay Generation, Vancouver, B.C. and B.C. Ministry of Environment, Lands, and Parks, Nelson Region. R.L.& L. Report No. 96-377F: 94 p. + 6 app.

Scholz, A.T., J.K. Uehara, J. Hisata, and J. Marco. 1986. Feasibility report on restoration and enhancement of Lake Roosevelt fisheries. In: Northwest Power Planning Council. Applications for amendments. Vol. 3A:1375-1489.

Scholz, A., K.O'Laughlin, D. Geist, D. Peone, J. Uehara, L. Fields, T. Kleist, I. Zozya, T. Peone, and K. Teesatuski. 1985. Compilation of information on salmon and steelhead trout run size, catch, and hydropower related losses in the Upper Columbia River Basin, above Grand Coulee Dam. Upper Columbia United Tribes, Fisheries Center. Eastern Washington University, Cheney, WA. Fisheries Technical Report No. 2.

Scholz, A.T., R.J. White, M.B. Tilson, and S.A. Horton. 1993. Measurement of thyroxine concentration as an indicator of the critical period for imprinting in kokanee salmon (Oncorhynchus nerka): Implications for operating Lake Roosevelt kokanee hatcheries, Annual report 1992. Bonneville Power Administration. Portland, OR. Project Number 88-63. 60 pp.

Scholz, A.T., R.J. White, V.A. Koehler, and S.A. Horton. 1992. Measurement of thyroxine concentration as an indicator of the critical period for imprinting in kokanee salmon (Oncorhynchus nerka): Implications for operating Lake Roosevelt kokanee hatcheries, Annual report 1991. Bonneville Power Administration. Portland, OR. Project Number 88-63. 96 pp.

Stober, Q.J., M.E. Kopache and T.H. Jagielo. 1981. The limnology of Lake Roosevelt. Final Report Contract No. 14-16-0009-80-00004, To the U.S. Fish and Wildlife service. National Fisheries Research Center, Seattle, Washington. Fisheries Research Institute, University of Washington, Seattle. FRI-VW-8106.

Sylvester, Robert O. and Ray T. Oglesby. 1964. The Moses Lake water environment. U.W. Civil Engineering. Seattle, Washington.

Tilson, M.B., A.T. Scholz, R.J. White, and J. Galloway. 1994. Thyroid induced chemical imprinting in early life stages and assessment of smoltification in kokanee salmon: Implication for operations Lake Roosevelt kokanee salmon hatcheries, Annual Report 1993. Bonneville Power Administration. Portland, OR. Project number 88-63. 156 pp.

Tilson, M.B., A.T. Scholz, R.J. White, and J.L. Hendrickson. 1995. Artificial imprinting and smoltification in juvenile kokanee salmon: Implication for operations Lake Roosevelt kokanee salmon hatcheries, Annual Report 1994. Bonneville Power Administration. Portland, OR. Project number 88-63.

Truscott, K. 1997. Draft Colville Tribal fish hatchery production report. Internal report. Colville Confederated Tribes Fish and Wildlife Division. Nespelem, WA.

Truscott, K. 1995. Draft Colville Tribal fish hatchery production report. Internal report. Colville Confederated Tribes Fish and Wildlife Division. Nespelem, WA.

United States Corps of Engineers. DART website. http://www.cqs.washington.edu/dart/dart.html

Underwood, K.D., and J.P. Shields. 1996. Lake Roosevelt fisheries and limnological research 1995 annual report. U.S. Department of Energy, Bonneville Power Administration contract No. DE-8179-88DP91819. Portland, OR.

Unsworth, J.W., Pac, D.F., White, G.C., and Bartmann, R.M. 1999.
Mule deer survival in Colorado, Idaho, and Montana. J. Wildl. Manage. 63: 315-326.

Washington Department of fish and Wildlife. 1999 Game Status and Trend Report. Wildlife Manage. Program., Washington. Department. Fish and Wildlife., Olympia. 195 pp.

Washington Department of Fish and Wildlife. 1997. Final Joint WDFW/Tribal Wild Salmonid Policy: Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Tribes Concerning Wild Salmonids. WDFW. Olympia, WA.

Washington Department of Fish and Wildlife. 1991. Management Recommendations for Washington's Priority Habitats and Species. WDFW. Olympia, WA.

Walton, James M. and Will Wirt. 1989. Fish population assessment of four eastern Washington lakes. Peninsula College. Port Angeles, Washington.

Welch, Eugene B., James Buckley and Ronald M. Bush. 1971. Dilution as a control for nuisance algae blooms. U.W. Civil Engineering. Seattle, Washington.

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.

Willson, M.F., and K.C. Halupka. 1995. Anadromous fish as keystone species in vertebrate communities. Conservation Biology. 9:489-497.

Zook, William. 1976, 1977. 2 vol.. Fisheries management annual report. Washington Department of Game. Olympia, Washington.

Personal Communications

Berger, M. Confederated Tribes of the Colville Reservation, Wildlife Biologist. Nespelem, WA

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Subbasin Recommendations

FY 2001 Projects Proposals Review

Projects and Budgets

Project: 21003 - Upper Columbia Subbasin Native Rainbow Population Study

Sponsor: WT

Short Description:

Evaluate structure, dynamics, and long-term viability of selected redband rainbow populations in the Colville National Forest.

Abbreviated Abstract

Six populations of redband rainbow trout *O. mykiss gairdneri* located on the Colville National Forest in the Upper Columbia Subbasin will be examined to evaluate influence of physical conditions in the stream channel, riparian zone and catchment uplands on population productivity and structure. A comparison of population productivity and structure in populations with and without competitive interactions with non-native brook trout *Salvelinus fontinalis* would be undertaken as well. Results would be incorporated into population viability analyses for Inter-Mountain Province rainbow in small-order streams.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
200004800	Yakima Benthic Index of Biotic Integrity	support
199802600	Native Trout survey, 1999	support

Relationship to Existing Goals, Objectives and Strategies

Project 21003 is a request for funding to evaluate structure, dynamics and long-term viability of selected redband rainbow trout populations in the Colville National Forest. This proposal addresses Fish and Wildife Need 15 in the Lake Roosevelt Subbasin Summary. The review team suggested the methods would not likely meet the objectives and that similar work has been done elsewhere, and results from those studies could be utilized. In addition, reviewers questioned the use fly-fishing as a means of collecting fish.

Review Comments

The team's recommendation was do not fund.

Budget

FY01	FY02	FY03
$44,850	$44,850	$45,750

Project: 21006 - Characterize and Assess Wildlife-Habitat Types and Stuctural Conditions for Subbasins within the Inter Mountain Ecoprovince

Sponsor: NHI

Short Description:

Fine-scale wildlife habitat assessment for the Inter-Mountain Ecoprovince will produce critical baseline data for planning and monitoring efforts that is consistent within the NWPPC Framework wildlife-habitat relationships process.

Abbreviated Abstract

As ecological assessments of the Columbia River Basin step down in geographic scale to the subbasin level, the need for fine-scale wildlife habitat depiction and assessment rises markedly. The NHI proposed that the same mapping methodology and wildlife-habitat types be reviewed and mapped at a finer level of resolution (4 ha minimum mapping unit, (mmu) --- 10 acres) for all subbasins within the Inter Mountain Ecoprovince. Objectives of the study are to: 1) map wildlife-habitat types at a refined resolution (4 ha mmu); (2) map wildlife habitat structural conditions (4 ha mmu); 3) validating the mapping effort by field visits; and 4) evaluate the current conditions for wildlife using the wildlife-habitat relationships data set in conjunction with the wildlife-habitat types and structural conditions mapping information. To be successful with conservation actions, strategies, habitat restoration, and mitigation, projects having the ability to predict species associations, map wildlife-habitat types and structural conditions, and put that information into context with existing landscapes, will allow for a more comprehensive assessment of individual subbasins and successful design.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
2000742	Establishing Baseline Key Ecological Functions of Fish & Wildlife for Subbasin Planning	A refined map would depict with greater accuracy those areas where ecological functions are thought to have increased or decreased. Maintaining ecological functions is identified as a wildlife goal #1 for the Spokane River Subbasin Summary.

Relationship to Existing Goals, Objectives and Strategies

Project 21006 is a request for funding to perform a fine-scale wildlife habitat assessment for the Inter-Mountain Province that would result in critical baseline data for planning and monitoring efforts that is consistent within the NWPPC Framework wildlife-habitat relationships process. The review team suggested that this project is linked to the EDT process and thus should be funded through a different budget.

Review Comments

The team's recommendation was do not fund.

Budget

FY01	FY02	FY03
$84,571	$0	$0

Project: 21008 - Evaluation of the Banks Lake Fishery

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Determine the abundance and ecological interactions of fish populations in Banks Lake. Identify limiting factors for naturally recruiting and hatchery supplemented fish. Provide management recommendations to maximize the fishing potential of Banks Lake.

Abbreviated Abstract

Relative to historic values, productivity of Banks Lake kokanee and warmwater species fisheries have declined in recent years. Limiting factors for these and other species need to be determined if Banks Lake is to maximize its contribution as a fishery providing harvest as mitigation for the loss of anadromous salmon above Chief Joseph and Grand Coulee Dams. The WDFW plans to evaluate factors (i.e., water quality, habitat, food limitation, predation, and entrainment) that are limiting recruitment of naturally produced and hatchery released fish.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199104600	Spokane Tribal Hatchery (Galbraith Springs) Operation and Maintenance	Determine limiting factors and contribution to the fishery for kokanee stocked into Banks Lake. Provide information on kokanee from Lake Roosevelt received through the pumping facility.
199104700	Sherman Creek Hatchery Operations and Maintenance	Provide information on kokanee from Lake Roosevelt received through the pumping facility
199404300	Lake Roosevelt Fisheries Evaluation	Provide information on kokanee and rainbow trout from Lake Roosevelt received through the pumping facility. Data and analysis exchange regarding ecological interactions of native and exotic species in similar and contiguous reservoir environments.
199502800	Restore Moses Lake Recreational Fishery	Data and analysis exchange regarding ecological interactions of native and exotic species in similar and contiguous reservoir environments.
199500900	Rainbow Trout Net Pen Rearing Project	Provide information on rainbow trout from Lake Roosevelt received through the pumping facility.

Project ID	Title	Nature of Relationship
199501101	Hydroacoustic and Sonic Tracking and ADCP Velocity Mapping of Grand Coulee Dam	Provide information on kokanee or rainbow from Lake Roosevelt received through the pumping facility, tagged with sonic transmitters.
200001800	Lake Roosevelt Kokanee Net Pens	Provide information on kokanee and rainbow trout from Lake Roosevelt received through the pumping facility.
0	Ford Hatchery Improvement, Operation and Maintenance	Determine limiting factors and contribution to the fishery for kokanee stocked into Banks Lake from the Ford hatchery.
9700400	Joint Stock Assessment	Information exchange, coordination, provide data for the blocked area.

Relationship to Existing Goals, Objectives and Strategies

Proposal 21008 is a request for funding to determine the abundance and ecological interactions of fish populations in Banks Lake as well as identify limiting factors for naturally recruiting and hatchery supplemented fish that will result in the development of management recommendations that maximize the fishing potential of Banks Lake. The proposal addresses the Fish and Wildlife Needs 11 and 12, the Overall Subbasin Goal which is provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, Objectives IVA /strategies 4-6 and IVB/strategies 1-5 identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$170,408,	$347,500	$340,000

Project: 21020 - Monitor and Enhance the Lakes and Streams of the Spokane Indian Reservation

Sponsor: Spokane Tribe of Indians (STOI)

Short Description:

Monitor current and future stocking of four interior lakes. Monitor natural and hatchery stocks in streams within the Spokane Indian Reservation. Enhance lakes and streams to maximize mitigation benefits to tribal members.

Abbreviated Abstract

The STOI plans to monitor and enhance lakes and streams on the Spokane Indian Reservation to partially mitigate for fish and wildlife losses suffered because of Grand Coulee Dam. The Tribe will monitor four interior lakes, collect pertinent data on each lake for two years to determine limiting factors, and incorporate enhancement projects into written management plans for each lake. In addition, wild and hatchery fish populations in tributaries on the reservation will be surveyed and monitored. Streams that could support development of adfluvial stocks will be identified, as well as habitat improvements needed in those with existing adfluvial stocks.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199700400	Resident Fish Stock Status above Chief Joseph and Grand Coulee Dams	Preliminary data collection on the interior lakes and streams, data housing, sharing of personnel, and equipment.
199404300	Monitor, Evaluate, Research, and Model the Lake Roosevelt Fishery	Field equipment, personnel expertise, laboratory assistance and equipment.
199104600	Spokane Tribal Hatchery	Inland lake stocking and tagging, personnel assistance
199800300	Spokane Tribe of Indians Operations and Maintenance/ Partial mitigation to protect and enhance mitigation lands within the Spokane Indian Reservation.	Land ownership in each of the lake watersheds with the goal of improving not only wildlife, but fish habitat. Riparian revegetation projects, restoring connectivity of streams to lakes. Sharing of fencing and planting equipment and personnel.
199106200	Spokane Tribe of Indians Wildlife Mitigation Project/ Securing mitigation land to offset wildlife losses within the Spokane Indian Reservation.	Owernship of land within a majority of the lake and stream watersheds. Joint management effort to enhance those lands for fish and wildlife.
199001800	Habitat Improvement Project	Implemented habitat improvement stuctures on one tributary on the Spokane Indian Reservation. Supplies habitat and fish population changes over time of a native rainbow trout stock.

Relationship to Existing Goals, Objectives and Strategies

Project 21020 is a request for funding to monitor current and future stocking of four interior lakes on the Spokane Indian Reservation as well as monitor natural and hatchery stocks in streams within the Spokane Indian Reservation. These efforts will enhance lakes and streams allowing the Tribe to maximize mitigation benefits to tribal members. The proposal addresses Fish and Wildlife Needs 11, 12, 14, 18, 21, the Overall Subbasin Goal which is to provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, and Objectives IIB3/Strategies 1-2 and IIB4/Strategies 1-3 identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$92,177	$96,000	$93,000

Project: 21021 - Ford Hatchery Improvement, Operation and Maintenance

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Improve water supply and operate and maintain the Ford Hatchery to enhance the recreational and subsistence kokanee fisheries in Lake Roosevelt and Banks Lake, and bolster put-and-take resident trout fishing lakes in Eastern Washington.

Abbreviated Abstract

The Washington Department of Fish and Wildlife plans to improve the water supply and operate and maintain Ford Hatchery to enhance the recreational and subsistence kokanee fisheries in Lake Roosevelt and Banks Lake, and bolster put-and-take resident trout fishing lakes in Region 1 (Eastern WA). Monitoring and evaluation of the Ford stocking programs will involve utilizing existing WDFW creel and lake survey programs to assess resident trout plantings in trout managed waters and will include a BPA funded creel survey to assess kokanee plantings in Banks Lake, which is included in this proposal.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9104600	Spokane Tribal Hatchery O & M (FWP Measure 10.8B.2)	Operated in conjunction with Sherman creek Hatchery; serves as the primary egg incubation and rearing facility for the Lake Roosevelt kokanee and rainbow trout program. Ford Hatchery production will augment this program.
9104700	Sherman Creek Hatchery O&M (FWP Measure 10.8B.2)	Operated in conjunction with Spokane Tribal Hatchery; serves as kokanee egg collection site and kokanee and rainbow trout fingerling/yearling rearing and acclimation facility. Ford Hatchery production will augment this project.
9500900	Lake Roosevelt Rainbow Trout Net Pens (FWP Measure 10.8B.11)	Net Pens rear 500,000 rainbow trout fingerlings raised at Spokane Tribal & Sherman Creek Hatcheries. Releases into Lake Roosevelt after annual spring drawdown.
5228100	Lake Roosevelt Kokanee Net Pens (FWP Measure 10.8B)	Net Pens rear 500,000 kokanee fingerlings tranferred from Spokane Tribal Hatchery for release into Lake Roosevelt after annual spring

Project ID	Title	Nature of Relationship
		drawdown. Ford Hatchery production will augment this project.
9001800	Habitat Improvement – Lake Roosevelt (FWP Measures 10.8B9 and 10.8B.10)	Habitat improvement in Lake Roosevelt tributaries for rainbow trout to enhance juvenile rearing and adult passage. Aim is to increase natural production.
9404300	Lake Roosevelt Monitoring/Data Collection Program (FWP Measure 10.8B.5)	Monitors and evaluates hatchery stocking program harvest goals; effects of hatchery fish on Lake Roosevelt biota. Collects fisheries and limnological data for reservoir modeling. Will evaluate Ford Hatchery stocking in Lake Roosevelt.
950110	Grand Coulee Kokanee Enhancement Project (FWP Measures 10.8B.7 & 10.8B.8)	Monitors fish entrainment through Grand Coulee Dam and evaluates natural reproduction of wild kokanee stocks in Lake Roosevelt.
	Monitors fish entrainment through Grand Coulee Dam and evaluates natural reproduction of wild kokanee stocks in Lake Roosevelt.	Fishery managers from above projects meet quarterly for review of projects and coordination/information sharing.
9700400	Joint Stock Assessment (JSA) (FWP Measure 10.8B.26)	Information exchange/blocked area coordination. Creel data collected at Banks Lake to evaluate Ford Hatchery kokanee stocking will provide data for JSA.

Relationship to Existing Goals, Objectives and Strategies

Project 21021 is a request for funding to improve water supply, operate and maintain the Ford Hatchery to enhance the recreational and subsistence kokanee fisheries in Lake Roosevelt and Banks Lake, and bolster put-and-take resident trout fishing lakes in Eastern Washington. Improving the existing facilities is essential to other programs in the subbasin because the Ford Hatchery is responsible for augmenting kokanee production at the Sherman Creek and Spokane Tribe hatcheries. The proposal addresses Fish and Wildlife Needs 9, the Overall Subbasin Goal, which is to provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, and Objective IVA and Stategies 1-2 identified in the lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$213,249	$389,086	$166,128

Project: 21023 - Determine causes of mule deer population declines in the IM Columbia Basin: a test of the "apparent competition" hypothesis

Sponsor: WSU

Short Description:

Determine if increasing white-tailed deer and resulting increased cougar predation are responsible for mule deer population declines in the Intermountain Province of the Columbia Basin.

Abbreviated Abstract

Mule deer in the shrub-steppe are ranked high priority target species for mitigation and management and are declining in most portions of the subbasins of the Intermountain Province (IM) of the Columbia Basin. White-tailed deer are not ranked as target species and are believed to be increasing throughout the basin, partly because of habitat changes brought about by dams (e.g., irrigation agriculture). Recent studies suggest that increasing white-tailed deer populations are resulting in increased predation by cougars on mule deer (apparent competition or alternate prey hypothesis). The apparent competition hypothesis predicts that as alternate prey (white-tailed deer) densities increase, so do densities of predators, resulting in increased incidental predation on sympatric native prey (mule deer). We will test the apparent competition hypothesis by conducting a controlled, replicated "press" experiment in two treatment and two control areas of the IM subbasins by reducing densities of white-tailed deer and observing any changes in cougar predation on mule deer. Results will be used to determine the cause and try to halt the mule deer population declines.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
	Co-op mule deer study: WDFW, Colville Conf. Tribes, USFS, Inland NW Wildlife Council	Our study is in collaboration with this project. This project will test other competing hypotheses (e.g., food limitation) see attached letter of collaboration from WADFW

Relationship to Existing Goals, Objectives and Strategies

Project 21023 is a request for funding to determine if increasing white-tailed deer and resulting increased cougar predation are responsible for mule deer population declines in the IM Columbia Basin. Results will be used to determine the cause and try to halt the mule deer population declines. Reviewers believed that it is not within the Program to fund predation studies that are focusing on predation that results from dry-farming practices. This proposal addresses Fish and Wildlife Need 3, Wildlife Goal 2, and Objective 2/Strategy 2.7 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was do not fund.

Budget

FY01	FY02	FY03
$205,532	$161,588	$164,505

Project: 21025 - Intermountain Province Resident Fish Symposium

Sponsor: Lake Roosevelt Forum

Short Description:

Develop, coordinate, promote, and convene an annual three-day symposium dealing with fish and wildlife programs and related research within the Inter-mountain Province.

Abbreviated Abstract

The Lake Roosevelt Forum plans to develop, coordinate, promote and convene an annual three-day resident fish and wildlife symposium focusing on issues in the Intermountain Province. The symposium will allow managers to present technical papers documenting fish and wildlife research and mitigation programs to an audience of biologists, fish and wildlife managers, agency and tribal representatives, policy makers, and the public. In addition, the symposium will include workshops and keynote presentations.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
8503800	Colville Tribal Hatchery	Participation of all resident fish projects with the Intermountain Province is crucial to the success of the Intermountain resident fish symposium.
9104600	Spokane Tribal Hatchery	See previous line.
9104700	Sherman Creek Hatchery	See previous line.
9500900	Lake Roosevelt Rainbow Trout Net Pen Project	See previous line.
9501100	Chief Joseph Kokanee Enhancement Project	See previous line.
9001800	Lake Roosevelt Rainbow Trout Habitat/Passage Improvement Project	See previous line.
944300	Lake Roosevelt Monitoring Program	See previous line.
9502800	Restore Moses Lake Recreational Fishery	See previous line.
9700400	Resident Fish Stock Status Above Chief Joseph and Grand Coulee dams	See previous line.

Relationship to Existing Goals, Objectives and Strategies

Project 21025 is a request for funding to develop, coordinate, promote, and convene an annual three-day symposium dealing with fish and wildlife programs and related research within the Intermountain Province. Although the project does not address any needs, goals, objectives, or strategies that have been explicitly specified in the subbasin

summaries, the reviewers deemed the project to be a needed vehicle for transferring research results to other biologists, managers, and the public.

Review Comments

The team's recommendation was fund - Recommended Action.

Budget

FY01	FY02	FY03
$41,000	$43,050	$45,247

Project: 21029 - A cooperative approach to identify the role of forage quality in affecting physical condition . . . of mule deer in north central Washington

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Assessment of the role of habitat in maintaining mule deer numbers.

Abbreviated Abstract

Mule deer *Odocoileus hemionus*, a high priority ranked target species for mitigation and management, have been declining in the Intermountain Province (IM). The Washington Department of Fish and Wildlife (WDFW) and Washington State University (WSU) plan to assess the role of habitat in maintaining mule deer numbers by measuring the effects of differing quality in seasonal forage upon physical condition and reproductive performance of adult female mule deer through laboratory and field investigations.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
0	Cooperative Mule Deer Project	Direct
0	Cougar Mortality-Testing reduction hypothesis	Data sharing

Relationship to Existing Goals, Objectives and Strategies

Project 21029 is a request for funding to assess the role of habitat in maintaining mule deer numbers. Results will be useful to managers for development of field techniques to assess the physical condition and reproductive performance of mule deer, identify landscape and project scale management treatments/actions to enhance forage quality, increase mule deer reproductive potential and winter survival, and reverse habitat related declines in mule deer numbers. The project addresses Fish and Wildlife Needs 3, Wildlife Goal 2, Objective 2, and Strategy 2.1 in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Recommended Action.

Budget

FY01	FY02	FY03
$133,650	$84,500	$107,100

Project: 21034 - Colville Tribes Restore Habitat for Sharp-tailed Grouse

Sponsor: CCT-FWD

Short Description:

Conduct a population viability analysis for a comprehensive, adaptive management plan to restore critical shrub-steppe and riparian deciduous habitat to secure a viable meta-population of sharp-tailed grouse on the Intermountain Province.

Abbreviated Abstract

The single largest remaining population of threatened Columbian sharp-tailed grouse *Tympanuchus phasianellus columbianus* (<175 birds) in Washington occurs on the Colville Indian Reservation. During 2000, fires on the Colville Reservation and elsewhere in the Intermountain Province, destroyed critical Columbian sharp-tailed grouse habitat. The Colville Tribe proposes to 1) develop a comprehensive habitat management plan to restore native shrub-steppe and riparian/deciduous vegetation on the Colville and Spokane Reservations and selected areas managed by WDFW, and 2) quantitatively and statistically evaluate the following working hypothesis: persistence of the existing subpopulation of sharp-tailed grouse depends on availability of critical native shrub-steppe and riparian/deciduous habitat within 1.6 to 8 km (1-5 mi) of leks (and about 1.5 km of nesting and brood-rearing sites).

Relationship to Other Projects

Project ID	Title	Nature of Relationship
(none)		.

Relationship to Existing Goals, Objectives and Strategies

Project 21034 request funding to conduct a population viability analysis for a comprehensive, adaptive management plan to restore critical shrub-steppe and riparian deciduous habitat. This work will lead to development and implementation of an adaptive management plan that will include restoration of native plant communities on 60,000 acres of former agricultural lands within the Province to support a viable meta-population of sharp-tailed grouse. This project addresses Fish and Wildlife Needs 6 and 8, Wildlife Goal 4, Objective 3/Strategies 3.2, 3.3, 3.6, 3.7, 3.8, and Objective 4/Strategies 4.1,4.1-4.7 identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Recommended Action.

Budget

FY01	FY02	FY03
$169,400	$169,400	$169,400

Project: 21035 - Phalon Lake Native Redband Rainbow Trout Trap Construction and O&M

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Construct and operate a pumped water trapping facility to capture and spawn indigenous stocks of redband rainbow trout for subsequent use in the subbasin.

Abbreviated Abstract

The Washington Department of Fish and Wildlife plans to construct and operate a trapping facility to capture and spawn a locally adapted, indigenous stock of redband rainbow trout for subsequent use by agencies and tribes throughout the province. This work will allow for the replacement of hatchery rainbow trout released into Lake Roosevelt subbasin waters with an indigenous stock.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9104600	Spokane Tribal Hatchery O&M	Resident Fish Production
9104700	Sherman Creek Hatchery O&M	Resident Fish Production
9404300	Lake Roosevelt Fisheries Evaluation Program	Resident Fish Evaluation
9500900	Lake Roosevelt Rainbow Net pens	Resident Fish Production
9001800	Evaluate habitat and Passage improvements of Tributaries to Lake Roosevelt	Native species habitat evaluation
9700400	Resident Fish Stock Status above Chief Joseph and Grand Coulee Dams	Resident fish stock inventory

Relationship to Existing Goals, Objectives and Strategies

Project 21035 requests funding to construct and operate a pumped water trapping facility to capture and spawn indigenous stocks of redband rainbow trout for subsequent use in the subbasin. Managers from throughout the province identified this project as essential for continued progress towards replacing non-native hatchery rainbow trout strains currently used in numerous hatchery programs in this subbasin with native populations. The project addresses Fish and Wildlife Needs 9 and 10, the Overall Subbasin Goal which is provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, Objective IA/Strategy 2 identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Recommended Action.

Budget

FY01	FY02	FY03
$126,000	$31,421	$42,250

Project: 198503800 - Colville Tribal Fish Hatchery

Sponsor: CCT

Short Description:

Produce 22,679 kg (50,000 lbs) of resident salmonids for distribution to reservation waters in an effort to provide a successful subsistence/recreational fishery as partial mitigation for anadromous fish losses above Chief Joseph and Grand Coulee Dams.

Abbreviated Abstract

The Colville Tribe plans to produce 22,679 kg (50,000 lbs) of resident salmonids for distribution to reservation waters in an effort to provide a successful subsistence/ recreational fishery as partial mitigation for anadromous fish losses above Chief Joseph and Grand Coulee Dams. Critical project actions/elements that will be implemented include 1) production of 22,679 kg (50,000 lbs) of resident salmonid production into reservation waters that support a tribal subsistence and recreational fishery that produces CPUE's of .5-1.0 fish/hr. (brook trout, lahontan cutthroat, and rainbow trout with average creel fork lengths of 305mm, 340mm and 500 mm respectively, with a fish condition factor of 125x10-7); 2) determine contribution to subsistence and recreational fisheries of natural production fish, and hatchery origin fingerling, sub-yearling and legal size fish; 3) determine bull trout, redband rainbow trout and westslope cutthroat trout presence/ distribution/status and determine potential utilization as a production source to support harvest; and 4) determine phytoplankton/zooplankton/fish ecological interaction in selected lacustrine environments (Buffalo Lake, Owhi Lake and North Twin Lake) as an initial step in establishing carrying capacity estimates for lakes that receive stocking from this project.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
(none)		.

Relationship to Existing Goals, Objectives and Strategies

Project 198503800 is a requests continued to produce 22,679 kg (50,000 lbs) of resident salmonids for distribution to reservation waters in an effort to provide a successful subsistence/recreational fishery as partial mitigation for anadromous fish losses above Chief Joseph and Grand Coulee Dams. This project addresses Fish and Wildife Needs 9,11, and 12, the Overall Subbasin Goal which is provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, Objective IIA/Strategies 1-8, Objective

IIB1/Strategies 1-9, and Objective IIB2/Strategies 1-5 identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$789,642	$829,124	$870,580

Project: 199104600 - Spokane Tribal Hatchery (Galbraith Springs) Operation and Maintenance

Sponsor: Spokane Tribe of Indians (STOI)

Short Description:

Operate and maintain the Spokane Tribal Hatchery to aid in the restoration and enhancement of the Lake Roosevelt and Banks Lake fisheries.

Abbreviated Abstract

The Spokane Tribe plans to operate and maintain the Spokane Tribal Hatchery to aid in the restoration and enhancement of the Lake Roosevelt and Banks Lake fisheries.
The hatchery is operated in conjunction with the Sherman Creek Hatchery, Lake Roosevelt Rainbow Trout Net Pen Rearing and Kokanee Net Pen Rearing Projects to produce kokanee salmon *Oncorhynchus nerka* and rainbow trout *Oncorhynchus mykiss* for release into Lake Roosevelt. The intention of this project is to continue providing a readily accessible sport fishery as partial mitigation for fish losses caused by the construction of Grand Coulee Dam.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199104700	Sherman Creek Hatchery O&M Each of these projects are involved in fisheries restoration and enhancement work in Lake Roosevelt. Coordination between each project and is facillitated through the Lake Roosevelt Hatcheries/Fisheries Coordination Team.	Operates in conjunction with Spokane Tribal Hatchery and Lake Roosevelt Rainbow Trout and Kokanee Net Pen Rearing Projects; serves as kokanee egg collection site and kokanee and rainbow trout fingerling/yearling rearing and acclimation facility.

Project ID	Title	Nature of Relationship
199500900	Lake Roosevelt Rainbow Trout Net Pens	Operates in conjunction with Spokane Tribal & Sherman Creek Hatcheries to net pen rear and release 550,000 rainbow trout yearlings/catchables into Lake Roosevelt after annual reservoir drawdown period.
200001800	Lake Roosevelt Kokanee Net Pens	Operates in conjunction with Spokane Tribal & Sherman Creek Hatcheries to net pen rear and release 500,000 kokanee yearlings/catchables into Lake Roosevelt after annual reservoir drawdown period.
199404300	Lake Roosevelt Fisheries Evaluation Program (Formerly known as Lake Roosevelt Monitoring, Evaluation, Modeling and Data Collection Program)	Monitors and evaluates performance of hatchery production and its effects on Lake Roosevelt biota; coordinates and performs research to identify management implications and changes in hatchery production.
199501100	Chief Joseph Kokanee Enhancement Project	Coordinates fishery entrainment and natural kokanee production enhancement work.with hatchery and net pen projects as part of Lake Roosevelt fishery restoration and enhancment efforts.
199001800	Evaluate Rainbow Trout/Habitat Improvements of Tributaries to Lake Roosevelt.	Coordinates rainbow trout natural production enhancement work.with hatchery and net pen projects as part of Lake Roosevelt fishery restoration and enhancment efforts.

Relationship to Existing Goals, Objectives and Strategies

Project 199104600 requests continued funding to operate and maintain the Spokane Tribal Hatchery to aid in the restoration and enhancement of the Lake Roosevelt and Banks Lake fisheries. The Spokane Tribal Hatchery project is a key component of a comprehensive program to restore and enhance the fishery in Lake Roosevelt. The proposed project addresses Fish and Wildlife Need 9, the Overall Subbasin Goal which is provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, Objective IA1/Strategies 1,3,4, and Objective IVA/Strategy 1 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fun - Urgent/High Priority.

Budget

FY01	FY02	FY03
$549,856	$650,000	$536,000

Project: 199104700 - Sherman Creek Hatchery Operation and Maintenance

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Operate and maintain Sherman Creek Hatchery (SCH) and the Lake Roosevelt Kokanee Net Pens to aid in the restoration and enhancement of the Lake Roosevelt and Banks Lake Fisheries.

Abbreviated Abstract

The primary objective of SCH is the restoration and enhancement of the recreational and subsistence fishery in Lake Roosevelt and Banks Lake. The role of SCH in this program is to 1) provide for kokanee imprinting and egg collection; 2) enhance the resident fishery within Lake Roosevelt; and 3) rear rainbow trout for net pen stocking. Current annual production goals at SCH include 800,000 yearling kokanee salmon and 200,000 rainbow trout fingerlings. Current objectives include expanded use of native/indigenous stocks (i.e., wild redband rainbow trout and native Kootenay Lake kokanee salmon), where available, for propagation into Upper Columbia River Basin Waters.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9104600	Spokane Tribal Hatchery O&M (STH)	Operated conjunctively with Sherman Creek Hatchery to maximize the attributes of each facility while optimizing production. STH is the primary incubation, and early rearing facility.
9500900	Volunteer Rainbow Trout Net Pen Project	Net Pen Project rears 530,000 rainbow trout yearlings initially raised at Sherman Creek and Spokane Tribal Hatcheries for annual release into Lake Roosevelt.
5228100	Lake Roosevelt Kokanee Net Pens	This projects operation and maintenance is now included in Sherman Creek Hatcheries proposal. These net pens will rear 500,000 kokanee yearlings transferred from Spokane Tribal Hatchery for annual release into Lake Roosevelt.
9404300	Lake Roosevelt Fisheries Evaluation Program	Monitors and evaluates effects of hatcheries and stocking on Lake Roosevelt fisheries; collects fisheries and limnological data for reservoir modeling.

Project ID	Title	Nature of Relationship
9001800	Habitat Improvement Project	Habitat improvement in Lake Roosevelt tributaries for rainbow trout juvenile rearing and adult passage to increase natural production.
9501100	Chief Joseph Kokanee Enhancement Project	Monitors native kokanee stock interactions and development, and fish entrainment through Grand Coulee Dam.
9502700	Lake Roosevelt Sturgeon Project	Restoration and enhancement of the Lake Roosevelt fishery.
5513500	Ford Hatchery Water Supply Improvement	Increased kokanee survival through increased yearling releases. Works in cooperation with Spokane Tribal Hatchery to meet Lake Roosevelt and Banks Lake program objectives.
5513300	Phalon Lake Rainbow Trapping Facility	This native red band rainbow trout project supplies native trout for net pen and tributary stocking in the Upper Columbia River Basin through the WDFW Colville Trout Hatchery.
	Lake Roosevelt Hatcheries Coordination Team	Fishery managers from above projects, meet quarterly for project review and coordination / information sharing.
9700400	Resident Fish Stock Status Above Chief Joseph/Grand Coulee Dam	Informational exchange / Blocked Area Coordination.

Relationship to Existing Goals, Objectives and Strategies

Project 199104700 requests continued funding to operate and maintain SCH and the Lake Roosevelt Kokanee Net Pens to aid in the restoration and enhancement of the Lake Roosevelt and Banks Lake Fisheries. The SCH is vital to the future stocking/management of native redband rainbow trout and kokanee. The proposal addresses Fish and Wildlife Needs 9 and 10, the Overall Subbasin Goal which is provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, and Objective IA1/Strategies 1 and 3 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fun - Urgent/High Priority.

Budget

FY01	FY02	FY03
$269,898	$262,545	$270,241

Project: 199106200 - Spokane Tribe of Indians Wildlife Mitigation Project

Sponsor: Spokane Tribe of Indians (STOI)

Short Description:

Mitigation and protection of lands purchased for partial mitigation on the Spokane Indian Reservation (SIR) due to the construction and inundation of winter range habitat caused by Grand Coulee Dam.

Abbreviated Abstract

Efforts of the Spokane Tribe of Indians Grand Coulee Dam Wildlife Mitigation Project are a portion of the Northwest Power Planning Council's overall Wildlife Mitigation Program Goal. This is to achieve and sustain levels of habitat and species productivity in order to fully mitigate for the wildlife losses that have resulted from the construction, inundation, and operation of the federal and non-federal hydropower facilities within the Lake Roosevelt Subbasin. The Spokane Tribe lost over 3,900 of these acres within their reservation. The Spokane Tribe's goal is to fully mitigate for these losses. The Spokane Tribe is attempting to secure funding to allow us to mitigate for at a minimum of 1500 acres a year until full mitigation is reached for the losses identified by Creveling in the 1986 Wildlife Protection, Mitigation and Enhancement Planning for Grand Coulee Dam Document. Lands identified as possible purchase for mitigation are ranked for habitat quality using a matrix developed by STI and BPA to assess the habitat quality of lands. Habitat Evaluation Procedures are not conducted on these lands until they are purchased through the mitigation process.

The Spokane Tribe has attempted to purchase mitigation lands within four areas on the Spokane Indian Reservation being identified as being critical habitats for wildlife.

The Blue Creek Winter Range area is one of the more important winter areas for big game on the SIR. There are currently over 700 acres of land within this area set aside for wildlife habitat enhancements, attempts are being made to secure the remaining 4,300 acres within this area to secure management for winter range.

The Turtle Lake –Wellpinit Mountain Wildlife Area is also a critical wildlife management area on the SIR. The Spokane Tribe has only purchased 80 acres of lands through the BPA Process and have purchased an additional 300 acre within the identified area using other mitigation funds. Acquisition of an additional 1000 acres within this areas is hoped for before 2010.

The McCoy Lake Watershed Management Area has been assessed as a 7,000 acre Watershed. Currently, the STOI has purchased 769 acres within this watershed to manage for wildlife habitat. The Tribe is currently attempting to purchase an additional 135 acres within this watershed using other mitigation funds. Purchase of an additional 1000 acres within this watershed through BPA Mitigation is being reviewed.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199506700	Colville Tribes Performance Contract for Continuing Acquisition	Protect, enhance and evaluate wildlife habitat and species for partial mitigation for losses to wildlife resulting from Grand Coulee.

Relationship to Existing Goals, Objectives and Strategies

Project 199106200 requests continued funding for mitigation and protection of lands purchased for partial mitigation on the SIR due to the construction and inundation of winter range habitat caused by Grand Coulee Dam. This proposal addresses Fish and Wildlife Needs 4 and 5, Wildlife Goal 1, and Objective 1/Strategy 1.1 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$1,528,806	$1,655,000	$1,603,500

Project: 199204800 - Hellsgate Big Game Winter Range Operation and Maintenance Project

Sponsor: CCT-FWD

Short Description:

Protect, enhance, manage, and evaluate wildlife habitats and species for partial mitigation for losses to wildlife resulting from Grand Coulee and Chief Joseph Dams.

Abbreviated Abstract

The Hellsgate Operation and Maintenance Project encompasses all O&M activities associated with the Hellsgate Big Game Winter Range Wildlife Mitigation Project. We are mitigating for wildlife losses suffered from Grand Coulee and Chief Joseph Dam Projects. HEP studies based on target species were conducted, or are scheduled for new acquisitions, to determine habitat quality and quantity baseline data and future projections. Limited life values or Habitat Suitability Index's for each target species was determined for existing habitats on project lands based on field data collection. From this data long-term management plans were developed (Berger and Judd, 1999). These plans contain proposed management actions, habitat enhancements, and tools that will be used to protect, restore and enhance habitats on project lands to desired conditions for wildlife species.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199506700	Colville Tribes Performance Contract for Continuing Acquisition	Acquires lands for O&M under this Project

Relationship to Existing Goals, Objectives and Strategies

Project 199204800 requests continued funding to protect, enhance, manage, and evaluate wildlife habitats and species for partial mitigation for losses to wildlife resulting from Grand Coulee and Chief Joseph Dams. The project addresses Fish and Wildlife Needs 5, 6, and 7, Wildlife Goal 3, and Objective 1/Strategy 1.2 – 1.4 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$388,071	$410,400	$465,000

Project: 199404300 - Lake Roosevelt Fisheries Evaluation Program

Sponsor: Spokane Tribe of Indians (STOI)

Short Description:

Monitor and evaluate the performance of hatchery fish. Develop and maintain a model able to predict the effects of hydro operations and management actions on the lake's ecosystem and fishery. Use model results to refine fisheries management plans.

Abbreviated Abstract

The Lake Roosevelt Fisheries Evaluation Program (Evaluation Program) addresses measure 10.8B.5 of the NWPPC's 1994 Fish and Wildlife Program. The goal of the Evaluation Program is to scientifically scrutinize Lake Roosevelt mitigation projects working towards the achievement of fishery management objectives. Evaluation Program objectives are to: 1) monitor and evaluate angler harvest success of hatchery and wild fisheries within Lake Roosevelt; 2) monitor, evaluate, research and model the Lake Roosevelt ecosystem; 3) recommend fishery management actions and hydro operations which has the highest probability of resulting in the achievement of fisheries management objectives; and 4) assess the reasonableness of current fisheries management objectives. Tasks of the Evaluation Program include but are not limited to the following.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9104600	Spokane Tribal Hatchery	Releases hatchery reared kokanee and ranbow trout into Lake Roosevelt. The Evaluation Project monitors and evaluates the performance of hatchery products in the fishery and ecosystem.
9104700	Sherman Creek Hatchery	Releases hatchery reared kokanee and ranbow trout in Lake Roosevelt. The Evaluation Project monitors and evaluates the performance of hatchery products in the fishery and ecosystem.
9500900	Lake Roosevelt Net Pen Program	Releases hatchery reared kokanee and ranbow trout in Lake Roosevelt. The Evaluation Project monitors and evaluates the performance of hatchery products in the fishery and ecosystem.
20096	Ford Hatchery Improvement, Operation and Maintenance	The Evaluation Project monitors and evaluates the performance of hatchery products in the fishery and ecosystem.
20097	Phalon lake Wild Rainbow Trap Improvements	The Evaluation Project monitors and evaluates the performance of hatchery products in the fishery and ecosystem.
9001800	Evaluate Rainbow Trout/Habitat Improvements of Tributaries to Lake Roosevelt	The Habitat Improvement Project will provides information essential to the development of model development and management planning.
9501100	Chief Joseph Kokanee Enhancement Project	The Chief Joseph Kokane Enhancement Project provides information essential to the development of model development and management planning.
9502700	Collect Data on White Sturgeon Above Grand Coulee Dam	The Lake Roosevelt Sturgeon Project will provide information essential to the development of biological/integrated rule curves.
9700400	Resident Fish Stock Status Above Chief Joseph and Grand Coulee Dams	The Resident Fish Stock Status above Chief Joseph and Grand Coulee Dams identifies status of stocks and maintains a centralized database for the Upper Columbia River. These two projects are complimentary and rely on each other for pertinent information.
881084	Streamnet	Provides regional information vital to model development.

Project ID	Title	Nature of Relationship
	Little Falls Kokanee Egg Collection And Acclimation Facility.	Collects adult kokanee spawners for egg collection and acclimates yearling kokanee prior to stocking into Lake Roosevelt
	Lake Roosevelt Forum	Provides a forum that facilittes roundtable discussions among resource managers and other stakeholders on topics germaine to managing fisheries.
	Lake Roosevelt Water Quality Council	Provides peer review for the Lake Roosevelt Fisheries Evaluation Program, and conducts supporting reserch such as fheavy metal and orgainc toxin loads in fish tissues.

Relationship to Existing Goals, Objectives and Strategies

Project 199404300 requests continued funding to monitor and evaluate the performance of hatchery fish, develop and maintain a model to predict effects of hydro operations and management actions on the lake ecosystem and fishery, and use model results to refine fisheries management plans. This project has been identified as a vital component in the evaluation of the hatchery programs. The proposal addresses Fish and Wildlife Needs 11, 12, 16, 17, the Overall Subbasin Goal which is provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, Objective IA1/Strategy 9, Objective IA2/Strategies 4 and 5, Objective IB/Strategies 11 and 13, and Objective ID/Strategies 6 and 8 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$1,113,584	$1,048,584	$950,000

Project: 199500900 - Rainbow Trout Net Pen Rearing Project

Sponsor: LRDA

Short Description:

Operate and maintain the net pen program to aid in the enhancement and restoration of the Lake Roosevelt fisheries.

Abbreviated Abstract

Roosevelt is directly related to reservoir operations. Lake Roosevelt is drawn down during late winter and spring resulting in a high rate of entrainment of rainbow trout through Grand Coulee Dam. Reservoir operation also adversely affects the limited suitable

spawning and rearing habitat for natural production of rainbow trout. The current annual target release goal for the net pen program includes 500,000 rainbow trout yearling to aid in reaching an angler harvest goal of 190,000. Monitoring data indicates the program is an effective approach to increase rainbow harvest. This program facilitates tagging studies of net pen fish and performs abundance and creel surveys to constantly monitor and evaluate the net pen program.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199104600	Spokane Tribal Hatchery O&M	Transfer hatchery fingerlings to net pens
199104700	Sherman Creek Hatchery O&M	Operated in conjunction with Spokane Tribal Hatchery; serves as kokanee egg collection site and kokanee and rainbow trout fingerling/yearling rearing and acclimation facility.
199404300	Lake Roosevelt Fisheries Evaluation Program (formerly known as Lake Roosevelt Monitoring/Data Collection Program)	Monitors and evaluates effects of hatcheries on Lake Roosevelt fisheries; collects fisheries and limnological data for reservoir modeling.
199001800	Habitat Improvement – Lake Roosevelt	Habitat improvement in Lake Roosevelt tributaries for rainbow trout juvenile rearing and adult passage to increase natural production.
200001800	Lake Roosevelt Kokanee Net Pens	Net Pen rear 500,000 kokanee fingerlings transferred from Spokane Tribal Hatchery for release into Lake Roosevelt after annual spring drawdown.

Relationship to Existing Goals, Objectives and Strategies

Project 199500900 requests continued funding to operate and maintain the net pen program to aid in the enhancement and restoration of the Lake Roosevelt fisheries. Data suggests the program, is an an effective approach to increase rainbow harvest. This proposal addresses Fish and Wildlife Need 9, the Overall Subbasin Goal which is provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, and Objective IA1/Startegy 1 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$100,550	$112,761	$115,017

Project: 199502700 - Develop and Implement Recovery Plan for Depressed Lake Roosevelt White Sturgeon Populations

Sponsor: Spokane Tribe of Indians (STOI)

Short Description:

Recruitment of young-of-the-year white sturgeon in Lake Roosevelt is absent. Recruitment is limited by hydropower development, and possible predation of eggs and larvae, and pollution. Investigate limitations and develop mitigative actions.

Abbreviated Abstract

Research and surveys of white sturgeon status are directly called for in the 1994 Columbia Basin Fish and Wildlife Program (Section 10.4A) as white sturgeon *Acipenser transmontanus* populations are declining, possibly a result of hydropower operations. White sturgeon surveys conducted by the Oregon Department of Fish and Wildlife and the Spokane Tribe of Indians during 1998 revealed an aged population above Grand Coulee Dam with virtually no recruitment during the past 20-25 years. The goal of the proposed project is to assess population reproductive characteristics of white sturgeon in Lake Roosevelt and develop mitigative measures, including artificial propagation to preclude listing of this strain/stock under the Endangered Species Act (ESA). Specific objectives are to 1) define population characteristics of white sturgeon above Grand Coulee Dam; 2) define potential for white sturgeon spawning between Grand Coulee Dam and the international border, 3) assess biological and environmental factors affecting abundance of white sturgeon, and 4) develop a restoration and management plan for white sturgeon above Grand Coulee Dam. This project will provide baseline data regarding the status of and alternative management strategies for the restoration of white sturgeon in Lake Roosevelt.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9404300	Lake Roosevelt Fisheries Evaluation Program	Research and evaluation of factors precluding recruitment and survival of YOY white sturgeon in Lake Roosevelt, and developing mitigative and restoration measures, dependent on the findings of this white sturgeon evaluation project.
9700400	Joint Stock Assessment	Proposed research and restoration project will develop data sets on critical life history aspects of declining white sturgeon. The proposed research will be complimentary to existing data compilation, analyses, and program direction.

Relationship to Existing Goals, Objectives and Strategies

Project 199502700 requests continued funding to identify factors limiting the recruitment of young-of-the-year white sturgeon in Lake Roosevelt and develop mitigative actions. This project will provide baseline data regarding the status of, and alternative management strategies for the restoration of white sturgeon in Lake Roosevelt. This proposal addresses Fish and Wildlife Needs 11 and 12, the Overall Subbasin Goal which is to provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, and Objective Ic/Strategies 1, 6, and 7 identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority - for one year or for the life of the $152,000 implementation money. Following completion of this segment, the project should be reviewed as a new project.

Budget

FY01	FY02	FY03
$152,000	$135,000	$250,000

Project: 199502800 - Restore Moses Lake Recreational Fishery

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Restore/enhance the failed recreational fishery for resident species in Moses Lake, once the premier fishery for resident game fish in the Columbia Basin, in lieu of lost recreational anadromous fisheries.

Abbreviated Abstract

Historically, Moses Lake was a premier crappie, bluegill, largemouth bass, and yellow perch fishery, and in later years a prime fishery for rainbow trout. Beginning in the late 1970's and throughout the 1980's, these fisheries experienced a decline and by 1990 carp, bullheads, and walleye were the dominant predator species.

The purpose of this project is to restore the failed recreational fishery for resident gamefish species in Moses Lake in lieu of lost recreational fishing opportunities for anadromous species in the upper Columbia River. The Washington Department of Fish and Wildlife proposes to restore the historic fisheries through the systematic investigation of the individual aspects (e.g. harvest, species diversity and abundance, recruitment, predator-prey relationships, primary productivity, habitat types, and availability). This information will enable the identification of aspects which have the greatest impacts on the fishery. Once identified, aspects capable of being manipulated can be discerned and restoration methods implemented.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199700400	Joint Stock Assessment	Information exchange, coordination, provide data for the blocked area.
199404300	Monitor, Evaluate, Research, and Model the Lake Roosevelt Fishery	Data and analysis exchange regarding ecological interactions of native and exotic species in similar and contiguous reservoir environments.
0	Evaluate Banks lake Fishery Interactions	Data and analysis exchange regarding ecological interactions of native and exotic species in similar and contiguous reservoir environments.

Relationship to Existing Goals, Objectives and Strategies

Project 199502800 requests continued funding to restore/enhance the failed recreational fisheries in Moses Lake, once the premier fishery for resident game fish in the Columbia Basin, in lieu of lost recreational anadromous fisheries. This project is viewed as important because revival of these fisheries could alleviate angling pressure on other populations in the province. This proposal addresses Fish and Wildlife Needs 11, 12, and 21, the Overall Subbasin Goal which is provide fish and wildlife harvest opportunities in the Lake Roosevelt Subbasin, and Objective III1/Strategies 1-18 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$213,072	$217,902	$222,702

Project: 199506700 - Colville Tribes Performance Contract for Continuing Acquisition

Sponsor: CCT-FWD

Short Description:

Acquire, protect, enhance and evaluate wildlife habitat and species for partial mitigation for losses to wildlife resulting from Grand Coulee and Chief Joseph Dams.

Abbreviated Abstract

Continuing segment of the Colville Tribes overall goal of mitigating for as much of the wildlife losses suffered from Grand Coulee and Chief Joseph Dam Projects as is possible. This project will add 2,000 to 4,000 acres to the existing mitigation base by acquiring management rights to adjacent or similar lands within the project area that will enhance and buffer current efforts. The land will be managed to protect, enhance and partially mitigate for habitat losses due to hydropower developments as provided under the

Northwest Power Act of 1980 and the 1994 FWP. Primary emphasis is on deer winter range and sharp-tailed grouse habitat; however, a large number of species will receive benefit due to habitat protection and enhancements, which will lead to overall, increased bio-diversity.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
(none)		.

Relationship to Existing Goals, Objectives and Strategies

Project 199506700 requests continued funding to acquire, protect, enhance and evaluate wildlife habitat and species for partial mitigation for losses to wildlife resulting from Grand Coulee and Chief Joseph Dams. This work is unique in the large number of species of importance that will benefit due to habitat protection and enhancements. This proposal addresses Fish and Wildlife Needs 1, 4, and 5, Wildlife Goals 1-4, and Objective 1/Strategey 1.1 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$1,500,000	$1,500,000	$1,500,000

Project: 199800300 - Spokane Tribe of Indians Wildlife Operations and Maintenance

Sponsor: Spokane Tribe of Indians (STOI)

Short Description:

Partial mitigation to protect, mitigate, and enhance wildlife mitigation lands on the Spokane Indian Reservation (SIR) for losses of wildlife habitat on the SIR caused by Grand Coulee Dam.

Abbreviated Abstract

The goal of this project is to achieve and sustain levels of habitats and wildlife species productivity in order to fully mitigate for the wildlife habitat and wildlife species lost on the SIR that resulted from the construction, inundation, and operation of the federal and non-federal hydroelectric system.

The STOI Wildlife Program has been mitigating Fox Creek with 220 acres of mitigation lands within, McCoy Lake Watershed Management Area (MLWMA) with 769.43 acres of mitigation lands within, Blue Creek Winter Range with 778.5 acres of mitigation lands within and Turtle Lake – Wellpinit Mountain Wildlife Area with 80 acres within.

The STOI Wildlife Program developed the site specific management plan on mitigation lands and have spent the last two years implementing the habitat enhancements

and restoration activities identified on the management plan. Additional funding is being requested for the next three years to begin implementing wildlife species and habitat monitoring and evaluation on mitigation lands.

The main focus of habitat enhancements over the next three years is going to be placed within the McCoy Lake Watershed and the Blue Creek Winter Range. McCoy Lake Creek has been heavily degraded from human impacts (i.e., farming and livestock grazing), attempt will be made to reestablish a riparian overstory canopy along the two miles of creek using native poplar trees and native shrubs to begin to develop an overstory canopy to provide shading for the creek for water quality and quantity. In the upland portion of the mitigation lands, attempts will be made to decrease the invasion of noxious weeds using both biological and mechanical methods, as well as planting native or "native-like" grass species in some of the agriculture ground adjacent to McCoy Lake Creek. These enhancement measures will benefit four of the Target Species for wildlife: ruffed grouse, white-tail deer, mule deer, and yellow warbler (riparian forest). Livestock exclusion will be conducted by fencing the 769.43 acres of wildlife mitigation lands within the McCoy Lake Watershed. Maintaining and repairing fences on mitigation lands will be crucial for the first three years to exclude livestock and working with the local cattle ranchers to help maintain and reduce livestock from impacting mitigation lands.

With the described enhancements and restoration, the goals are to increase water flows back into McCoy Lake, and increase and/or maintain wildlife habitat units for all Target Species of Wildlife identified in the loss assessment and credited to BPA, along with all other species of wildlife that use this area for any of their life requisites (i.e., food, cover, brood rearing). Wildlife species monitoring and evaluation within the McCoy Lake Watershed for both species of deer and yellow warbler will be developed and implemented, as will drumming counts for ruffed grouse .

In the Blue Creek Winter Range (BCWR) more intensive vegetation sampling will be conducted using Habitat Evaluation Procedures for community based modeling to collect more detailed grass species composition of native grasses within the BCWR. This will assist in better determining enhancements, goals, and objectives to benefit white-tail deer and mule deer, and begin a feasibility study for a reintroducing sharp-tailed grouse on the SIR.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199106100	Swanson Lakes Wildlife Area (SLWA)	Protect and maintain a self sustaining sharp-tailed grouse population, establish sage grouse in viable numbers, increase mule deer use of the project site, and enhance associated shrub-steppe habitat for other shrub-steppe obligate species.
199609400	Scotch Creek Wildlife Area	Protect and maintain a self sustaining sharp-tailed grouse population, increase and enhance mule deer winter range, and enhance associated shrub-steppe habitat for other shrub-steppe/conifer forest species.

Project ID	Title	Nature of Relationship
199506700	Colville Tribes Performance Contract for Continuing Acquisition	Protect, enhance and evaluate wildlife habitat and species for partial mitigation for losses to wildlife resulting from Grand Coulee and Chief Joseph Dams.

Relationship to Existing Goals, Objectives and Strategies

Project 199800300 requests continued funding to protect, mitigate, and enhance wildlife mitigation lands on the SIR for losses of wildlife habitat on SIR caused by Grand Coulee Dam. This proposal addresses Fish and Wildlife Needs 3, 5, 6, 7, and 8, Wildlife Goals 1-3, and Objective 3/Strategies 3.1, 3.2, 3.3, 3.6, 3.7, and 3.8 as identified in the Lake Roosevelt Subbasin Summary.

Review Comments

The team's recommendation was fund - Urgent/High Priority.

Budget

FY01	FY02	FY03
$182,497	$185,914	$190,563

Research, Monitoring and Evaluation Activities

Numerous activities are ongoing in the subbasin (both BPA and non-BPA funded) that currently provide some of the research, monitoring and evaluation needs in the Lake Roosevelt Subbasin. Monitoring activities cover a wide range of both fish and wildlife and associated habitats including:

Monitoring effectiveness of in-stream habitat and passage improvement actions within the Lake Roosevelt tributaries (Project # 199501100).

Monitoring and evaluating performance of fish released into Lake Roosevelt by the Spokane Tribal and Sherman Creek Hatcheries, investigating/defining biotic and abiotic impacts of reservoir operations and model development to predict ecosystem and fishery impacts resulting from existing and proposed reservoir operations (project # 19944300).

Monitoring and evaluation activities continue to characterize critically depressed and declining population of naturally spawning kokanee in the Lake Roosevelt Tributaries, including genetics and adult spawning escapement. Additionally, important potential limiting factors to tributary production such as abnormal peak late-winter/early-spring flows, bedload movement and passage barriers relating to reservoir operations and fish entrainment at Grand Coulee Dam have been investigated (Project # 199501100). This project proposes to continue refining the genetic evaluation, trend monitoring of adult escapement, and test the efficacy of strobe lights as a deterrent to fish entrainment at Grand Coulee Dam.

The Colville Tribal Fish Hatchery (Project # 198503800) proposes to investigate the presence/distribution/status of native salmonid populations within the Colville Reservation.

The Monitor and Enhance the Lakes and Streams of the Spokane Indian Reservation (Project # 21020) will monitor and evaluate the affects of mitigation actions on reservation tributaries and lakes.

Joint Stock Assessment (Project #19970400) collects baseline data in tributaries and lake, compiles information into standardized database and coordinates management activities.

The Banks Lake Fishery Evaluation (Project # 21008) will determine the abundance and ecological interactions of fish populations in Banks Lake. Identify limiting factors for naturally recruiting and hatchery supplemented fish. Provide management recommendations to maximize the fishing potential of Banks Lake.

Moses Lake Fishery Evaluation (Project # 199502800) will monitor and evaluate biotic and abiotic factors believed to affect the fishery.

The Spokane and Colville Tribes wildlife projects are monitoring both habitat and animal population responses to management activities. From the habitat stand point, this is being done using habitat evaluation procedures (HEP), permanent vegetative transects and photo plots. Both large and small mammal surveys are being conducted for the animal populations. Lek surveys for sharp-tailed grouse are also being conducted. Surveys for other bird species are planned for the near future. Wildlife management activities on the project also include small mammal surveys, neo-tropical breeding bird surveys, fawn counts (mule deer production), threatened and endangered species presence survey (initial survey at time of acquisition of properties), weekly wildlife species visual counts on mitigation lands.

The Colville National Forest has and continues to investigate the presence of native salmonids within the National Forest.

Other non-BPA funded activities in the subbasin include:

Eastern Washington Mule Deer Study (WDFW, CTCR, Chelan County PUD).

The Colville and Spokane Tribes issues harvest regulations annually for tribal and non-tribal members on the Reservation and Tribal member regulations.

The State of Washington issues harvest regulations annually for the general public on the northern half of the subbasin.

The Conservation Service, Colville Tribe, Spokane Tribe and Department of Ecology conduct water quality studies on tributaries of the subbasin.

The WDFW study and rehab lakes for cold and warmwater fish enhancement.

The Colville (CTCR) and Spokane (STI) Tribes attempts annual aerial population surveys for mule deer, whitetail deer, elk, wild horse and predators (on Reservations).

Hellsgate Post Season Deer Count (CTCR- on Reservation)

North Half Big Game Surveys (CTCR)

Upland Game Bird Brood Counts (CTCR- on Reservation)

Waterfowl Pair and Brood Counts (CTCR- on Reservation)

Bald Eagle Nest Surveys (CTCR and STI- on Reservations)

Predator control and beaver recolonization (CTCR, STI and WDFW)

Lake Roosevelt Bald Eagle Production Surveys (NPS)

Peregrine Falcon Introduction Survey (NPS)

Needed Future Actions

Limiting factors to fish production in the Lake Roosevelt Subbasin is primarily related to operations of the hydro-system (water regimes, productivity and fish entrainment), habitat conditions (water quantity and quality, sedimentation, riparian conditions etc.) and knowledge about the ecosystem(s), such as species, life histories, habitat use, population dynamics etc. Causes of the affected environment are all attributable to human development, predominately water and land use/practices in one form or another.

In general, the primary limiting factors for wildlife are habitat loss, fragmentation, and conversion of habitat for agricultural and other anthropogenic purposes. Predation and hunter harvest may impact some species; however, to what extent is largely unknown at this juncture. Specific limiting factors for mule deer and sharp-tailed grouse within the Lake Roosevelt Subbasin and adjacent Subbasins/Provinces include habitat quality issues, reproductive performance limitations, and relatively unknown and/or unsubstantiated mortality factors. Additional information on limiting factors is described for representative species within the broad categories of large mammals, small mammals and birds.

BPA funding should be used in the future to restore the condition and function of watersheds within the subbasin**.** In efforts to address watershed management consistent with functioning ecosystems, continued funding of research activities to increase knowledge of site-specific species life histories, habitat utilization, and population dynamics are appropriate. Furthermore, funding activities that specifically address physical and biological constraints to fish and wildlife productivity in the subbasin watersheds are critical elements to effective resource management and appropriately funded by BPA.

Future activities include:

Fish passage- Feasibility studies to assess the re-introduction of anadromous fish to the area above Grand Coulee Dam are paramount to meeting fish and wildlife goals and objectives in this subbasin. Additionally, identification/planning/implementation of fish passage activities to address human induced blockages throughout the subbasin is appropriate to increase available fish habitat and utilization.

Improved water flow regimes- Activities that promote improved water flow regimes in Lake Roosevelt (maximize elevations and water retention times) to maximize productivity and minimize entrainment.

Implement littoral and deepwater habitat improvement to Lake Roosevelt and other area lakes requiring rehabilitation.

Continue conducting surveys that provide information relative to species presence/distribution/status as a function of existing and future habitat conditions. Knowledge of existing conditions (population and habitat) and responses to mitigation actions (both population and habitat) are essential to adaptive management philosophy and proactive management within the basin.

Research and monitoring activities that provide information regarding Inter- and Intra-specific interactions within and between populations and species are important data gaps that need to be addressed to effectively manage altered habitats and diverse species assemblages (both native and non-native) within this subbasin. Investigation activities include but are not limited to genetic introgression, competition (forage and habitat), predation and habitat utilization.

Improved fluvial habitat conditions- Activities that promote watershed management to increase instream flows and water quality that are consistent with species requirements are critical to meeting fish and wildlife objectives in the subbasin. Such activities include but are not limited to upland management, riparian management, water allocation (acquisition and or conservation of consumptive water rights and their conversion to instream water), point and non-point pollution management and total dissolved gas abatement. Re-establishing perennial flows throughout the subbasin should be a primary fisheries focus.

Improved upland habitat conditions- Activities that promote improved upland management is important to watershed function. Actions that decrease habitat loss, fragmentation and isolation will be critical if both fish and wildlife objectives are to be achieved in this subbasin. Specific elements include conservation easements, land acquisition and watershed management plans.

Actions by Others

The NRCS will continue to provide technical support to soil and water managers with distribution of federal cost-share monies associated with reducing soil erosion. They also provide engineering support for land and water resource development, protection and restoration projects.

The U.S. Army Corp of Engineers, Bonneville Power Administration, and Bureau of Reclamation will continue to work towards effective regulation of water flows and elevations within Lake Roosevelt consistent with fish and wildlife needs, including state, federal and tribal water quality standards while meeting hydropower, flood control and irrigation needs.

The Department of Natural Resources (DNR), through a Memorandum of Understanding, and the Forest Practice Act will continue to regulate forest practice applications through the timber, fish and wildlife process on fee lands within the reservation, and areas outside of the reservation.

The U.S. Forest Service will continue to restore and protect stream habitat within the national forest. They will also continue to identify native salmonid populations and evaluate and rectify potential fish passage obstacles associated with the forest road system and special forest use-permit holders (i.e. irrigation districts).

The Department of Fish and Wildlife will continue management of fish and wildlife resources within Lake Rufus Woods consistent with legal jurisdiction.

The Department of Ecology will continue to administer the State Shoreline Management Act in those areas outside of the reservation boundaries.

The Natural Resources Department of the Colville Confederated Tribes and Spokane Tribe will continue to manage and regulate natural resources (including fish and wildlife and associated habitats) within the Tribes legal jurisdiction. Activities include but are not limited to the following areas: Fish and wildlife management, enforcement, land use activities (timber, range and mineral development), water rights and adjudication, development permitting, hydraulics permitting and shore line protection (e.g. CTCR Shoreline Management Act).

Ferry, Grant, Lincoln, Okanogan and Stevens Counties will continue to regulate and enforce the Growth Management Act in areas outside the Colville and Spokane Reservations, consistent with regulatory authority, to perpetuate responsible planning and land use activities.

Table 1. Lake Roosevelt Subbasin Summary FY 2001 BPA Funding Proposal Matrix (New Projects)

Project Proposal ID	21008	21020	21021	21034	21035	21003	21006	21023	21025	21029
Provincial Team Funding Recommendation	**Urgent/High Priority**	**Urgent/High Priority**	**Urgent/High Priority**	**Urgent/High Priority**	**Urgent/High Priority**	**Do Not Fund**	**Do Not Fund**	**Do Not Fund**	**Recommended Action**	**Urgent/High Priority**
Fish Objective IA1: Create and maintain a high quality sport and subsistence kokanee salmon and rainbow trout fishery					+					
Fish Objective IA2: Develop self-sustaining wild populations of kokanee salmon and rainbow trout with hatchery origin fish in a minimum of five by 2010										
Fish Objective 1B: Manage native wild rainbow trout and native wild kokanee populations to provide tribal subsistence and recreational harvest										
Fish Objective IC: Create and maintain, enhance self-sustaining sport and subsistence fishery for sturgeon, burbot, lake whitefish, mountain whitefish										
Fish Objective ID: Create and maintain, enhance self-sustaining sport and subsistence fishery for wild walleye, smallmouth bass										
Fish Objective IE: Restore self-sustaining anadromous fish population above Grand Coulee Dam										
Fish Objective IIA: Annually enhance and maintain successful subsistence fishery for Colville Tribal members as well as non-member sport fishery with hatchery-reared rainbow trout in lakes and streams of the Colville Reservation										
Fish Objective IIB1: Annually Annually enhance and maintain successful subsistence brook trout fishery for the Colville Tribal members as well as non-members on the Colville Reservation										
Fish Objective IIB2: Where feasible, restore, enhance, and maintain wild/ native salmonid populations of the Colville Indian Reservation at harvestable levels										
Fish Objective IIB3: Provide successful subsistence fishery for Spokane Tribal members with rainbow trout and kokanee salmon in three reservation lakes		+								
Fish Objective IIB4: Maximize rainbow trout and kokanee habitat in Spokane Tribe Reservation lakes.		+								
Fish Objective IIIA1: Maintain and enhance balanced productive Moses Lake warmwater recreational fishery as off-site resident fish substitution for loss of anadromous fish above Chief Joseph and Grand Coulee dams										
Fish Objective IVA1: Create and maintain high quality kokanee salmon and rainbow trout subsistence and recreational fishery as subsitution for loss of anadromous fish above Chief Joseph and Grand Coulee dams	+		+							
Fish Objective IVB1: Create, maintain, enhance self-sustaining sport and subsistence fishery for wild walleye, large- and smallmouth bass	+									
Fish Objective VA1: Create and maintain rainbow trout and kokanee salmon fishery in 10 waters in the subbasin as subsitution for loss of anadromous fish above Chief Joseph and Grand Coulee dams										
Wildlife Objective 1: Acquire land and/or management rights to 111,515 habitat units by 2010										
Wildlife Objective 2: Identify specific factors limiting/affecting mule deer										

populations in the Lake Roosevelt Subbasin and adjacent subbasins/provinces by 2004								+		+
Wildlife Objective 3: Enhance existing habitat to optimize conditions needed to increase overall productivity of desired species										
Wildlife Objective 4: Increase present sharptailed grouse populations in the Intermountain Province and associated subbasins to a minimum of 800 grouse by 2010				+						
These project titles are referenced by ID above: 21008 - Evaluation of the Banks Lake Fishery 21020 - Monitor and enhance the lakes and streams of the Spokane Indian Reservation 21021 - Ford Hatchery improvement, operation, and maintenance 21034 - Colville Tribe restoration of habitat for sharptailed grouse 21035 - Phalon Lake native redband trout trap construction and O&M 21003 - Upper Columbia Subbasin native rainbow population study 21006 - Characterize and assess wildlife-habitat types and structural conditions for subbasins within the Intermountain ecoprovince 21023 - Determine causes of mule deer population declines in the Intermountain Columbia Basin: a test of the "apparent competition" hypothesis 21025 - Intermountain Province resident fish symposium 21029 - A cooperative approach to identifying the role of forage quality in affecting physical condition . . .of mule deer in north central Washington										

Note: + = Potential or anticipated effect on subbasin objectives and strategies.

Table 1. Lake Roosevelt Subbasin Summary FY 2001 BPA Funding Proposal Matrix (On-going Projects)

Project Proposal ID	19850380	19910460	19910470	19910620	19920480	19940430	19950090	19950270	19950280	19950670	19980030
Provincial Team Funding Recommendation	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority	Urgent/High Priority
Fish Objective IA1: Create and maintain sport and subsistence kokanee salmon and rainbow trout fishery as substitution for loss of anadromous fish above Grand Coulee Dam		+	+				+				
Fish Objective IA2: Develop self-sustaining wild populations of kokanee salmon and rainbow trout with hatchery origin fish in a minimum of 5 tributaries by 2010						+					
Fish ObjectiveIB: Manage native wild rainbow trout and native wild kokanee salmon to provide annual tribal subsistence and recreational harvest						+					
Fish Objective IC: Create and maintain substantial, high quality sport and subsistence fishery for sturgeon, burbot, lake whitefish, mountain whitefish								+			
Fish Objective ID: Create, maintain, enhance a self-sustaining substantial, high quality sport and subsistence fishery for wild walleye, smallmouth bass						+					
Fish Objective IIA: Annually enhance and maintain subsistence fishery for Colville Tribal members as well as non-member sport fishery with hatchery-reared rainbow trout in lakes and streams on the Colville Reservation											
Fish Objective IIB1: Annually enhance and maintain subsistence fishery for Colville Tribal members as well as non-member sport fishery on the Colville Reservation	+										
Fish Objective IIB2: Where feasible, restore, enhance, and maintain wild/ native salmonid populations on the Colville Reservation at harvestable levels	+										
Fish Objective IIB3: Provide successful subsistence fishery for the Spokane Tribal members with rainbow trout and kokanee salmon in three reservation lakes											
Fish Objective IIB4: Maximize rainbow trout and kokanee habitat in Spokane Tribe Reservation lakes											
Fish Objective IIIA1: Maintain and enhance balanced productive Moses Lake warmwater recreational fishery as off-site resident fish substitution for the loss of anadromous fish above Chief Joseph and Grand Coulee dams									+		
Fish Objective IVA1: Creat and amintain kokanee salmon and raibow trout sibsistence and recreational fishery as substitution for anadromous fish angling above Chief Joseph and Grand Coulee dams		+									
Fish Objective IVB1: Create, maintain and enhance self-sustaining sport and subsistence fishery for wild walleye, large- and smallmouth bass											
Fish Objective VA1: Create and maintain rainbow trout and kokanee salmon fishery in 10 waters in the subbasin as substitution for lost fishing opportunities above Grand Coulee Dam											
Wildlife Objective 1: Acquire land and/or management rights to 111,515 habitat units by 2010				+	+					+	+

Wildlife Objective 2: Identify specific factors limiting/affecting mule deer populations in the Lake Roosevelt Subbasin and adjacent subbasins/provinces by 2004											+
Wildlife Objective 3: Enhance existing and available habitat to optimize conditions required to increase overall wildlife productivity of desired species											+
Wildlife Objective 4: Increase present sharptailed grouse populations in the Intermountain Province and associated subbasins to a minimum of 800 grouse by 2010											
198503800 - Colville Tribal fish hatchery 199104600 - Spokane Tribal Hatchery (Galbraith Springs) operations and maintenance 199104700 - Sherman Creek Hatchery operation and maintenance 199106200 - Spokane Tribe of Indians wildlife mitigation project 199204800 - Hellsgate big game winter range operations and management project 199404300 - Lake Roosevelt fisheries evaluation program 199500900 - Rainbow trout net pen rearing project 199502700 - Develop and implement recovery plan for depressed Lake Roosevelt white sturgeon populations 199502800 - Restore Moses Lake recreational fishery 199506700 - Colville Tribes performance contact for continuing acquisition 199800300 - Spokane Tribe of Indians wildlife operations and maintenance											

Note: + = Potential or anticipated effect on subbasin objectives and strategies.