# Draft

# Lake Rufus Woods Subbasin Summary

*(including the Nespelem River)*

November 15, 2000

Prepared for the
Northwest Power Planning Council

**Subbasin Team Leader**
Richard LeCaire
Confederated Tribes of the Colville Reservation

# Lake Rufus Woods Subbasin Summary
*(including the Nespelem River)*

Table of Contents

# Lake Rufus Woods Subbasin Summary

## Fish and Wildlife Resources

### Subbasin Description

#### General Location

Lake Rufus Woods is a 51-mile long Columbia River mainstem impoundment located in north central Washington. It is bounded by Chief Joseph Dam at river mile (RM) 545.1 at its lower end is the Grand Coulee Dam at RM 596.6 at its upper end. The Colville Indian Reservation borders the entire north shoreline of the lake. The Nespelem River is the only major tributary and enters Lake Rufus Woods at RM 582 (Figure 1).

#### Drainage Area

The Lake Rufus Woods Subbasin encompasses approximately 915 square miles of Douglas and Okanogan counties. The watershed for the Nespelem River consists of 224 square miles and exists entirely on the Confederated Tribes of the Colville Reservation, CTCR (Environmental Protection Agency, EPA, 2000). The majority of the Nespelem watershed was historically blocked to anadromous fish and is currently blocked to adfluvial resident species by a waterfall located at RM 1.5.

#### Climate

The basin has a continental climate that is influenced by maritime air masses from the pacific coast. The average annual temperature is 49° F, with July being the warmest month and January being the coldest. The annual precipitation for the area is 10.5 inches with approximately 21 inches of snowfall (Weather Underground 2000).

#### Topography and Geomorphology (geology/soil types)

The Lake Rufus Woods Subbasin lies on three geologic provinces. The first province that the Nespelem River flows through is the Kootenay Arc. It was the old coastal plain of North America in the Paleozoic period. The second province to the north is the Okanogan subcontinent. It was a small island about the size of California off the west coast in the Mesozoic period. Both of these collided into the Old North American continent to form the Okanogan highland area. The area is mostly old granite folded in layers (Alt and Hyndman 1984). The third province, which the southern part of the watershed lies on, is the Columbia Plateau. The Plateau is a large volcanic province that is the product of numerous volcanic eruptions. These eruptions created the Miocene basalt flows. The plateau is made up of fine-grained black basalt. Floodwaters from glacial Lake Missoula left a series of flood channels throughout the region known as the Channeled Scablands. The plateau has little to no soil on top of the basalt. The soil that is found here is mostly loess, a light brown silt loam. (Alt and Hyndman 1984)

Soils in these areas are tied to elevation. In mountainous areas, the soil is mostly stony or gravelly sandy loams of one meter or less in depth. At lower elevations the soils are mostly glacial till consisting of glacial out wash, sands, and gravels that are well drained. (Dyrness and Franklin 1988)

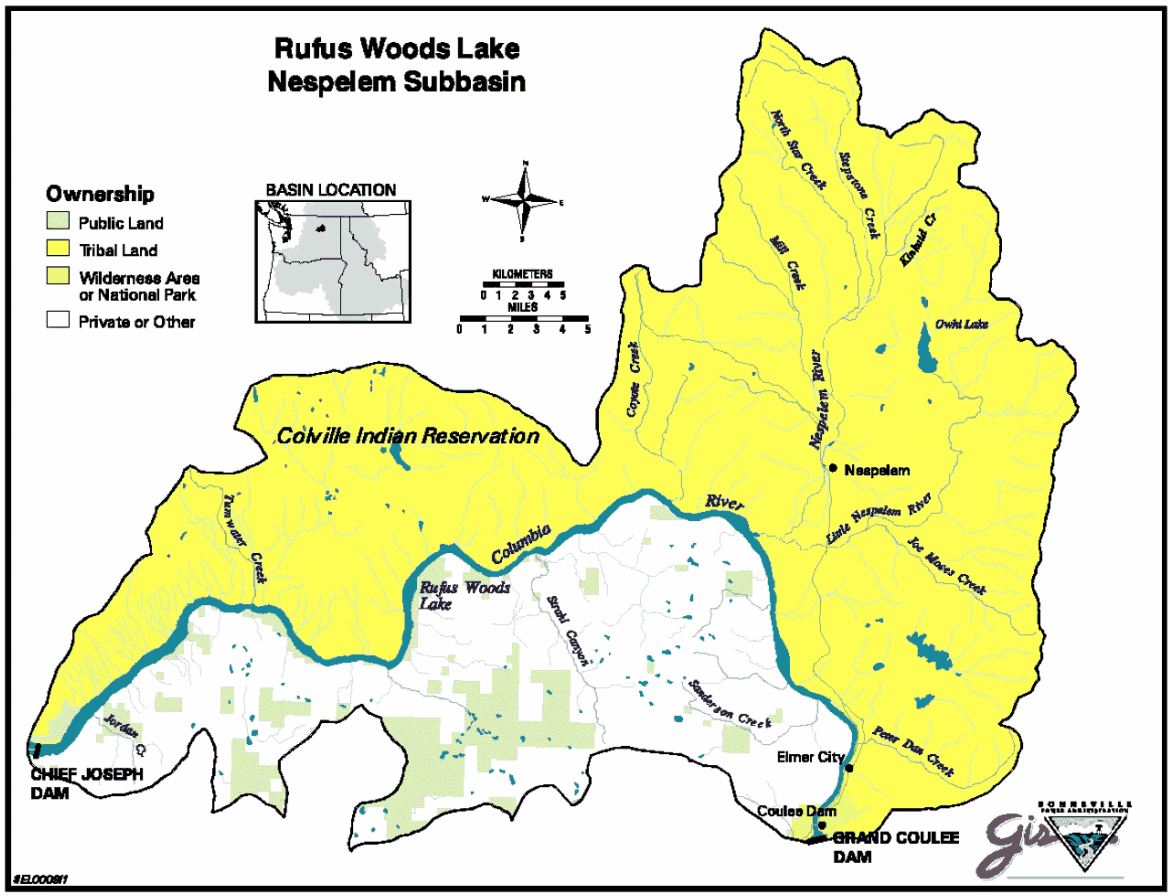


Figure 1. Lake Rufus Woods Subbasin

### Fish and Wildlife Status

#### Fish

The native fish assemblage within the boundaries of the Lake Rufus Woods Subbasin was supported by pristine habitat conditions and consisted of both resident and anadromous fish species. Anadromous fish transported marine nutrients into the subbasin and were an ecological keystone species to the ecosystem (Willson and Halupka 1995; Mills et al. 1993, Cederholm et al. 1989; Kline et al. 1990). Construction of Chief Joseph Dam in 1958 blocked the upstream migration of adult salmon. As a result, anadromous fish were extirpated from Lake Rufus Woods Subbasin and the fish assemblage shifted to non-native species (Scholz et al. 1985, Dave Venditti, Research Fish Biologist, U.S. Geological Survey personal communication). Therefore, discussions regarding native fish and/or native ecosystem recovery efforts must consider anadromous fish, as they are a significant part of the native ecosystem.

#### Lake Rufus Woods

Very little biological data has been collected in Lake Rufus Woods proper. Perhaps the earliest study was conducted by the U.S. Department of the Interior, Bureau of Reclamation during 1953; prior to the construction of the Chief Joseph Dam formerly known as the Foster Creek Dam Project. Subsequent studies followed that include

"Evaluation of Wildlife Mitigation Sites at the Chief Joseph Dam" (Shapero and Associates 1987), "Evaluation of the Wildlife Mitigation Sites at the Chief Joseph Dam" (Evans and Associates 1994), "Assessment of the Impact on the Wildlife and Fisheries Resources of Rufus Woods Reservoir Expected From Raising Chief Joseph Dam from 946 feet to 956 feet M.S.L. (Erickson et al, 1977).

A great deal of biological data, mostly limnological, has been collected on Colville Indian Reservation Lakes that include Buffalo, Owhi, Little Goose, McGinnis, Rebecca, North and South Twin Lakes and Round Lake. All of the aforementioned investigations were conducted over several years by Dr. Ed. Brock under contract to the Colville tribes Fish and Wildlife Department. Additionally, the tribe conducts creel census and relative abundance surveys on several reservation lakes annually(Truscott, personal communication 2000). The most recent study performed in the reservoir was to determine gas bubble disease symptoms in the resident fish. A total of 28 fish have been identified in Lake Rufus Woods. Of those 28 fish species captured, the relative abundance of 23 is presented in Table 1 (Dave Venditti, Research Fish Biologist, USGS, personal communication; USACE In press). These data provides some insight as to what species exist in Lake Rufus Woods.

Table 1. Catch composition and relative abundance in combined electrofishing and beach seining samples from Lake Rufus Woods from April - July 1999 (Dave Venditti, Research Fish Biologist, USGS, personal communication).

| Species | Caught | Examined for GBD | Percent Catch | Mean Weight | Number Measured | Total Weight | Percent Weight |
|---|---|---|---|---|---|---|---|
| Total | 7171 | 6430 | 100.0 | 663 | 3976 | 2635229 | 100.0 |
| Longnose sucker | 1456 | 1403 | 20.3 | 516 | 1164 | 600161 | 22.8 |
| Redside shiner | 1102 | 688 | 15.4 | | 19 | | |
| Rainbow trout | 1046 | 1028 | 14.6 | 400 | 1038 | 415255 | 15.8 |
| Sculpin | 593 | 579 | 8.3 | | 35 | | |
| Unidentified sucker | 522 | 415 | 7.3 | | 4 | | |
| Bridgelip sucker | 494 | 477 | 6.9 | 1388 | 486 | 674396 | 25.6 |
| Walleye | 479 | 456 | 6.7 | 377 | 474 | 178674 | 6.8 |
| Largescale sucker | 462 | 460 | 6.4 | 1380 | 445 | 614263 | 23.3 |
| Northern pikeminnow | 438 | 390 | 6.1 | | 87 | | |
| Kokanee | 138 | 133 | 1.9 | 453 | 138 | 62506 | 2.4 |
| Mountain whitefish | 75 | 75 | 1.0 | | 11 | | |
| Smallmouth bass | 64 | 53 | 0.9 | 236 | 64 | 15112 | 0.6 |
| Yellow perch | 52 | 43 | 0.7 | 92 | 35 | 3206 | 0.1 |
| Carp | 51 | 49 | 0.7 | | 50 | | |
| Burbot | 47 | 42 | 0.7 | 448 | 47 | 21051 | 0.8 |
| Brown Trout | 36 | 34 | 0.5 | 415 | 36 | 14938 | 0.6 |
| Unidentified salmonids | 23 | 17 | 0.3 | | | | |
| Unidentified | 21 | 21 | 0.3 | | 4 | | |

| Species | Caught | Examined for GBD | Percent Catch | Mean Weight | Number Measured | Total Weight | Percent Weight |
|---|---|---|---|---|---|---|---|
| cyprinids | | | | | | | |
| Eastern brook trout | 21 | 21 | 0.3 | 265 | 21 | 5564 | 0.2 |
| Tench | 21 | 20 | 0.3 | 1266 | 20 | 25317 | 1.0 |
| Peamouth | 16 | 15 | 0.2 | | | | |
| Chinook salmon | 5 | 5 | 0.1 | 620 | 5 | 3100 | 0.1 |
| Unidentified larval fish | 4 | 2 | 0.1 | | | | |
| Unknown fish | 2 | 1 | 0.0 | | 1 | | |
| Bull trout | 2 | 2 | 0.0 | 107 | 2 | 213 | 0.0 |
| Brown bullhead | 1 | 1 | 0.0 | 390 | 1 | 390 | 0.0 |

The Lake Rufus Woods fish assemblage is likely influenced by downstream migrating fish entrained through Grand Coulee Dam from Lake Roosevelt. Results of a 42 month entrainment study at Grand Coulee Dam confirmed that entrainment of fish from Lake Roosevelt is a significant problem (LeCaire 1999). Between 1996 and 1999 the average entrainment through Grand Coulee Dam was estimated using single-beam hydroacoustics at nearly 403,000 fish annually, totaling over 1.6 million fish throughout the study (Table 2).

Table 2. Annual Entrainment Totals March 1999-September 1999

| Power plant | 1996 | 1997 | 1998 | 1999 | Total |
|---|---|---|---|---|---|
| Left | 10,442 | 33,192 | 26,718 | 9,313 | 79,665 |
| Right | 27,316 | 32,811 | 50,706 | 19,741 | 130,574 |
| Third | 538,918 | 470,009 | 208,926 | 182,631 | 1,400,484 |
| Total | 576,676 | 536,012 | 286,350 | 211,685 | 1,610,721 |

Kokanee salmon and rainbow trout comprised 89 percent of experimental gillnetting efforts in the Grand Coulee Dam forebay presented in Table 3. Therefore, it was assumed that a large number of fish immigrating to Lake Rufus Woods are kokanee and rainbow trout (LeCaire 1999). It is unknown how many of these fish continue migrating downstream and entrain through Chief Joseph Dam, and how many residualize in the Lake Rufus Woods and contribute to the fishery. Data presented in LeCaire (1999) summarize 1999 collection reports from the Rock Island Dam bypass facility, which captured 986 kokanee, and 234 floy-tagged rainbow trout that were released behind Grand Coulee Dam in 1998 and 1999. These data suggest that fish entraining through Grand Coulee Dam may continue to entrain downstream, although estimates of total fish migrating to that point does not exist.

Table 3. Percent of total catch, by species, in experimental gill nets set in the Grand Coulee Dam forebay (LeCaire 1999)

| | |
|---|---|
| Kokanee | 53% |
| Rainbow trout | 36% |
| Walleye | 2% |
| Lake whitefish | 4% |
| Chinook | 1% |
| Yellow perch | <1% |
| Burbot | <1% |

#### Rainbow Trout

The popular rainbow trout fishery in the reservoir consists mainly of fish originating from the Spokane Tribal Hatchery and Trout Lodge. The fish from the Spokane Tribal Hatchery are likely fish released from the Lake Roosevelt net pens that have entrained out of Lake Roosevelt. The Trout Lodge stock is a triploid steelhead stock that is stocked by the Colville Tribe in Lake Rufus Woods to supplement subsistence and recreational opportunities (Kirk Truscott, Fish Biologist, Confederated Tribes of the Colville Reservation Fish and Wildlife Department, personal communication). Trout Lodge stock also is known to escape from the Columbia River Fish Farms net pens in Lake Rufus Woods and enter the fishery. The Washington State Record for sport caught rainbow trout was caught in Lake Rufus Woods in February 1998 (25.45 lbs 2/23/98).

#### Kokanee

An adfluvial population of kokanee maintains a sustainable wild population in the reservoir by successfully spawning in the Nespelem River below the barrier falls at RM 1.5 (LeCaire 1999; Kirk Truscott, Fish Biologist, Confederated Tribes of the Colville Reservation Fish and Wildlife Department, personal communication). The primary hatchery stock of Kokanee in this area are released in Lake Roosevelt and derive from Lake Whatcom in western Washington. Although methods have not allowed the collection of enough fish to establish statistically significant results, preliminary allozyme analyses suggests that the Nespelem River stock of kokanee are a genetically unique stock; more similar to the Lake Roosevelt composite stock and North Arm Kootenay Lake stock than to Lake Whatcom stock (LeCaire 1999).

Since 1995, adult kokanee returns have been monitored annually in the lower Nespelem River with adult returns ranging from 6 to 389 in 1997 and 1999, respectively (Table 4). Upstream migration into the Nespelem River begins as early as mid-July and spawning occurs between August and November (LeCaire 1999), however, behavior of juvenile fish is unknown. Redd capping attempts have been unsuccessful due to unusually high flows during the spring months (LeCaire 1999). It is hypothesized that juvenile fish migrate to the reservoir shortly after emergence in the spring (Kirk Truscott, Fish Biologist, Confederated Tribes of the Colville Reservation, personal communication).

Table 4. Lower Nespelem River Adult Kokanee Escapement 1995-1999

| Year | Species | Number |
|---|---|---|
| 1995 | Kokanee | Est. 35-100 |
| 1996 | Kokanee | 18 |
| 1997 | Kokanee | 6 |
| 1998 | Kokanee | 70-100 |
| 1999 | Kokanee | 389 |

The barrier falls, located at RM 1.5 on the Nespelem River, prevent upstream adfluvial migrations. As previously noted, an adfluvial stock of kokanee utilizes the lower river as a spawning ground. Populations in the Nespelem watershed above the falls are fluvial and/or non-migratory resident populations.

Nespelem River Watershed The fish present in the Nespelem River represent a largely non-native assemblage of naturalized salmonid species that have responded favorably to altered habitat conditions (Hunner and Jones 1996). These species include brook trout (*Salvelinus fontinalis)*, brown trout (*Salmo trutta)*, and rainbow trout (*O. mykiss)* (Hunner and Jones 1996). Other species present include bridgelip sucker (*Catastomus columbianus)*, sculpin (*Cottus sp*.), dace (*Rhinichthys sp*.) and unknown species of whitefish (*Coregonus spp* and/or *Prosopium sp*.) (Hunner and Jones 1996).

### Wildlife

The Lake Rufus Woods Subbasin is home to a diverse assemblage of large and small mammals, amphibians, and birds. Since mammalian species are highly mobile, the animals tend to range throughout multiple subbasins. Table 5 illustrates target and listed species identified for the Rufus Woods Subbasin. Population status/information is also provided for each respective category (large mammal and birds).

Table 5. Target wildlife species

| Large Mammals | Small Mammals | Birds | Amphibians |
|---|---|---|---|
| Mule deer *Odocoileus hemionus* | Bobcat *Lynx rufus* | Spruce grouse *Dendragapus canadensis* | *Columbia spotted frog *Rana luteiventris* |
| White-tailed deer *Odocoileus virginianus* | Weasel *Mustela vison* | Ruffed grouse *Bonasa umbellus* | *Western toad *Bufo boreas* |
| Moose *Alces alces* | Marten *Martes americana* | Blue grouse *Dendragapus obscurus* | |
| Elk *Cervus elaphus* | Badger *Taxidea taxus* | Turkey *Meleagris gallopavo* | |
| Black bear *Ursus americanus* | Beaver *Castor canadensis* | California quail *Colinus spp.* | |
| *Grizzly bear *Ursus arctos* | Muskrat *Ondatra zibethicus* | Ring-necked pheasant *Phasianus colchicus* | |
| *Gray Wolf *Canis lupus* | Coyote *Canis latrans* | Gray partridge *Perdix perdix* | |
| | White-tailed jackrabbit *Lepus townsendii* | Chukar *Alectoris chukar* | |
| | Cougar *Felis concolor* | Mourning dove *Senaida macroura* | |
| | *Townsend's big-eared bat | Ducks | |

| Large Mammals | Small Mammals | Birds | Amphibians |
|---|---|---|---|
| | *Plecotus townsendii* | | |
| | *Fisher *Martes pennanti* | Geese | |
| | *Lynx *Lynx lynx* | Swans | |
| | *Wolverine *Gulo gulo* | *Golden eagle *Aquila chrysaetos* | |
| | *Merriam's shrew *Sorex merriami* | *Merlin *Falco columbarius* | |
| | *Washington ground squirrel *Spermophilus washingtoni* | *Northern goshawk *Accipitergentilis* | |
| | | Peregrine Falcon F*alco peregrinus* | |
| | | Sharp-tailed grouse *Tympanuchus phasianellus* | |
| | | *Sandhill crane *Grus canadens*is | |
| | | *Burrowing owl *Athene cunicularia* | |
| | | *Flammulated owl *Otus flammeolus* | |
| | | *Vaux's swift *Chaetura vauxi* | |
| | | *Black-backed woodpecker *Picoides articus* | |
| | | *Ferruginous hawk *Buteo regalis* | |
| | | *Pileated woodpecker *Dryocopus pileatus* | |
| | | *Whitehead woodpecker *Picoides allbolarvatus* | |
| | | Neotropical birds | |
| | | *Loggerheaded shrike L*anius ludovicianus* | |
| | | *Sage sparrow *Amphispiza belli* | |
| | | *Sage thrasher *Oreoscoptes montanus* | |
| | | *Common loon *Gavia immer* | |
| | | *American white pelican *Pelecanus erythrorhynchus* | |
| | | *Upland sandpiper *Calidris himantopus* | |
| | | *Bald eagle *Haliaeetus leucocephalus* | |

* denotes Washington State listed/sensitive species

## Large Mammal Population Status

### Mule/White-tailed Deer, Elk, and Moose

On the Colville Reservation side (north side) of Lake Rufus Woods, winter aerial surveys indicated that the deer populations are declining. Fawns per 100 adults for mule deer and

white-tailed deer fell from 72-89 to 24 per 100 adults in 1985 and 1997, respectively (Murphy and Judd, 1998).

Conversely, mule deer populations are stable since implementation of the three point harvest restriction rule for mule deer throughout the State of Washington including game management unit (GMU) 248, located on the south side of the Lake Rufus Woods Subbasin (Mark Quinn, R2 – WDFW, personal communication). In Game Management Units adjacent to GMU 248 and the Colville Reservation, mule deer populations are experiencing declines similar to those found on the north side of Lake Rufus Woods. During winters with heavy snow accumulation on the plateau, mule deer move down to lands adjacent to the reservoir and may move further down river, outside of the subbasin. However, mule deer populations on the Colville Indian Reservation and adjacent areas are declining for a variety of reasons.

Additional research and monitoring is needed to identify differences in habitat quality and other factors limiting mule deer populations and to provide a basis to develop strategies to reverse downward population trends (Steve Judd, CCT, personal communication; Woody Myers, WDFW, personal communication).

Mule and white-tailed deer are culturally significant and contribute subsistence to CCT members and are an important big game species in the State of Washington. Elk and moose populations are also present, and increasing. Some proportion of the increase could be attributable to animal/herd movement from adjacent subbasins.

### Bird Population Status

#### Columbia Sharp-tailed Grouse

The Columbia sharp-tailed grouse (State Classified as Threatened) population in Washington is estimated to be 858 birds in eight small populations (Michael A. Schroeder, Upland Bird Research Biologist, personal communication, Nov. 1999). Two populations are on the north side (Colville Reservation) of the subbasin and account for approximately half of the remaining birds. Nespelem /Agency Butte, along with the shrub-grasslands and riparian areas running south to around Buffalo Lake are considered some of the best habitat left in existence for the species in the state and possibly the entire Northwest. The WDFW requested 12 birds from Agency Butte to supplement the Scotch Creek State Wildlife Management Area. The state side (south) of the subbasin also contains birds from the Dyre Hill population near Bridgeport, WA in the northeastern corner of Douglas County. This population is considered part of the Nespelem population (Schroeder, personal communication, May 11, 2000). Recent declines of sharp-tailed grouse appear to be linked to the dramatic losses of native grassland habitats and degradation of the remaining habitat; wintering, nesting and brood rearing habitat.

#### Sage Grouse

Two populations of sage grouse (State Classified as Threatened) are found in Washington. Sage grouse are present on the south side of the Lake Rufus Woods Subbasin. There are two active display grounds in this area and one near the town of Del Rio (Schroeder, personal communication, May 11, 2000). The estimated sage grouse population in Douglas County is 300. They are dependent on shrub-steppe habitat consisting of sagebrush/ bunchgrass stands having medium to high canopy cover of sagebrush in a variety of height

classes and a diverse grass and forb understory. There are few areas in the present shrub-steppe habitat that meets the above criteria (WDFW 1995a).

#### Bald and Golden Eagles

Bald and golden eagles are present, and have nesting territories within the subbasin. There are two known golden eagle nesting territories in rock habitat. There are six bald eagle nesting territories, along the reservoir (Ron Freeze, R2 WDFW, personal communication). There is also an active bald eagle nest at Buffalo Lake (M. Murphy personal communication 2000).

### Habitat Areas and Quality

#### Fish

The habitat conditions found in Rufus Woods Reservoir are largely controlled by the operation of Grand Coulee and Chief Joseph dams. Chief Joseph Dam has very little storage capacity and functions as a re-regulating reservoir passing the water released from Grand Coulee Dam either by spilling or power generation. This situation creates highly variable water levels. Grand Coulee Dam operations, (power production and spill), contributes to dissolved gas saturation that has been recorded to 138 percent in Lake Rufus Woods (USACOE, 2000) and is listed on the 1998 final EPA 303(d) list for the State of Washington.

The hydrology of the Nespelem Watershed is generally a product of snowmelt from forested mountains in the headwaters (Harkness et al. 1974). Between 86 and 91 percent of the annual surface water discharge of the Nespelem River at the mouth is from melting snow (Harkness et al. 1974). The historic conditions, with unaltered riparian areas and forested uplands, allowed vegetative ground protection that caused snow to melt off slowly throughout the summer months (Hunner and Jones 1996). This resulted in perennial stream flow and cold-water conditions necessary for native salmonid persistence. Further, sedimentation and embedded substrate were minimal due to less erosion and fluvial characteristics (channel morphology and hydraulics).

Natural conditions have been altered by human caused impacts including logging, road building, grazing, mining, and agriculture. The lack of canopy closure reduces the amount of shade allowing snow to melt off rapidly, resulting in unusually high spring flows and unusually low late summer flows. Hunner and Jones (1996) reported that 44 percent of the Nespelem River tributaries that are now intermittent, likely had perennial flows historically. Further, the lack of canopy closure, particularly in the riparian area, results in warm water conditions that often create metabolic demands that native salmonids cannot maintain with the given food supply. The lack of ground protecting vegetation allows for increased erosion that deposits fine sediments in streams, functionally reducing or eliminating native salmonid spawning habitat by increasing embedded substrate (LeCaire and Peone 1991). Additionally, increased embeddedness reduces invertebrate production, which is the primary food source for native tertiary consumers (fish).

The lakes throughout this subbasin are mostly found on the Colville Indian Reservation. The majority of the lakes are in the southwest plateau and are saline or highly alkaline and cannot support fisheries (Hunner and Jones 1996). Five lakes in the subbasin have conditions suitable for maintaining subsistence and recreational fisheries and range from

eutrophic to meso-oligotrophic (Hunner and Jones 1996). These lakes are largely closed basin lakes with little or no connectivity to the fluvial system. Lakes are maintained largely by stocking from the Colville Tribal Hatchery and through some natural production of non-native warm water species (Hunner and Jones 1996).

#### Wildlife

Seventy eight percent of low elevation shrub-steppe rangelands, which historically provided for winter/spring use, are in a declining state (from potential natural community). The canopy of low to high elevation forested habitats in the subbasin has been opened. Thermal/snow intercept cover appears to be marginal in meeting the requirements of big game. Timber stands with greater than 60 percent crown cover in structure classes 4 and 5 (larger diameter trees) did not appear in queries of the GIS database. Security cover in forested areas is also declining, as sight distance has increased do to forest practices (CTCR – IRMP Phase I, Wildlife 1998).

The north facing aspect maximizes moisture for transitional, ponderosa pine/bunch grass/shrub-steppe habitats and is considered to be in good condition on the south side of Lake Rufus Woods. The proportion of converted and farmed agricultural lands vs. shrub-steppe habitat is assumed to be relatively stable at present, with large areas being put into CRP/CREP programs, providing forage and cover for game. Past and present forest practices currently favor forage production opportunities beneficial to elk and moose; however, cover and security requirements are beginning to be sacrificed. Open road density is estimated at between 4 and 6 miles per square mile (CTCR-IRMP Phase I, Wildlife 1998).

### Watershed Assessment (Limnological Assessments)

No watershed assessment information is available for Lake Rufus Woods or the Nespelem River. Most of the existing information for this subbasin is available in LeCaire and Peone 1991 and Hunner and Jones 1996.

### Limiting Factors

#### Fish

##### Lake Rufus Woods

Total dissolved atmospheric gasses in Lake Rufus Woods is the factor that has caused it to be placed on the Washington 303(d) list. This high gas concentration is potentially a limiting factor to all fish populations in the reservoir. Research conducted by the U.S. Geological Survey (USGS), using gear types designed to sample species and habitats most likely to be affected by GBD, indicated that only one fish out of more than 5,000 examined exhibited signs of gas bubble disease in 1999 presented in Table 6, (Dave Venditti, Research Fish Biologist, USGS, personal communication). However, 1999 was a relatively low water year and gas saturation levels were substantially lower than the previous three years. Therefore, it is likely that results based on data collected during 1999 didn't reveal the impacts of gas supersaturation on the fish assemblage. For example, data collected by Chief Joseph Fish Farms and Columbia River Fish Farms suggests that fish in net pens exhibit higher mortalities when total dissolved gas (TDG) levels elevate to levels above

110 percent (USACOE draft in press). It is also worth noting that these increased TDG levels usually correspond with increasing water temperatures (15-24$^0$ C) making gas less soluble (USACOE draft in press).

Table 6. Prevalence of gas bubble disease (GBD) in five common fish species collected by electrofishing and beach seining in Rufus Woods Lake between April-July, 1999. Sucker spp. includes bridgelip, largescale, longnose, and unidentified suckers

| Species | Number examined | Number with GBD |
|---|---|---|
| Rainbow trout | 1028 | 0 |
| Walleye | 456 | 0 |
| Northern pikeminnow | 390 | 0 |
| Redside shiner | 688 | 0 |
| Sucker spp. | 2755 | 1 |

#### Nespelem River Watershed

Limiting factors to fish populations are hypotheses in this subbasin, and have little or no experimental data to support them. However, it is widely accepted that degraded fluvial habitat conditions, similar to those existing in the San Poil watershed, limit native salmonid populations.

One of the most important fish populations in the subbasin, from a native fish recovery standpoint, is the adfluvial kokanee population that spawns in the lower Nespelem River. The habitat conditions existing in the 1.5-mile section of the Nespelem River below the barrier falls appear to be limiting the kokanee spawning production (Kirk Truscott, Fish Biologist, Confederated Tribes of the Colville Reservation Fish and Wildlife Department, personal communication). Silt deposition creates embedded substrates, unusually high spring flows create large bed load movements that destroy redds, water temperatures often exceed standards established by the Colville Environmental Trust, and elevated non-point source ammonia levels have resulted in lethal parasitic infection by Columnaris (*Columnaris flexibacter*) (LeCaire 1999; Hunner and Jones 1996). High water temperatures documented during mid to late summer may also effect juvenile survival (Figure 2). The bulk of the spawning activity takes place in one general area and the balance occurs in pockets behind boulders (Kirk Truscott, Fish Biologist, Confederated Tribes of the Colville Reservation Fish and Wildlife Department, personal communication).

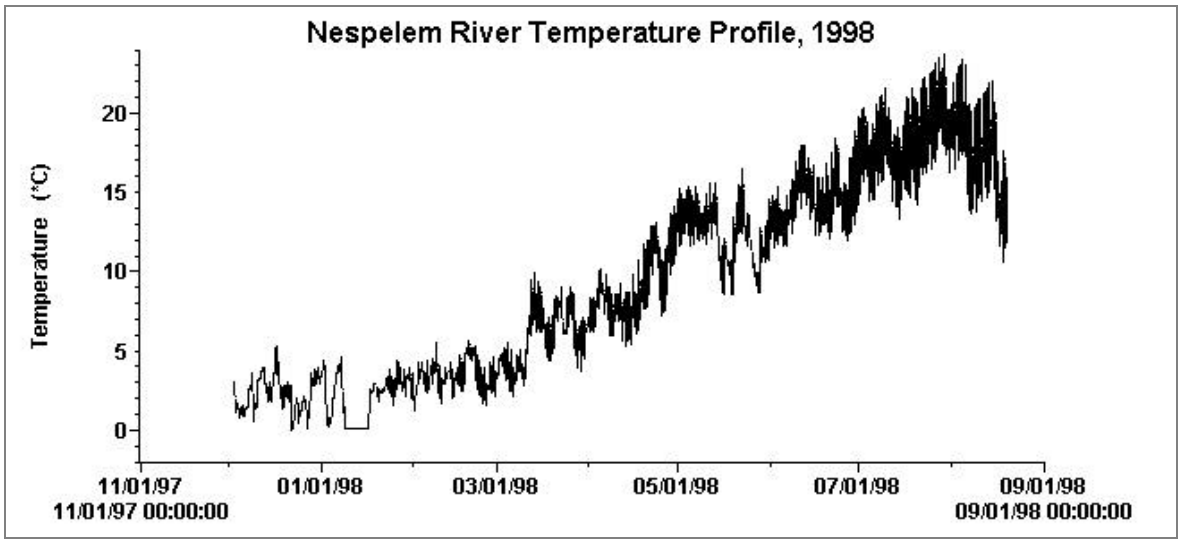


Figure 2. Nespelem River Water Temperature Profile

The unknown behavior of the juvenile age classes of native kokanee may be a limiting factor to the total population. If a large percentage of juvenile kokanee entrain through Chief Joseph Dam, then they will not be able to contribute to the next generation in the Nespelem River. Further, the lack of knowledge regarding the genetic composition and juvenile behavior may be allowing for managers and dam operators to implement measures that are actually creating negative impacts to the population. Finally, predation from species such as northern pikeminnow and walleye may also be impacting the wild kokanee population.

Intermittent stream flow in streams that were historically perennial is a limiting factor that will take watershed level restoration to reverse.

#### Lakes

Many lakes exist throughout this subbasin, although most will not support fish populations due to saline or highly alkaline water conditions (Hunner and Jones 1996). The lakes in the subbasin that will support fish populations are managed to enhance subsistence and recreational fisheries. Lake management strategies are based on harvest objectives established using the best available information/knowledge. The quantitative nature of these trophic structures is largely unknown which limits the manager's ability to maximize recreational and subsistence harvest opportunities. Improved knowledge of trophic dynamics in each lake will allow fish managers to improve management implementations (e.g., stocking) that will result in more efficient use of resources and possibly enhanced fisheries.

Buffalo Lake on the Colville Indian Reservation is a cause of concern for tribal fish managers. Rainbow trout and brook trout stocked into the lake are not recruiting to the fishery as expected evidenced by poor CPUE data gathered in gill net surveys. The cause of this situation has been examined and determined to be unrelated to angling pressure, sampling bias, and health of hatchery stocked fish (Truscott 1997). Causes of the depleted fishery may be related to illegal introduction of largemouth bass in the early 1990's and a complete collapse of the macrophyte community within the lake due to unknown causes

(Truscott 1997). These factors may be causing synergistic negative impacts by decreasing littoral zone productivity and increasing predation. The Colville Tribal Fish and Wildlife Division are currently implementing intensive investigations of trophic level interactions.

### Wildlife

Current land uses facilitate habitat fragmentation and maintain very little contiguity. In the natural environment, the terrestrial system consisted of contiguous core areas and many different interconnected critical habitat types. It is well documented that management of terrestrial resources directly affects aquatic conditions.

The two natural processes that were historically responsible for shaping the terrestrial habitats (predictable floods and fire) have been managed and largely eliminated. Channelization, diking, and hydroelectric development have controlled floodplain interactions that linked the terrestrial environment and aquatic environment. The results of these alterations to the terrestrial environment negatively effected, and in some cases eliminated, the critical habitats in low elevation areas such as riparian areas, wetlands, big game winter range, and habitat necessary to maintain subsistence plants.

Expansion of the timber industry and human settlement promoted fire suppression. Fire suppression, combined with timber management promotes habitat fragmentation and eliminates the natural successional landscape. Fire control throughout the Blocked Area is promoting homogeneous successional stages throughout the landscape; thus promoting increased species diversity, largely composed of undesirable species and limiting ecosystem function.

Cattle grazing has had drastic impacts to ecosystem function throughout the Blocked Area. Destroying riparian vegetation, increasing stream width to depth ratios and increasing fine sediment in streams, trampling sensitive shrub-steppe vegetation, and compacting soils are all degradations caused by cattle grazing.

The introduction of non-native plant species and proliferation of noxious weeds have also negatively impacted the ecosystem and Blocked Area Wildlife. Reed canary grass and cheat grass displaced native vegetation in wetland and shrub-steppe habitats respectively. Populations of noxious weeds have exploded due to the increased frequency and magnitude of disturbances such as road building and timber harvest.

Aerial surveys and harvest trends have shown a steep decline in mule deer numbers over the last 10 years on the Colville Reservation side of the Lake Rufus Woods 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.

Limiting factors for Sage and Sharp-tailed grouse include shrub-steppe conversion to cropland, livestock grazing which affects seasonally needed species and cover of vegetation, and range management practices, such as herbicide spray on sagebrush or other woody plants that provide cover and /or forage. Invading noxious weeds, such as knapp weed, are also a threat to sage and sharp-tailed grouse habitats, affecting cover and forage values.

Both eagle species are affected by human disturbance, during nesting and fledging. Bald eagle nest sites are also affected by forest practices that remove large limbed trees suitable for nesting and implementation of timber harvest schedules that do not favor maintaining large trees suitable for nesting.

### Artificial Production

The Colville Tribal Hatchery provides an annual average of 215,344 catchable and subcatchable rainbow and brook trout to five water bodies throughout the subbasin (Truscott 1997). Success of the artificial production program is monitored by creel surveys on Owhi Lake and a gill net survey in Buffalo Lake. The hatchery program began in Owhi Lake in 1991 and through 1997 provided an average CPUE of 0.87 brook trout/hour. The average length and weight of fish harvested in Owhi Lake is 363 mm and 603 grams (Truscott 1997).

Results of the Buffalo Lake gill net survey have created concern for tribal fish managers. Rainbow trout and brook trout are stocked into the lake annually, however very few are observed in the annual gill net surveys. Catch per unit effort for rainbow trout averaged 0.04 fish per hour between 1994 and 1997 while brook trout averaged 0.06 fish per hour (Truscott 1997). Causes of these low numbers are hypothesized to be related to trophic disturbances and ecological degradations and are currently being investigated.

A completed Hatchery and Genetics Management Plan (HGMP) will be submitted with Fiscal Year 2001 Project Proposals on August 16, 2000 for the WDFW Colville Hatchery and for the Colville Tribal Hatchery.

### Existing and Past Efforts

#### Fish

Past efforts in the Rufus Woods/Nespelem subbasin have been very limited. Most recently, the Biological Resources Division of the U.S. Geological Survey completed an assessment of the prevalence and severity of gas bubble disease in Lake Rufus Woods. Results of this study yielded relative abundance of the species present in the near shore area in the lake susceptible to electrofishing and beach seining.

The Chief Joseph Kokanee Enhancement Project has collected baseline data on an adfluvial kokanee population that spawns in the Nespelem River. Recent, limited genetic studies suggest that this population may be genetically unique from other area kokanee stocks in the Upper Columbia Subregion. Run size has been highly variable between 1995 and 1999. Knowledge of juvenile behavior is nearly all hypotheses based on fish managers' experience with other kokanee populations. Attempts to conduct redd capping surveys at known kokanee spawning sites failed due to high flows and excessive bed load movement.

Certainly this kokanee population is potentially very significant to native fish restoration efforts and continued study to determine juvenile behavior, genetic composition, and limiting factors analysis is warranted.

In-stream habitat inventories conducted by the Colville Confederated Tribe Fish and Wildlife Division and the Washington Department of Fish and Wildlife have identified existing habitat parameters that are likely limiting salmonid production in the Nespelem River tributaries. These parameters include high temperatures, lack of clean adequate spawning gravels, rearing habitat availability, lack of riparian vegetation and woody debris. Implementation of habitat improvements has not been implemented to date and should be completed to address degraded habitat conditions throughout respective watersheds.

## Wildlife

### Land Acquisition/Enhancement Projects

The tribes and agencies in the subbasin that are responsible for managing wildlife have initiated several projects under the councils wildlife program. These projects represent a start in mitigating for the losses that occurred.

Since 1993, the Colville Tribes have acquired about 21,00000 acres of land under the Hellsgate Big Game Winter Range Project (#9204800). A portion of these acquisitions has occurred within the Lake Rufus Woods Subbasin. Baseline habitat assessments have been completed on all but about 1,800 acres. The results of these assessments as described by vegetative cover types are as follows:

- Shrub-steppe, totals of 6,264 acres are protected and will be enhanced to shrub-steppe obligate species with sharp-tailed grouse and mule deer the main management species for this cover type.
- Grasslands, a total of 3,108 acres are protected and will be enhanced for wildlife species, such as sharp-tailed grouse, using this cover type.
- Conifer forest, a total of 2,565 acres are protected and will be enhanced for wildlife species, such as downy woodpecker and blue grouse using this cover type.
- Agricultural lands, a total of 2,360 acres will be converted back to native habitat types based on soil types. These areas will then be managed for the benefit of wildlife. This includes land enrolled into CRP.
- Conifer woodland/Ponderosa pine savanna, a total of 1,365 acres are protected and will be enhanced for mule deer, Lewis woodpecker, and other wildlife species using this cover type.
- Riparian, a total of 336 acres will be protected and enhanced for obligate species such as mink and beaver using this cover type.
- Rock/shrub-steppe, a total of 220 acres will be protected and enhanced for species such as bobcat using this cover type.
- Mixed forest, a total of 208 acres will be protected and enhanced for wildlife species using this cover type.
- Deciduous woodland, a total of 75 acres will be protected and enhanced for species using this cover type especially neo-tropical migrant birds.
- Shoreline areas, a total of 60 acres will be protected and enhanced for waterfowl species and wading birds using this cover type.

Management actions to protect and enhance these cover types include:

- Maintaining boundary fences to prevent livestock trespass.
- Removing trespass livestock.
- Control and/or eliminate noxious weeds.
- Maintain and enhance the desired vegetation for each cover type.
- Enhance plant community composition by planting and/or seeding.

The 8,240-acre Douglas County Pygmy Rabbit Project (now the Sagebrush Flat Wildlife Area) was approved as a mitigation project by BPA in 1990. Although it is not known whether pygmy rabbits were actually lost due to inundation, they ranked high on the Northwest Power Planning Council's priority list because they depend on shrub-steppe habitat. Enhancement activities to meet mitigation objectives for the Sagebrush Flat Wildlife Area were made based on the Washington State Recovery Plan for the Pygmy Rabbit (WDFW, 1995b). Wildlife enhancement activities have been under way since 1995 and are anticipated to be completed in 2002.

Furthermore, the Sagebrush Flat Wildlife Area has four management units. The primary management objective for the Sagebrush Flat and Dormaier Units is to protect and enhance existing pygmy rabbit habitat and convert agricultural fields to shrub-steppe vegetation. WDFW's primary wildlife management goal for this Unit is to increase the existing pygmy rabbit population and reintroduce pygmy rabbits, through artificial or natural means into unoccupied habitats.

## Subbasin Management

### Goals, Objectives and Strategies

Maintain viable populations (numbers and distribution of reproductive individuals) of native and desired non-native species of fish and wildlife, and their supporting habitats, while providing sufficient numbers to meet the cultural, subsistence and recreational needs.

Objectives and strategies below were developed by adaptation or modification of statements in the State of Washington Draft Wild Salmonid Policy Environmental Impact Statement (1997), Interior Columbia Basin Ecosystem Management Plan by the US Forest Service, the Colville Confederated Tribes (CTCR) Fish and Wildlife Department (Tribes' Integrated Resource Management Plan) and the ongoing subbasin planning process for the Northwest Power Planning Council (NWPPC).

Federal, state, county and tribal governments have management authority within this subbasin. The largest landowner in the subbasin is the Confederated Tribes of the Colville Reservation. The following is a list of entities having regulatory/management authority in the subbasin and a short description of their responsibility areas.

#### Federal Government

##### Bonneville Power Administration

Water flow regulation, power production, flood control and as the funding source for mitigation projects.

#### Natural Resource Conservation Service

The NRCS provides 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.

#### U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife service (USFWS) administers the endangered species act as it pertains to resident fish and wildlife species.

#### U.S. Army Corp of Engineers

The Army Corp of Engineers is the regulatory entity that controls water levels within Lake Rufus Woods. They also regulate water flows (flood control) and irrigation easements.

### State Government

#### Washington Department of Natural Resources

The Department of Natural Resources (DNR), through a Memorandum of Understanding, and the Forest Practice Act regulates forest practice applications through the Timber, Fish and Wildlife process on fee lands within the reservation, and areas outside of the reservation , and areas outside of the reservation boundaries.

#### Washington Department of Fish and Wildlife

The Department of Fish and Wildlife cooperatively with Tribal Fish and Wildlife manage fish and wildlife activities in Lake Rufus Woods. The WDFW also manages the Wild Salmonid Policy and the Hatchery Stocking Policy in those areas outside the reservation.

#### Washington Department of Ecology

The Department of Ecology provides professional guidance for water related concerns on fee lands within the reservation and administer The State Shoreline Management Act in those areas outside of the reservation boundaries.

### Tribal Government

#### Colville Confederated Tribes

The Natural Resources Department of the Colville Confederated Tribes has management and regulatory authority that include but are not limited to the following areas: Fish and Wildlife management, enforcement, land use activities, water rights and adjudication, development permitting, hydraulics permitting and shore line protection (e.g. CTCR Shoreline Management Act).

### Local Government

#### Douglas County

Douglas County on the east side of the reservoir regulates and enforces the Growth Management Act and is responsible for planning, land use and building permits.

#### Okanogan County

The Colville Confederated Tribes has management and regulatory authority of lands within the boundaries of the Colville Indian Reservation in Okanogan County.

### Fish Goal

The following objectives are not prioritized.

### Fish Objective 1

Annually support a subsistence and recreational coastal rainbow trout fishery where appropriate and consistent with native species conservation which provides a catch per unit of effort (CPUE) of one .5-1.0 fish/hr. and a fish K value (condition factor) greater than 125x10 - 7 with an average fork length 340 mm.

### Fish Strategies

1.1. Manage Buffalo Lake as a coastal rainbow trout fishery.

- Action 1.1.1 Annually stock 10,000 legal size (90-150 grams/fish coastal rainbow trout stock), 40,000 sub-catchable size coastal rainbow trout (15 grams/fish) and 20,000 fingerling size coastal rainbow trout (50 grams/fish). Optimize return to the creel of hatchery origin fish and adaptively manage the stocking and harvest level to meet objectives.
- Action 1.1.2 Maintain Buffalo Lake in a meso-oligotrophic productivity condition.
- Action 1.1.3 Maintain a functioning limnetic environment in Buffalo Lake that provides a productive/diverse zooplankton population consisting of moderate to large daphnia species.
- Action 1.1.4 Maintain a functioning littoral zone within Buffalo Lake.
- Action 1.1.5 Improve foraging capabilities of coastal rainbow trout in Buffalo Lake by reducing the kokanee salmon population.
- Action 1.1.6 Increase survival of coastal rainbow trout in Buffalo Lake by reducing predation by the largemouth bass population.

1.2 Manage the Nespelem River above the falls as a coastal rainbow trout fishery until habitat conditions improve to support valid Native salmonid populations at harvestable levels.

- Action 1.2.1 Annually stock 1,500 –2,000 legal size coastal rainbow trout (150 grams/fish) above the Nespelem River falls**.** Optimize return to the creel of hatchery origin fish in reservoir and associated tributaries.

Action 1.2.2 Maintain coastal rainbow trout biomass in the Nespelem River at a level consistent with stream productivity.

1.3 Manage coastal rainbow fishery in Lake Rufus Woods as a mixed-stock of coastal rainbow emigrating from Lake Roosevelt and triploid steelhead stocked directly into the reservoir.

1.4. Maintain water quality and habitat quality within species thresholds.

### Fish Objective 2

Maintain genetic composition of the existing kokanee population and determine its fishery potential in Lake Rufus Woods by 2005.

### Fish Strategies

2.1 Quantify available spawning habitat in the Nespelem River, Peter Dan, Coyote Creek and Lake Rufus Woods Reservoir.

2.2 Maintain kokanee population as a naturally producing, self- sustaining population.

Action 2.2.1 Maintain annual adult spawning escapement to the Nespelem River at 100-300 individuals.
Action 2.2.2 Maintain conservation fishery regulations.
Action 2.2.3 Minimize immigration of other kokanee stocks to Lake Rufus Woods Reservoir.

2.3. Maintain/improve water quality and habitat in Lake Rufus Woods and associated tributaries within species thresholds.

2.4. Determine genetic composition of existing kokanee populations in Lake Rufus Woods.

### Fish Objective 3

Annually support a subsistence and recreational brook trout fishery where appropriate and consistent with native species conservation which provides a catch per unit of effort (CPUE) of one .5-1.0 fish/hr. and a fish K value (condition factor) greater than 125X10 –7 with an average fork length 305 mm.

### Fish Strategies

3.1 Utilize hatchery and natural production components to provide basis for harvest.

Action 3.1.1 Annually stock 40,000 sub-catchable size brook trout (15 grams/fish) into Owhi Lake.
Action 3.1.2 Annual stock 30,000 sub-catchable size brook trout (15 grams/fish) into McGinnis Lake.

3.2 Manage Owhi and McGinnis Lakes as brook trout only lakes and in an meso-eutrophic productivity status.

3.3 Minimize emigration of brook trout from Owhi Lake

Action 3.3.1 Provide fish screen at outlet to Owhi Lake

3.4 Maintain free-ranging brood stock in Owhi Lake at a level to supply a minimum of 800,000 eggs annually.
3.5 Maintain functioning limnetic and littoral environments in Buffalo Lake and Owhi Lake.
3.6 Maintain conservation fishery regulations.
3.7 Maintain water quality within species thresholds.

### Fish Objective 4

Manage introduced cool/warm water species as a recreational fishery consistent with native species conservation by 2010.

### Fish Strategies

4.1 Manage as naturally reproducing self-sustaining populations.
4.2 Maintain current fishery regulations (i.e. those identified by the State of Washington and the Colville Tribe).
4.3 Maintain water quality within species thresholds.

### Fish Objective 5

Provide an anadromous fishery in the blocked area between Chief Joseph Dam and Grand Coulee Dam to meet consumptive and non-consumptive consistent with habitat conditions by 2010.

### Fish Strategies

5.1 Pursue adult and juvenile passage feasibility studies to facilitate reintroduction of salmon, steelhead, sturgeon and lamprey into Lake Rufus Woods.
5.2 Implement passage measures identified in feasibility studies.
5.3 Maintain or increase the quality and quantity of habitat necessary to sustain and restore anadromous fish populations to fishable levels.

### Fish Objective 6

Maintain functioning watersheds through out the subbasin by 2010.

### Fish Strategies

6.1 Perform watershed inventories/assessments to determine ecological function status and limiting factors.

6.2 Pursue actions to effectively address priorities established during watershed inventories/assessments. Where appropriate, utilize natural process attributes prior to technological “fixes”.

### Fish Objective 7

Establish indigenous resident salmonid populations at harvestable levels where feasible by 2005.

### Fish Strategies

7.1 Determine native species population status and feasibility to meet consumptive harvest needs as a self-sustaining population and or applicability for artificial production to augment the fishery.
7.2 Maintain/improve water quality and habitat quality/quantity parameters, consistent with native species requirements.
7.3 Minimize incidental harvest of indigenous stocks during recovery period.
7.4 Curtail non-native species/stock management emphasis as habitats are improved and provide appropriate conditions for production of native populations.

### Wildlife Goals

1. Fully mitigate for the losses that were incurred from the construction and operation of the hydropower system (Wildlife Program Rule, NWPPC 1995).
2. Maintain viable mule deer populations in the Rufus Woods/Nespelem Subbasin and throughout Northeast Washington.
3. Maintain viable sharp-tailed grouse populations.

### Wildlife Objective 1

Acquire management rights to enough property to mitigate for lost wildlife habitat by 2015.

- Shrub-steppe, totals of 2,507 acres are protected and will be enhanced to shrub-steppe obligate species with sharp-tailed grouse and mule deer the main management species for this cover type.
- Conifer forest, a total of 1,193 acres are protected and will be enhanced for wildlife species using this cover type such as downy woodpecker and blue grouse.
- Agricultural lands, a total of 465 acres will be converted back to native habitat types based on soil types. These areas will then be managed for the benefit of wildlife. This includes land enrolled into CRP.
- Conifer woodland/Ponderosa pine savanna, a total of 180 acres are protected and will be enhanced for mule deer, Lewis woodpecker, and other wildlife species using this cover type.
- Riparian (riverine and shrub wetland), a total of 139 acres will be protected and enhanced for obligate species such as mink and beaver using this cover type.
- Mixed forest, a total of 50 acres will be protected and enhanced for wildlife species using this cover type.
- Shoreline areas, a total of 4 acres will be protected and enhanced for waterfowl species and wading birds using this cover type.

### Wildlife Objective 1.2

Protect, enhance, and manage mitigation properties to attain their highest habitat potential. A total of 9,432 acres (4 parcels) of mitigation lands are in the Lake Rufus Woods. Part of one of the parcels actually lies within the Lake Roosevelt Subbasin by 2010.

### Wildlife Strategies

1.2.1 Protect, enhance or replace 2,290 habitat units of sharp-tailed grouse habitat to address shrub-steppe, rock land, and riparian losses resulting from Chief Joseph Dam. Species anticipated to benefit include sharp-tailed grouse, sage grouse, sage sparrow, downy woodpecker, northern oriole, pygmy rabbit, burrowing owl, white-tailed jackrabbit, yellow warbler, short-eared owl golden eagle and mule deer.

1.2.2 Protect, enhance, or replace 1779 habitat units of sage grouse habitat to address rock land and shrub-steppe losses resulting from Chief Joseph Dam. Species anticipated to benefit include sage grouse, sharp-tailed grouse, pygmy rabbit, sage sparrow, sage thrasher, loggerhead shrike, sage vole, sagebrush lizards, white-tailed jackrabbit, ferruginous hawk, Merriam's shrew, burrowing owl, short eared owl, mule deer, yellow warbler, downy woodpecker, northern oriole and golden eagle.

1.2.3 Protect, enhance, or replace 58 habitat units of yellow warbler habitat to address palustrine habitat losses resulting from Chief Joseph Dam. Species anticipated to benefit include yellow warbler, eastern and western kingbird, black-capped chickadees, pallid bat, western pipistrelle, long-legged bat, wood duck, great blue heron, Sylvan hairstreak butterfly, viceroy butterfly and yellow headed blackbird.

1.2.4 Protect, enhance, or replace 213 habitat units of Canada goose habitat to address island/sandbar losses resulting from Chief Joseph Dam. Species anticipated to benefit include Canada goose, shorebirds, gulls, terns, wading birds and waterfowl.

1.2.5 Protect, enhance or replace 239 habitat units of ring-necked pheasant wintering habitat to address agricultural losses resulting from Chief Joseph Dam. Species anticipated to benefit include ring-necked pheasant, California quail, Swainson's hawk, mourning dove, cottontails, western kingbird, meadowlark, northern harrier, gyrfalcon and red-tailed hawk.

1.2.6 Protect, enhance, or replace 286 habitat units of Lewis' woodpecker habitat to address ponderosa pine savanna and mixed forest losses resulting from Chief Joseph Dam. Species anticipated to benefit include Lewis' woodpecker, osprey, bald eagles, ruffed grouse, sharp-shinned hawk, Coopers hawk, sapsuckers, western bluebird, tree squirrels, pileated woodpecker, goshawk, bats and cavity nesters.

1.2.7 Protect, enhance, or replace 920 habitat units of mink habitat to address riverine/riparian losses resulting from Chief Joseph Dam. Species anticipated to benefit include mink, river otter, beaver, muskrat and riparian wildlife.

1.2.8 Protect, enhance, or replace 1992 habitat units of mule deer winter range to address mixed forest, ponderosa pine savanna, shrub-steppe and rock-land losses resulting from Chief Joseph Dam. Species anticipated to benefit include mule deer, sharp-tailed grouse, sage grouse, pygmy rabbit, loggerhead shrike, cavity nesters, passerine birds, yellow warbler, downy woodpecker, northern oriole, burrowing owl, short-eared owl, golden eagle, badger, bobcat and coyote.

1.2.9 Protect, enhance, or replace 401 habitat units of bobcat habitat to address rock and rock- land losses resulting from Chief Joseph Dam. Species anticipated to benefit include bobcat, golden eagle, yellow-bellied marmot, cottontail, bushy-tailed wood rat, great horned owl, porcupines, pocket mice and voles.

1.2.10 Protect, enhance, or replace 401 habitat units of bobcat habitat to address rock and rock- land losses resulting from Chief Joseph Dam. Species anticipated to benefit include bobcat, golden eagle, yellow-bellied marmot, cottontail, bushy-tailed wood rat, great horned owl, porcupines, pocket mice and voles.

1.2.11 Protect, enhance, or replace 1254 habitat units of spotted sandpiper habitat to address the sand/gravel/cobble losses resulting from Chief Joseph Dam. Species anticipate to benefit include spotted sandpiper, great blue heron, sand-hill crane, avocet, phalarope, Canada goose, morning doves, gulls, terns, shorebirds, waterfowl and wading birds.

Actions for Strategies 1.2.1-1.2.11

1. Maintain boundary fences to prevent livestock trespass.
2. Remove trespassing livestock.
3. Control and/or eliminate noxious weeds.
4. Maintain and enhance the desired vegetation for each cover type
5. Enhance plant community composition by planting and/or seeding.
6. Improve vegetation condition through prescribed burns.

### Wildlife Objective 1.3

Manage mitigation properties for wildlife benefits in perpetuity.

### Wildlife Strategies

1.3.1 Annually maintain and/or enhance the integrity of bald eagle nesting territories and winter roost sites.

Action 1.3.1.1 No land management activity should be preformed within 0.25 mile of an active bald eagle nest from February 1 through August 31. No activity within 0.25 mile of active bald eagle winter roost sites.

1.3.2 Annually protect peregrine falcon nest sites from disturbance.

Action 1.3.2.1 No activity within 0.25 mile of an active peregrine falcon nest during the breeding season.

### Wildlife Objective 2

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

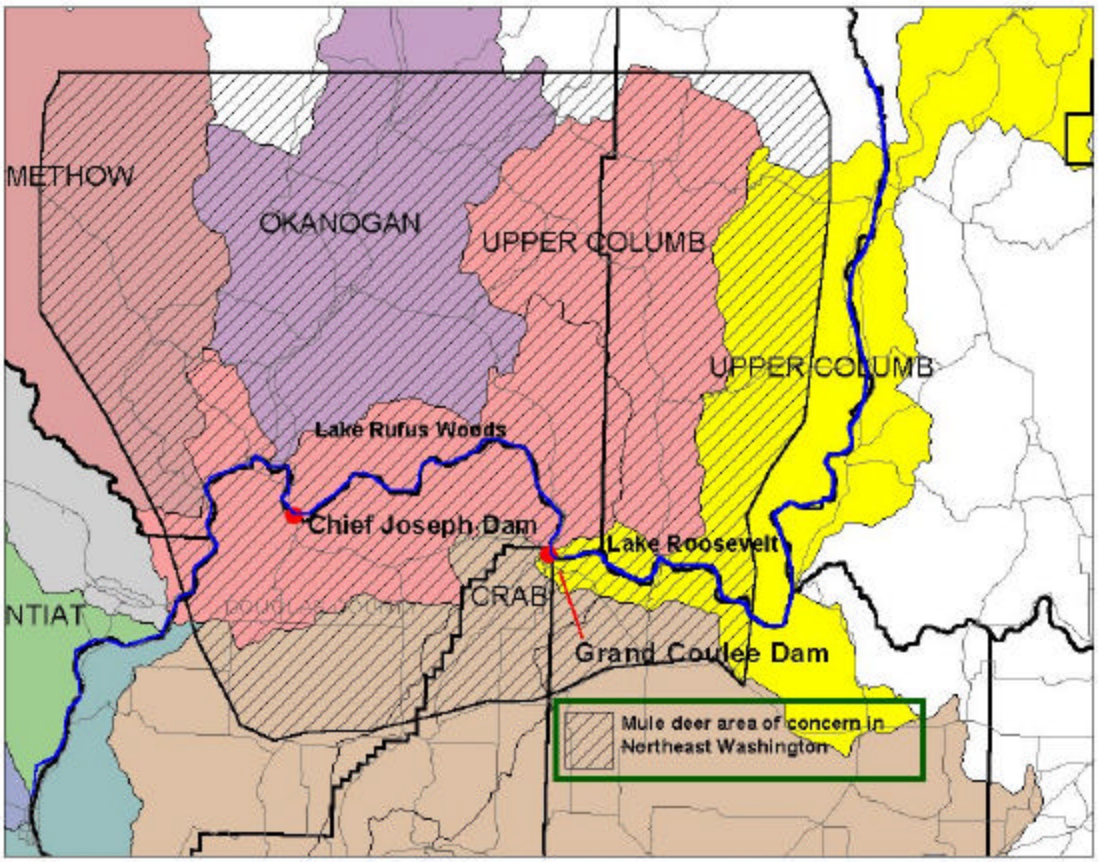


Figure 3. Mule deer area of concern in Northeast Washington.

### Wildlife Strategies

3.1 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 University, University of Washington, and the University of Idaho.

3.2 Monitor doe/fawn ratios and hunter harvest annually.

3.3 Conduct mule deer winter counts annually.

3.4 Control non-native weedy vegetation on critical mule deer habitat and re-establish preferred mule deer forage plant species where practical.

3.5 Monitor livestock use and determine grazing impacts.

3.6 Develop restoration strategies for altered landscapes/habitat.

### Wildlife Objective 3

Increase sharp-tailed grouse populations to a minimum of 800 grouse by 2010.

### Wildlife Strategies

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

## Research, Monitoring and Evaluation Activities

Several activities are ongoing in the subbasin (both BPA and non-BPA funded) that currently provide some research, monitoring and evaluation needs in the Lake Rufus Woods Subbasin. At this time the activities are focused on small areas and many are in the initial stages of assessment and enhancements (Hellsgate Winter Range Project, Hellsgate Mitigation Project, USGS Stock assessment, CJKE). Most of what does occur is done as part of a larger project and not necessarily focused at the subbasin. Adequate RME activities are not in place, but are identified as a need under Fish and Wildlife Needs.

### BPA Funded Activities

#### 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 potentially provide a brood-stock source for artificial production in Lake Roosevelt. Critical ongoing activities include 1) Monitor emigrating kokanee stocks into Lake Rufus Woods from upriver areas. (2) Determine genetic blue print of all in basin (upriver) stock using micro-satellite DNA analysis to determine origin and degree of introgression into wild origin stocks. (3) Current focus is examining methods of reducing entrainment using strobe light technology and hydroacoustic monitoring of fish entrainment using split and multi-beam hydroacoustic technology at Grand Coulee Dam.

Data collected by the project supplements fishery data collected by other BPA funded projects.

#### Colville Tribal Fish Hatchery (#8503800)

Currently the hatchery provides monitoring and evaluation activities associated with hatchery stocking efforts, fish health, hatchery operations, broodstock maintenance/development, fishery contribution and relative species abundance**.**

#### Lake Roosevelt Monitoring Program (#944300)

The effort expended by this project in this subbasin is limited. Data and information collected is shared with all regional fishery managers and helps provide a complete picture of the biological functions and interactions in the province.

#### Hellsgate Big Game Winter Range Project (#9204800)

This project provides partial mitigation from losses due to Chief Joseph Dam through protection, restoration and enhancement of low elevation winter range habitat and reducing fragmentation (long term) for wildlife. This project continues to protect and enhance wildlife habitat through property acquisition, fencing, planting of desirable forage and shelter plant communities, elimination of noxious and exotic weeds. Continued property acquisition is a necessity to fully mitigate for the habitat losses. In addition this project collects important information on the following parameters.

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

This project is determining the status of varied fish stocks in the blocked areas. Data analysis should provide insight into mixed stock interactions, limiting factors caused by lost nutrient recycling and permanent blockages and impacts associated with altered species assemblages.

### Non-BPA Funded Activities

#### Confederated Tribes of the Colville Reservation

- Northeastern Washington Mule Deer Study (WDFW, CTCR and Chelan Co. PUD)
- Colville Tribe develops and administers harvest regulations annually for tribal and non-tribal members on the reservation and Tribal member regulations on the North Half.
- The State of Washington issues harvest regulations annually for the general public on the North Half.
- Colville Tribes Fish and Wildlife attempts annual aerial population surveys for mule deer, elk, and wild horse.
- Hellsgate Post Season Deer Count (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 on reservation)
- Predator control and beaver re-colonization (CTCR on reservation)
- Lake Roosevelt Bald Eagle Production Surveys (BOR/CTRC)
- Lake Roosevelt Bald Eagle Winter Population Surveys (NPS).
- Peregrine Falcon Introduction Survey (NPS)
- Ecological Interaction Study is funded by the tribe on Rufus Woods Reservoir.
- Ecological Interaction Research Study (Tropic Cascade) and limnological studies are conducted on several subbasin lakes.
- Creel census' is conducted on many subbasin lakes and streams.
- Both the Colville Tribes Parks and Recreation Department and the WDFW enforce fish and Wildlife regulations.

- Tribal Environmental Trust department monitor's water quality and flow regimes in subbasin lakes and streams

#### Washington Department of Natural Resources

Monitors land use and forest practice activities on feel lands within the subbasin.

#### U.S. Bureau of Reclamation

Monitors water flow regimes, water quality (dissolved gas and lake levels).

#### U.S. Geological Survey

United States Geological Survey Stock Status Above Chief Joseph and Grand Coulee Dams, #9700400). This project is developing better communication and data use throughout the province while conducting inventories on all pertinent fish species.

#### Douglas County

Various building and shoreline codes are monitored and permitted by this county government.

### Statement of Fish and Wildlife Needs

Limiting factors to fisheries production in the Lake Rufus Woods Subbasin are primarily related to blockages, operation of the hydro-system, habitat conditions (P/R, 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 water and land use/practices in one form or another.

The primary limiting factor from a wildlife standpoint is habitat loss, fragmentation and isolation from land use practices. Therefore, the needs are to address what has been altered. Additional limiting factors may include predation and hunter harvest.

#### Present BPA Projects in the Subbasin and the Limiting Factor(s)

#### Chief Joseph Kokanee Enhancement Project (CJKE, #9501100)

Stock assessment project that monitors the following limiting factors. a) Entrainment through Grand Coulee Dam is substantial and significant and is considered to be the greatest threat to the present fishery programs in Lake Roosevelt. The CJKE project is addressing this limiting factor by examining methods of reducing or eliminating entrainment. b) Genetic introgression between hatchery and wild origin stock is unknown and is a limiting factor. c) Adult spawner escapement (status) in tributaries to Lakes Roosevelt and Lake Rufus Woods is not known.

#### Lake Roosevelt Fisheries Monitoring Program (#944300)

Does a very limited amount of work in this subbasin. Artificial production enhancement activities such as Lake Roosevelt Rainbow Trout Net Pens, #9500900, the Spokane Tribal Hatchery and the Sherman Creek Hatchery probably contribute a great deal to the Lake

Rufus Woods fishery. These projects are primarily mitigation projects that address losses from hydro-operations to fisheries.

#### Hellsgate Big Game Winter Range Project (#9204800)

Addresses limiting factors related to habitat loss, fragmentation and effects caused by agriculture monoculture.

#### Colville Tribal Hatchery Project (#8503800)

Addresses the limiting factor of altered habitat and its affect upon fishing opportunities resulting from anadromous fish blockage, nutrient loss and habitat alteration.

#### Joint Stock Assessment Project (#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 the blocked 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.

### Fisheries, Wildlife, Watershed, Hydro Power, and Water Quality Needs for the Lake Rufus Woods Subbasin

Several of the following subbasin needs that have been identified and categorized may fit under more than a single category.

**Fisheries**

1. Conduct stock assessments and population inventories (both adult and juvenile) to estimate population strength and population dynamics for the species identified for management.
2. Conduct fish habitat (quality and availability-passage) and watershed inventory assessment in the subbasin.
3. Water withdrawals and permits issued needs to be addressed; fish loss to diversions and screening of them is unknown.
4. Annual monitoring of adult spawning populations of mixed stock fishery that will determine impacts on a mixed stock fishery.
5. Genetic evaluation of potentially distinct stocks of kokanee is just beginning in the CJKE Project. Very little is known about other stocks in the subbasin and potential negative/positive interactions between hatchery and indigenous species or management actions.
6. Investigate the habitat and use by natural production kokanee salmon through radio tag monitoring in the Rufus Woods/Nespelem River Subbasin.
7. Conduct assessment of exotic plant and animal species on indigenous fish and wildlife species.
8. Determine a methodology that will successfully determine the egg to fry survival of natural production kokanee in subbasin streams.
9. Reduce water temperatures in Lake Rufus Woods and in the Nespelem River.
10. Investigate the use of the Nespelem River kokanee stock(s) for hatchery use (may possibly be part of a stock assessment for the CTCR Hatchery Program).
11. Investigate the invertebrate species and populations in the Nespelem River and Rufus Woods Subbasin. River (macro invertebrates and mollusks etc.
12. Investigate the mountain whitefish population dynamics in the Rufus Woods/Nespelem River Subbasin.
13. Investigate the potential for spawning channel and/or fish production facilities near the Rufus Nespelem River Subbasin (RBT, KOK, anadromous spp. in the future?).
14. Investigate white sturgeon population dynamics in the Rufus Woods/Nespelem Subbasin.

15. Investigate spawning habitat suitability and availability in Rufus Woods Lake for potential re-introduction of anadromous species. (This may be currently being done).
16. Conduct baseline assessment of biological parameters (stream survey using modified ambient monitoring techniques).
17. Following assessment of baseline information; increase structure, pool riffle ratios, reduce suspended solids and siltation, stabilize flows and lower summer water temperatures
18. Re-establish macro-phyte plant community within littoral zone in Buffalo Lake and other lakes and reservoirs within the subbasin.
19. Install a fish screen at the outlet to Owhi Lake.
20. Conduct entrainment and species composition study at Chief Joseph Dam similar to the study done at Grand Coulee Dam to determine entrainment effects on specie assemblage in Lake Rufus Woods.
21. Conduct a fertilization project at the international boundary (United States and British Columbia) to replace a portion of the nutrients lost in the blocked areas as a result of the construction of Grand Coulee and Chief Joseph Dams.
22. Develop a non-lethal sampling methodology to determine relative abundance and population estimates using purse seine technology.

**Wildlife**

A great deal more remains to be done for wildlife mitigation than what has been accomplished to this point in time. Continue to monitor, protect and enhance all acquired lands to determine effectiveness of enhancement practices. Species response studies will occur as management activities are completed. Purchase additional property when available dependant upon financial constraints.

1. Wildlife habitat assessments on a Province basis need to be completed to address the current status and availability.
2. Wildlife species, including aquatic, populations need to be evaluated as to composition (occurrence), relative density, and habitat use (mapping).
3. Assess the feasibility of using a hydro-mulching system for restoring native shrub/grassland habitats over large areas.
4. Wildlife species, including aquatic, populations need to be evaluated as to composition (occurrence), relative density and habitat use (mapping).
5. Identify specific limiting factors such as habitat quality, reproductive performance, and mortality factors affecting mule deer populations within the Lake Rufus Woods Subbasin and adjacent Subbasins/Provinces. Develop new and innovative management strategies based on research results.
6. Identify specific limiting factors such as habitat quality, reproductive performance, and mortality factors affecting sharp-tailed grouse/sage grouse populations within the Lake Rufus Woods Subbasin and adjacent Subbasins/Provinces. Develop new and innovative management strategies based on research results.

**Water Quality**

1. Research and identify methods for solving the dissolved gas problem present below Grand Coulee Dam that effect fish populations in Rufus Woods reservoir.

2. Investigate/assess water quality/watershed assessment (define) of each sub-watershed in the subbasin.
3. Conduct a complete limnological survey of the reservoir with emphasis on water quality issues (dissolved gas, TMDL's) and macro-invertebrate populations including mollusks.

**Hydro-Power**

1. Minimize impacts by Grand Coulee and Chief Joseph Dams operations regarding lake elevations.
2. Continue to provide mitigation for losses due to Chief Joseph Dam through protection, restoration and enhancement of fish and wildlife habitat.
3. Investigate and address the TMDL and saturated gas problem at Grand Coulee Dam.
4. Investigate reasons why the reservoir does not meet the Clean Water Act and develop regulations to address the shortfall in areas including water temperatures.
5. Create/investigate the passage of anadromous fish into their historic ranges (Blocked area), probably multiple projects.

**Watershed**

1. Identify and assess stressed aquatic systems every five years. This includes determining impaired use(s), causes of impairment, and sources of pollution. Prioritize systems and pursue corrective action.
2. Fund regulation development and enforcement for those agencies that support/enforce the regulations. Presently, most environmental laws are not enforced due to lack of funding and community understanding.
3. Initiate watershed management activities to complement stream habitat improvement as they are completed.
4. Reduce water temperatures in Lake Rufus Woods and in the Nespelem River

## References


Alt, D.D. and D.W. Hyndman, 1984. Roadside Geology of Washington. Mountain Press Publishing Company, Missoula, Montana.

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.

Broch, Edmond. 1993. Sediment Phosphorus Release in Owhi, Little Goose and Buffalo Lake as Indicated Through Sediment Sampling and Analysis (Based Upon 1992 Sampling Period). Colville Confederated Tribes Surface Waters Monitoring Program. Colville Confederated Tribes Fish and wildlife Department, Nespelem WA.

Broch, Edmond. 1993. Limnology of Reservation Lakes, Spring 1992 Monitoring Data. Colville Confederated tribes Department of Physical Resources, Nespelem WA.

Broch, Edmond. 1993. Surface Waters Monitoring Program. 1993, Monitoring Data, Little Goose Lake. Colville confederated Tribes, Department of Physical Resources, Nespelem Wa.

Broch, Edmond, and Judith Loescher. 1995. Nutrient, Primary Productivity, and Alkanity Data of Colville Reservation Lakes From September 1986 to September 1994. Prepared for Colville Confederated Tribes, Surface Waters Monitoring Program, Department of Physical Resources, Nespelem WA.

Broch, Edmond. 1994. 1994 Monitoring Data for Buffalo, Little Goose, Owhi, South Twin, North Twin and Round Lakes. Confederated Tribes of the Colville Reservation, Surface Waters Monitoring Program, Nespelem WA.

Broch, Edmond. 1994. Nutrient, Primary Productivity, and Alkalinity Data of Colville Reservation Lakes From September 1986 to September 1993. Confederated Tribes of the Colville Reservation, Surface Waters Monitoring Program, Nespelem WA.

Broch, Edmond, Judith Loescher, and Jonna Ahl. 1984. The Distribution and Abundance of Aquatic Macrophytes in Colville Reservation Lakes. Colville Confedrated tribes Aquatic Macrophyte Study, Fishe and Wildlife Program, Nespelem WA.

Broch, Edmond, Judith Loescher. 1989. The Aquatic Vasculkar Plants of the Columbia River From Grand Coulee dam to the U.S.-Canadian Border, July 1988-October 1989. Department of Zoology, Washington State University, Pullman WA. 99164-4236.

Broch, Edmond, Judith Loescher. 1984. The Direction and Extent of the Eurasian Watermilfoil Invasion of Buffalo Lake, Okanogan County Washington. Colville Confederated Tribes, Buffalo Lake Aquatic Macrophyte Study. Colville Confederated Tribes. Nespelem WA.

Broch, Edmond, Judith Loescher, and Jonna Ahl. 1983. The Distribution and Abundance of Aquatic Macrophytes in Buffalo Lake, Okanogan County Washington. Colville Confederated Tribes, Fishnand Wildlife Program, Nespelem WA.

Dyrness, C.T. and J.F. Franklin, 1988. Natural Vegetation of Oregon and Washington. Oregon State University Press.

EPA. Environmental Protection Agency. Surf Your Watershed. May 2000. Available www.epa.gov/surf3/locate/

Erickson, A.W., Q.J. Stober, J.J. Brueggeman, and R.L. Knight. 1977. An Assessment of the Impact on the Wildlife and Fisheries Resource of Rufus Woods Reservoir Expected From the Raising of Chief Joseph Dam from 946 feet to 956 feet M.S.L. Prepared for Colville Tribal Council, Colville Indian Reservation, Nespelem, Washington, and the Seattle District of the U.S. Army Corps of Engineers, Seattle Washington.

Evans, Davis and Associates. 1994. Evaluation of Wildlife Mitigation Sites at the Chief Joseph Dam Project (1993/1994 SEASON). Prepared for the U.S. Army Corps of Engineers, Seattle District, Seattle Washington.

Fisher, Bob. 1987. Goose Nesting--- Lake Rufus Woods River Miles. Unpublished U.S. Army Corps of Engineers Report.

Fielder, P.C., C.E. McKay, Jr., and T.A. Clausing. 1979. Wildlife Observation Associated with the Chief Joseph Dam Project. Washington Department of Game Report.

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.

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.

Harkness, R.E., D.A. Meyers, and G.C. Bortleson. 1974. Water resources of Colville Indian Reservation of Washington. U.S. Department of Interior. Geological survey.

Hunner, W. and C. Jones. 1996. Present conditions of watersheds, including soils, vegetation, streams, lakes, riparian areas, and fisheries or the Colville Reservation. Confederated Tribes of the Colville Reservation Fish and Wildlife Division, Internal Report. Nespelem, WA.

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.

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.

LeCaire, R. and J. Peone. 1991. Lake Roosevelt rainbow trout habitat/passage improvement project: final report phase 1. Report to U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Contract No. DE-BI-79-90BP08120. Portland, OR.

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.

Scholz, A.T., K. O'Laughlin, D. Geist, D. Peone, J. Uehara, L. Fields, T. Kleist, I. Zozaya, T. Shapiro and Associates, 1987. Evaluation of Wildlife Mitigation Sites At The Chief Joseph Dam Project. Prepared for the U.S. Army Corps of Engineers. Seattle District Office, Seattle, Washington.

Truscott, K.T. 1998. Colville Tribal Fish Hatchery Production Report. Unpublished Report, Colville Confederated Tribes, Fish and Wildlife Division, Nespelem, Washington.

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

United States Department of the Interior, Region 1. 1953. Foster Creek Project, Washington Substantiating Materials. Regional Office, Boise Idaho.

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. 1995a. Washington State management plan for sage grouse. Game Div., Wash. Dept. Fish and Wildlife, Olympia. 101 pp.

Washington Department of Fish and Wildlife. 1995b. Washington State pygmy rabbit recovery plan. Game Div., Wash. Dept. Fish and Wildlife, Olympia. 56 pp.

Weather Underground. May 2000. Available www.wunderground.com

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.

Personal Communications

Atkins, Chad.Washington Department of Ecology.

Freeze, R. Washington Department of Fish and Wildlife, Wildlife Biologist.

Quinn, M. Washington Department of Fish and Wildlife, Wildlife Biologist.

Schroeder, M. A. Washington Department of Fish and Wildlife, Upland bird research biologist.

Truscott, K. Confederated Tribes of the Colville Reservation, Fish Biologist.

Venditti, D. U.S. Geological Survey, Research Fish Biologist.

Additional Relevant References

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.

Jones, C. 1999. Lake Roosevelt rainbow trout habitat/passage improvement project. 1999 annual report. Report to U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project number: 9001800.

Jones, Charles. 1998. Fisheries section in the Colville Confederated Tribes Integrated Resource Management Plan- Phase II. Colville Confederated Tribes.

Kuehn, Douglas and Matthew Berger. 1992. Wildlife Habitat Impact Assessment, Chief Joseph Dam Project, Washington. BPA Project 88-44. Washington Department of Wildlife, Colville Confederated Tribes.

Larkin, G.A., and P.A. Slancy. 1997. Implications of trends in Marine derived nutrient influx to South Coastal British Columbia Salmon Production. Fisheries. American Fisheries Society, 22: 16-24.

Quigley, Thomas M., et. al. Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin. USDA Forest Service. 1996.

Peone and K. Teesatuskie. 1985. Compilation of information on salmon and steelhead total run size, catch and hydropower related losses in the Upper Columbia River Basin, above Grand Coulee Dam. Upper Columbia United Tribes Fisheries Center Fisheries Technical Report No 2. Eastern Washington University, Cheney, Washington.

University of Washington. Columbia Basin Research. June 2000. Available www.cqs.washington.edu/index.html

U.S. Army Corps of Engineers. Chief Joseph Dam and Rufus Woods Lake. June 2000. Available www.nws.usace.army.mil/opdiv/cj/chiefjo.htm

U.S. Army Corps of Engineers. 2000. Draft Chief Joseph Dam gas abatement project Draft Environmental Assessment. U.S. Army Corps of Engineers, Seattle District. Seattle, WA.

Vigg, S. 1999. A Holistic Vision for Columbia Basin Fish & Wildlife Restoration – with equitable consideration to protection, enhancement and mitigation for anadromous & resident fish in the "Blocked Area" of the Upper Columbia River Basin.

## Subbasin Recommendations

### FY 2001 Projects Proposals Review

Although no projects were submitted specifically for the Rufus Woods Subbasin, several projects (e.g., 198503800, 19950110, 199700400, 199506700) possess tasks that take place within the subbasin.

### Projects and Budgets

#### Relationship to Existing Goals, Objectives and Strategies

#### Review Comments

#### Budget

| FY01 | FY02 | FY03 |
|---|---|---|
| | | |

### Research, Monitoring and Evaluation Activities

Several activities are ongoing in the subbasin (both BPA and non-BPA funded) that currently provide some research, monitoring and evaluation needs in the Lake Rufus

Woods Subbasin. At this time the activities are focused on small areas and many are in the initial stages of assessment of enhancements and other implementation activities.

Bonneville Power Administration (BPA) funded monitoring and evaluation activities in the subbasin include:

The Chief Joseph Kokanee Enhancement Project (project # 9501100) includes monitoring and evaluating the status (genetic determination and abundance) of a naturally reproducing kokanee population utilizing the Nespelem River and Rufus Woods Reservoir.

The Colville Tribal Hatchery Program (Project # 8503800) provides monitoring of the Owhi Lake fishery and stocking efforts in six bodies of water in the subbasin. This project proposes to increase the fishery monitoring effort in waters stocked in the subbasin (increased creel census survey) and monitor trophic level interactions as a result of stocking activities in Owhi Lake and Buffalo Lake.

The Hellsgate Winter Range Project (project # 199204800) conducts vegetative and population monitoring to assess current status (base-line data) and proposes to conduct periodic monitoring to assess response to activities associated with the project.

Non-BPA funded monitoring and evaluation activities in the subbasin include:

Periodic big game surveys.
Sharp-tail grouse lek surveys.
Bull trout presence/absence surveys.
Harvest monitoring (waterfowl, upland bird and big game).
Limited stream flow monitoring.

### Needed Future Actions

To achieve objectives to be funded by Bonneville Power Administration.

Limiting factors to fisheries production in the Lake Rufus Woods Subbasin are primarily related to blockages, operation of the hydrosystem, 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 water and land use/practices in one form or another.

The primary limiting factor from a wildlife standpoint is habitat loss, fragmentation, and isolation from land use practices. Therefore, the needs are to address what has been altered. Additional limiting factors may include predation and hunter harvest.

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

1) 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.

2) 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.

3) Fish passage. Feasibility studies to assess the re-introduction of anadromous fish to the area above Chief 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.

4) Improved water flow regimes. Activities that promote improved water flow regimes in Rufus Woods Reservoir (reduce daily variable flows and reservoir elevations), and a return to more naturalized hydrographs within the watersheds in the basin.

5) Improved fluvial habitat conditions. Activities that promote increased instream flow 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.

6) Improved lacustrine habitat conditions. Activities that promote improved fish and wildlife habitat within lacustrine habitats is important aspects in meeting fish and wildlife objectives in the basin. Actions that improve water quality, aquatic productivity, functioning littoral and pelagic zones, and wetland areas are just a few elements that are critical to improved lacustrine habitats.

7) 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 and land acquisition.

### Actions by Others

Additional efforts needed to achieve objectives to be funded by others.

1) 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.

2) The Army Corp of Engineers, Bonneville power Administration and Bureau of Reclamation will continue to work towards effective regulation of water flows and elevations within Rufus Woods Reservoir consistent with fish and wildlife needs, including State, Federal, and Tribal water quality standards while meeting hydropower, flood control, and irrigation needs.

3) 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.

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

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

6) The Natural Resources Department of the Colville Confederated Tribes 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).

7) Douglas County on the east side of the reservoir will continue to regulate and enforce the Growth Management Act to perpetuate responsible planning and land use.