Draft

Columbia Upper Middle Subbasin Summary

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Northwest Power Planning Council

Subbasin Team Leader
Chuck Peven
Chelan County Public Utility District

Contributors:
Kathleen Bartu, Foster Creek Conservation District
Ron Fox, Washington Department of Fish and Wildlife
Andrew Grassell, Chelan County Public Utility District
Waikele Hampton, Chelan County Public Utility District
Bob Heinith, Columbia River Inter-Tribal Fish Commission
Chuck Jones, Douglas County Transportation and Land Services
Rick Klinge, Douglas County Public Utility District
Joe Lukas, Grant County Public Utility District
John Monahan, Washington Department of Ecology
Lonnie Murphy, Chelan County Public Utility District
Nina Talayco, Golder & Associates, Inc.
Keith Wolfe, Golder & Associates, Inc.

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Introduction

The Columbia Upper Middle Subbasin summary was drafted to meet the interim need for a facilitated, subbasin project review by the Independent Scientific Review Panel (ISRP). Termed the "Rolling Provincial Review", this review and renewal process will establish budgets and approved activities for existing and new Bonneville Power Administration (BPA) funded projects. This summary is a step towards developing the formal and final Columbia Upper Middle Plan, which will be a comprehensive document meeting the objectives and standards set forth in the Northwest Power Planning Council's (NWPPC) revised Fish and Wildlife Program and against which future proposed projects will be assessed. These plans will also provide a means for implementation of projects that would address BPA's Endangered Species Act (ESA) responsibilities.

This Subbasin Summary addresses existing assessment and management information for the Columbia Upper Middle Subbasin within the Columbia Cascade Province. It is important to note that not all of the fish and wildlife issues that occur in this subbasin are covered in this summary due to time constraints.

Finally, development of actions and future planning actions will be coordinated with subbasin efforts across the Province from the , Chelan, Entiat, Methow and Wenatchee subbasins. Further, the Upper Columbia River Salmon Recovery Board will initiate efforts to incorporate these plans into all regional processes including those of the Governor's Salmon Recovery Strategy, and local, federal and tribal recovery planning efforts.

Subbasin Description

General Description

Subbasin Location

The Columbia River and its tributaries drain an area of 219,000 square miles in seven western states and 39,500 square miles in British Columbia. Most of the Columbia River Basin in the United States is located in Washington, Oregon, Idaho, and Montana (Figure 1). The Columbia River originates at Columbia Lake on the west slope of the Rocky Mountain Range in British Columbia and flows west and south, eventually draining into the Pacific Ocean between Washington and Oregon. Total river length is 1,214 miles (BPA et al. 1994).

Columbia Upper Middle lies within the Columbia Cascade Province of the Columbia Basin, encompasses an estimated 1.6 million acres, is bounded in the south at river mile 415.8 by Wanapum Dam near Vantage, WA, and in the north at river mile 545.1 near Bridgeport, WA and Chief Joseph Dam (Figure 2). Wanapum, Rock Island, Rocky Reach, and Wells dams and reservoirs are included within the subbasin as well as the Moses Coulee and Foster Creek watershed.

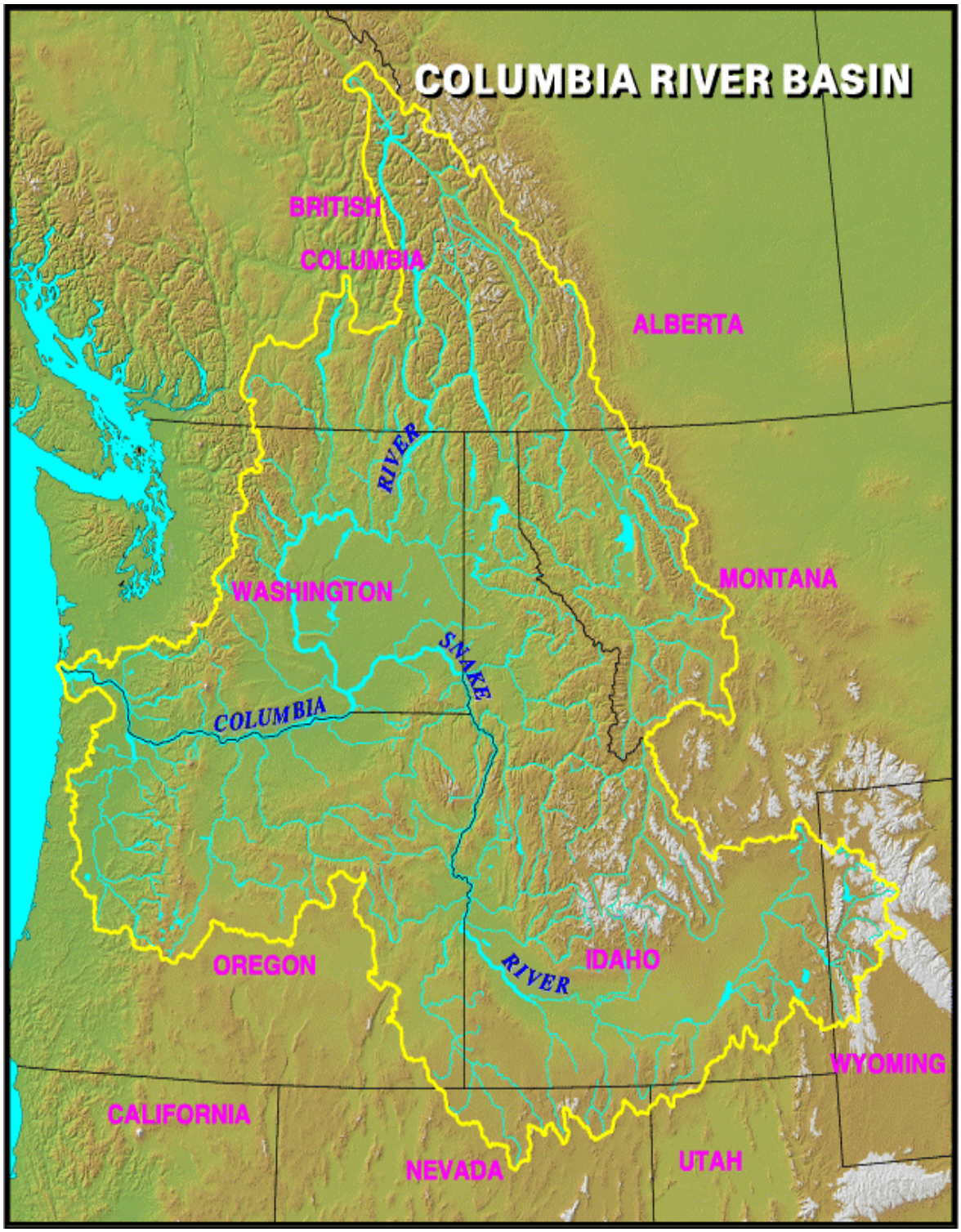

Figure 1. Location of the Columbia River Basin in the United States and British Columbia, Canada. Image courtesy of StreamNet.org and the Bonneville Power Administration.

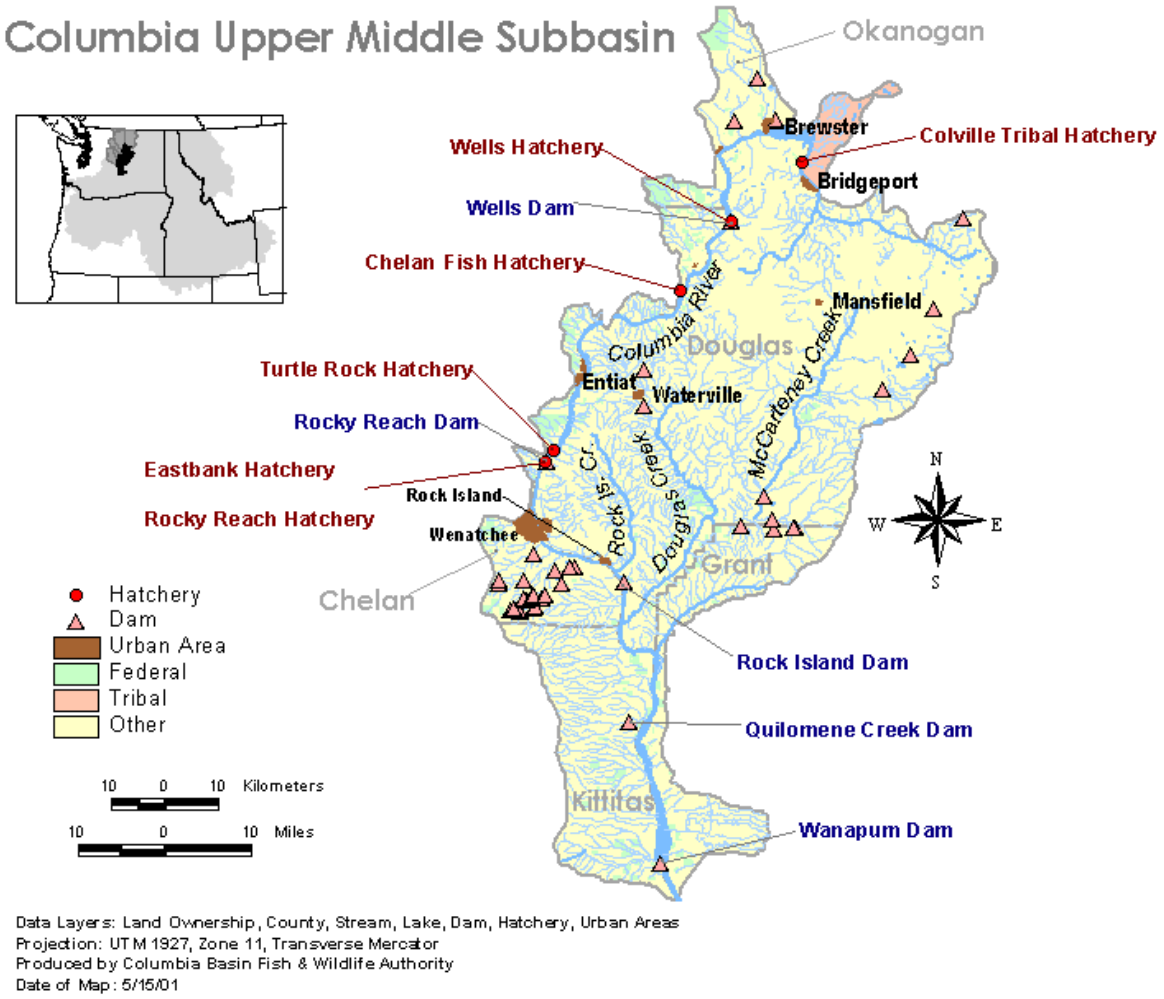

Figure 2. Overview of the Upper Middle Subbasin within the Columbia Cascades Province.

From Chief Joseph Dam, the mainstem Columbia River flows in a westerly direction past the small communities of Bridgeport and Brewster, WA. At the eastern edge of the Cascade Mountains, the river turns and flows south, passing by Pateros, Entiat, Wenatchee, East Wenatchee and Vantage, WA. Major tributaries to the mainstem Columbia River in the subbasin include the Methow, Chelan, Entiat, and Wenatchee rivers, however, they are not included in this Subbasin Summary. Wenatchee and East Wenatchee are the largest cities in the subbasin. An estimated 48,952 people live in the Wenatchee area along the mainstem river (U.S. Census, 2000). Population sizes for cities and counties associated with the Columbia Upper Middle are presented in Table 1 below. Most of the population in Kittitas and Grant counties lives just outside the Columbia Upper Middle, however, those populations can largely influence the Columbia Upper Middle through recreational activities or cumulative effects related to land use activities.

Table 1. Population estimates for cities or towns located within the Columbia Upper Middle. Data are from the 2000 U.S. Census unless otherwise noted by each city.

City/Community	Population	City/Community	Population
Wenatchee (city only)*	27,856	Waterville	1,163
West Wenatchee*	1,681	Orondo-1990*	383
East Wenatchee (city only)*	5,757	Bray's Landing-1990*	760
E. Wenatchee*	13,658	Bridgeport Bar area-1990*	1,100
Brewster*	2,189	Malaga*	2,608
Rock Island*	863		
Entiat-1990*	1,507		
Bridgeport*	2,059	Total Douglas County	32,603
Mansfield	319	Total Chelan County	66,616
Vantage*	70	Total Grant County	74,698
Pateros*	643	Total Kittitas County	33,362

* Indicates the city or town is located in adjacent to the mainstem Columbia River.

Drainage Area/Hydrology

Hydrology in the Columbia River Basin primarily reflects a snowmelt system despite numerous influences such as agriculture and irrigation, flood control measures, hydroelectric projects and transportation projects. Large amounts of snow generally accumulate in the mountain areas from late fall through winter, then melt and produce runoff during late spring and summer. The major runoff occurs with increased snowmelt in May and June, and streamflows normally peak in this subbasin in early June. During late summer and fall, instream flows in tributary streams often decline substantially and remain relatively low through April. Heavy rainfall in late fall or early winter can also lead to increased runoff and in the past, these rain-on-snow events in the eastern Cascades have caused some of the most significant flooding events in the subbasin.

Minor tributaries included within this Columbia Upper Middle summary include: Foster, Rock Island and Douglas creeks in Douglas County; Squilchuck, Stemilt and Colockum creeks in Chelan County; and Tekison, Brushy, Quilomene, Whiskey Dick and Johnson creeks in Kittitas County. Jameson and Grimes Lakes are also found within this subbasin. Grand Coulee Equalization Reservoir (Banks Lake) and the Sun lakes border the Columbia Upper Middle on the east but are not included within the boundary. The two largest watersheds located within the Columbia Upper Middle are the Foster Watershed Resource Inventory Area (WRIA) 50 and Moses Coulee WRIA 44.

Instream flows within the Columbia Upper Middle are considered run of river with little storage capacity present in the reservoirs above the four hydroelectric projects. Hydroelectric operations at Grand Coulee Dam greatly influence river flows for downstream hydroelectric operations. Within the Columbia Upper Middle, Wanapum, Rock Island, Rocky Reach and Wells dams impound the mainstem Columbia River. Rock Island was the first hydroelectric project to span the Columbia River and was completed in 1933. Wells Dam, which began operating in 1967, is the most recent hydroelectric project

completed on the Mainstem Columbia in the subbasin. Characteristics of the Columbia Upper Middle hydroelectric projects and associated reservoirs are listed below in Table 2.

Table 2. Hydroelectric projects within the Columbia Upper Middle and associated characteristics of each project.

Dam/Operator	Year Completed	River Km	Avg. Discharge (cfs)	Storage Capacity (1000s acre-ft)	Reservoir Length (km)
Wells/DCPUD	1967	830	109,400	281	46.7
Rocky Reach/CCPUD	1961	763	113,200	440	67.7
Rock Island/CCPUD	1933	730	116,300	132	31.6
Wanapum/ GCPUD	1964	669	119,000	566	61.1

[a]DCPUD= Public Utility District No. 1 of Douglas County; [b]CCPUD= Public Utility District No. 1 of Chelan County; [c]GCPUD= Public Utility District No. 2 of Grant County.

Average flow contributions from the three largest tributaries in the subbasin (Okanogan, Methow and Wenatchee Rivers) provide 7,860 cfs to the mainstem river, while the upriver contribution from the Columbia Basin in Canada provides 99,200 cfs of average flow (EPA, 2001).

Climate

Located in the rain shadow of the Cascade Mountain Range, this area is classified as arid to semiarid with low levels of annual precipitation, cold winters and hot, dry summers. Precipitation can vary widely in relation to topographic features but in general much of the subbasin receives less than 15 inches of annual precipitation and most of that precipitation falls in winter. Snowfall in the upper Cascade Mountains nearby sometimes exceeds 100 inches per year and this is where most water is held as natural storage until the runoff in the spring. Snowpack accumulation is dependent on storm systems moving inland to central Washington from the Pacific Ocean during the winter months.

Air temperatures also vary widely depending on topography and location within the subbasin. Summertime air temperatures generally exceed 100 ºF for one to several days each year. Winter temperatures can also drop below 0 ºF, but in general they are in the 20 to 40 ºF range. Along the mainstem Columbia River, winter and spring air temperatures remain very stable and this is where most orchards are located. The growing season ranges from 170 days (May-September) at Bridgeport and East Wenatchee to 135 days on the eastern plateau.

Topography

On the western side of the Columbia River, the topography is generally steep with slopes greater than 60% common. Elevations change quickly from 4,200 feet above sea level on Burch Mountain to 700 feet above sea level at Rocky Reach Dam nearby. Most tributary streams on the western edge of the Columbia Upper Middle flow from west to east into the Columbia River and are high gradient streams capable of transporting large volumes of water and sediment during the spring runoff period. Large alluvial fans are common in the areas where the major tributaries meet the mainstem Columbia River.

On the eastern side of the Columbia River in the Columbia Upper Middle elevations also rise quickly from 700 feet above sea level along the mainstem river to 4100 feet above sea level on Badger Mountain. Most of the eastern Columbia Upper Middle however, is best described as a sandy plateau where slopes are not as steep and the landscape has the appearance of rolling hills rather than mountains. Major landforms within the eastern portion of the Columbia Upper Middle include Dyer Hill, Waterville Plateau, Moses Coulee, and the Badger Mountain area. Minor tributaries that originate in the eastern portion of the Columbia Upper Middle and flow into the mainstem Columbia River include Foster, Douglas and Rock Island creeks.

Geology

The geology of the Columbia Upper Middle is influenced by three physiographic provinces: the Columbia Mountain/ Highlands to the north, the North Cascade Range to the west and the Columbia Basalt Plain to the east and south. The Columbia River mainstem which originates in an area known as the Rocky Mountain Trench flows over mainly Paleozoic metamorphic and intrusive rocks north of Rock Island Dam, while south of the dam the river passes through the Columbia basalt group (BPA et al. 1994).

Soils

A wide variety of soils occur in the subbasin including Cambothirds, Haploxerolls and Argixerolls. Soils range from light-colored, with thin A horizons poor in organic matter and calcium accumulations high in the profile to thick, very dark-brown to black A horizons rich in organic matter in which calcium carbonate accumulations may be deep in the profile or absent. Soils with high accumulations of salt (Solonchak) and large amounts of exchangeable sodium (Natragids or Solonetz) are also present (MCMCP 1995).

Vegetation

Vegetation in the Columbia Upper Middle consists mainly of steppe and shrub-steppe vegetation, and forest vegetation is generally confined to mountain slopes with sufficient precipitation (MCMCP 1995). Present vegetative communities (Figure 4) vary widely from the historic vegetative communities (Figure 3) as much of the Columbia Upper Middle area has been cultivated with a variety of crops or is now grazed by domestic livestock.

Natural vegetative communities in dry areas often consist of a shrub layer dominated by sagebrush (*Artemesia spp.*), bitterbrush (*Purshia tridentata*), Rabbitbrush (*Chrysothamnus spp*.), grease wood (*Sarcobatus spp.)* or Spiny hosage (*Grayia spinosa*) along with a variety of perennial grasses. Dominant grasses include the bunchgrasses (*Poa, Stipa, and Agropyon spp.*) and non-native cheat grass (*Bromus tectorum*). Higher elevation dry sites may also include ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii)* communities in the overstory.

Riparian vegetation along intermittent or perennial streams often consists of willows (*Salix spp.*), water birch (*Betula occidentalis*) rose (*Rosa spp.*), hawthorne (Crategus douglasii) snowberry (*Symphoricarpos albus*), black cottonwood (*Populus angustifolia*), *aspen (P. tremuloides*) and serviceberry (*Amelanchier anifolia*). Other habitats where distinct vegetation communities may exist include gravelly or sandy soils, shallow, stony sites and sand dunes near the Columbia River.

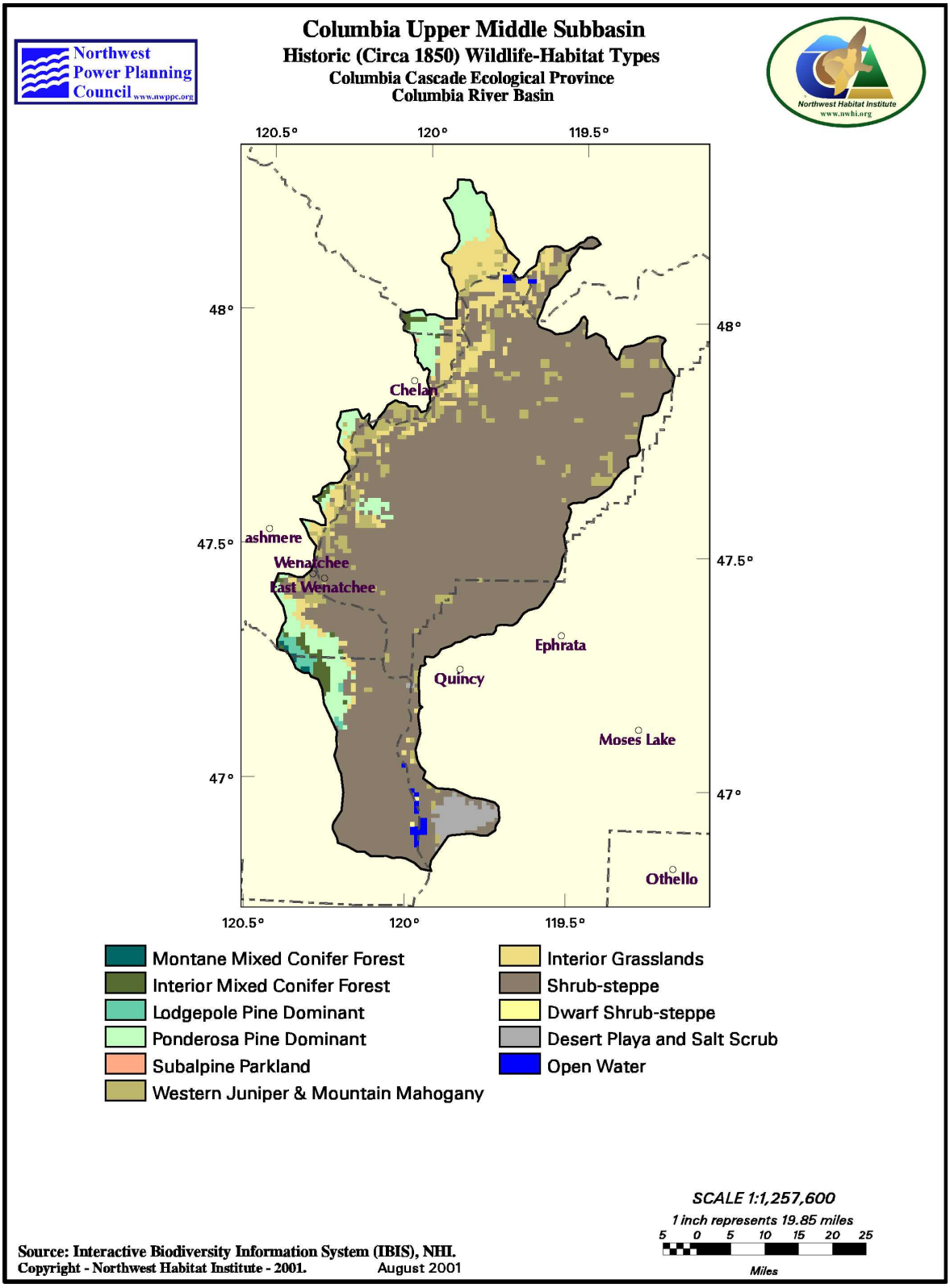

Figure 3. Historic habitat types of the Columbia Upper Middle (1850). Image provided by Interactive Biodiversity Information System (IBIS).

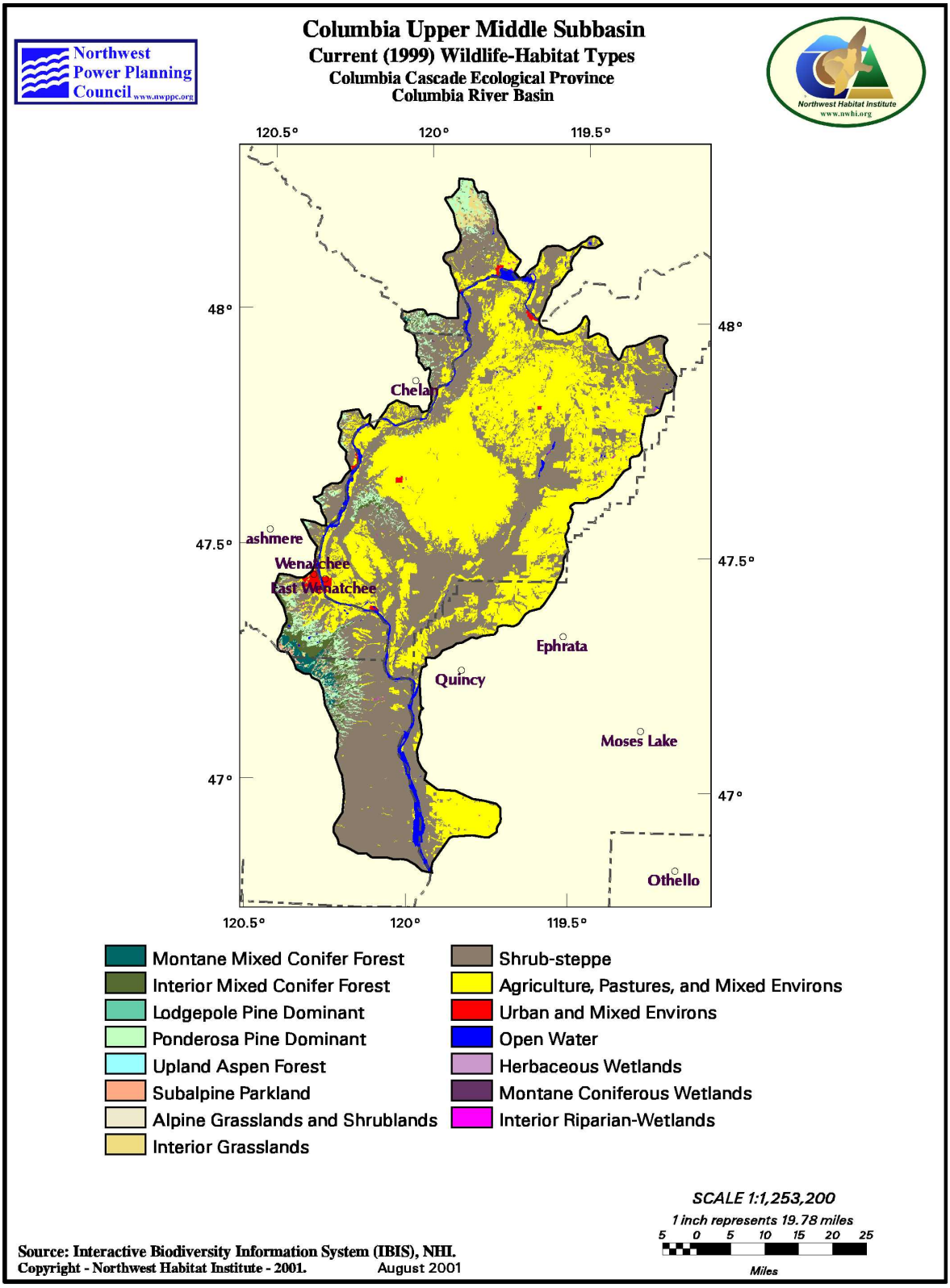

Figure 4. Current habitat types in the Columbia Upper Middle (1999). Image provided by IBIS

Land Uses

In the Columbia Upper Middle land uses varies considerably from north to south. Orchards dominate the Columbia River corridor between Chief Joseph and Rock Island dams. Dryland farming and rangelands are the dominant agricultural practices on the eastern plateaus. Small areas of irrigated cropland are also present on the eastern side of the Columbia Upper Middle. Just outside of Wenatchee, WA lies the Mission Ridge Ski Area which provides winter recreational opportunities. Both rural and urban portions of the Columbia Upper Middle have experienced residential and recreational growth in the past 10 years. Agricultural land use in contrast, has been declining within the Columbia Upper Middle, as agricultural market conditions have not been favorable for the past several years.

Land throughout the subbasin is mostly in private ownership, although there are a number of public land units (Figure 2). Federal land includes only small sections of the and Wenatchee National Forests on the western edge of the Columbia Upper Middle and scattered tracts of U.S. Bureau of Land Management (BLM) lands, U.S. Bureau of Reclamation lands and U.S. Department of Defense lands. State lands include Department of Natural Resources lands, Department of Fish and Wildlife lands and State Parks lands.

Fish and Wildlife Resources

Fish and Wildlife Status

Appendix A lists the binomial and common names of the fish and wildlife species that inhabit the Columbia Upper Middle. To facilitate the ease of reading the document, only the common fish and wildlife names are used in the body of the document. There is no specific appendix for vegetative names, so any reference to a plant species will include its common name and binomial name in the main body of the text.

Fish

There are 37 species of fish, representing 12 families that are either known to occur or thought to occur in the Columbia Upper Middle. **Error! Reference source not found.**1 contains a complete list of all the fish species found in this area. Most are freshwater species however, the steelhead trout, pacific lamprey, chinook, sockeye and coho salmon are five anadromous species that are known to inhabit the Columbia Upper Middle. The mainstem Columbia River serves as a spawning, rearing and migration corridor to and from the Pacific Ocean each year for adult and juvenile salmon, steelhead and pacific lamprey. Most fish species however, spawn and rear in tributary streams away from the mainstem Columbia River. Fall chinook salmon spawning has been observed in limited areas in the mainstem river and in the mouth of the Chelan River.

Ten-year average counts (1991-2000) for anadromous adult salmonids migrating through Rock Island Dam, Rocky Reach and Wells Dams are presented below in. Adult fish count data for Wanapum Dam are not available at this time.

Table 3. Ten year average (1991-2000) counts of adult salmon and steelhead migrating upstream through Columbia Upper Middle hydroelectric projects (Mosey and Murphy 2000).

Location	Chinook (jacks included)	Steelhead	Sockeye	Coho
Rock Island Dam	25,597	7,129	36,080	42
Rocky Reach Dam	11,241	4,934	18,714	24
Wells Dam	5,814	3,894	17,095	32

Spring Chinook Salmon

Upper Columbia spring chinook salmon were listed as endangered under the ESA on May 24, 1999. They use the mainstem Columbia River as a corridor for juvenile and adult migrations and tributary streams for spawning and rearing habitat (Figure 5). Therefore, all rivers and streams accessible to listed chinook salmon upstream from Rock Island Dam to Chief Joseph Dam, excluding the River have been designated as critical habitat by the National Marine Fisheries Service (NMFS 2000).

The majority of adult spring chinook migrating into or through the Columbia Upper Middle portion of the Columbia River are of hatchery origin, but natural production does occur in the Wenatchee, Entiat, and the Methow basins (Chapman et al. 1995a). Historically, natural production occurred in the basin but is not know to occur at present. Upriver migrations of adult spring chinook salmon through Rock Island Dam are generally observed in early April and continue until about the third week of June (Mosey and Murphy 2000). Spawning occurs in the upper reaches of tributary streams from early August through most of September. After spawning is completed, adult spring chinook do not migrate back to the ocean, but instead remain near their redds until death.

Juvenile spring chinook salmon rear in tributary streams to the mainstem Columbia River for approximately one year after emerging from redds, then migrate downstream to the ocean when smoltification occurs. Most juvenile spring chinook migrate through Rock Island Dam between April and early June (Chapman et al. 1995a, Petersen and Tonseth 1998). In 1993, the average length of yearling chinook collected at Rock Island Dam (mixture of naturally and hatchery produced individuals) was 138 mm (Chapman et al. 1995a). In general, hatchery smolts are larger than wild smolts at the time of migration. Juvenile spring chinook in the mid-Columbia migrate actively (averaging about 21.5 km/day from Rock Island to McNary Dam), thus the reservoir residence time is relatively short (Giorgi et al. 1997).

Spring Chinook adult returns in the Columbia Upper Middle have been cyclic rather then stable (Figure 6). Within the past 10 years counts declined to near record lows and remained low for four consecutive years from 1995-1999 (Mosey and Murphy 2000). In 2000 and 2001, adult returns increased dramatically with adult spring chinook counts at Rock Island Dam reaching the highest levels ever recorded in 2001 (41,262).

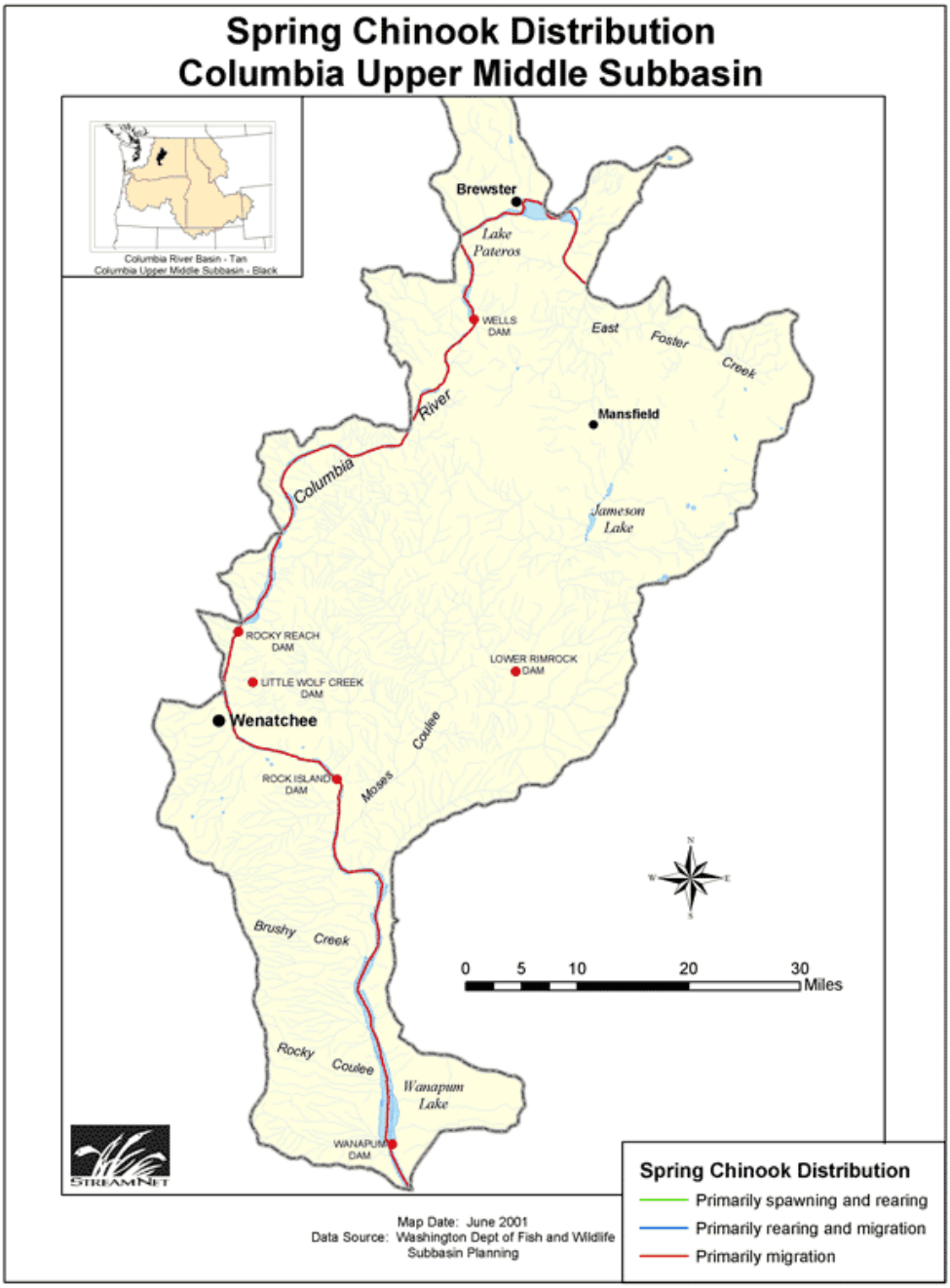

Figure 5. Spring Chinook Distribution in the Columbia Upper Middle.

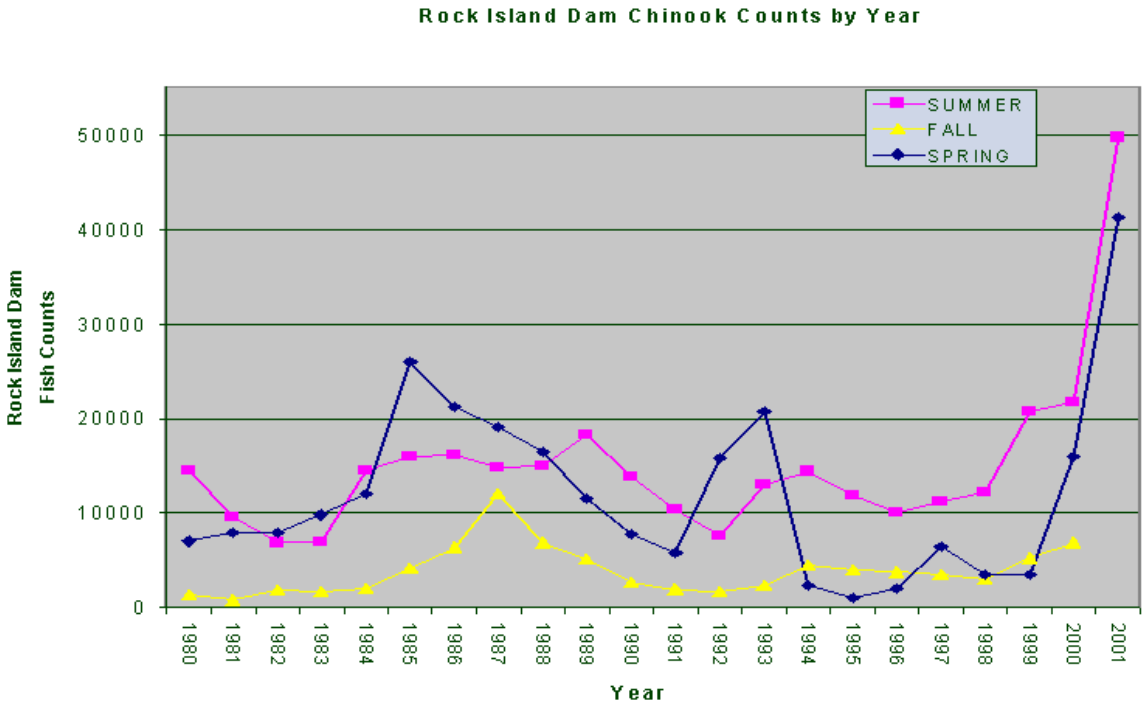

Figure 6. Adult Chinook Counts at Rock Island Dam 1980-2001. Chinook designated as spring race until June 23; summer race from June 24 to September 2; and fall race from September 3 to November (data from CCPUD adult fishway counts).

Summer and Fall Chinook

In the Columbia Upper Middle, summer chinook salmon are considered to be the late-run race of salmon that spawn in tributaries to the mainstem Columbia River and fall chinook are the race that spawn in the mainstem itself. However, there does appear to be overlapping of spawning of both races in the confluence areas between the tributaries and the mainstem Columbia River, consistent with historical information (Lichatowich and Mobrand 1995). See Figure 7 and Figure 8 below for summer and fall chinook distributions. Summer and fall chinook are not listed under the ESA.

Adults generally spend 2 to 4 years in the ocean, then enter the Columbia River between late May and early July and migrate upstream in the Columbia Upper Middle between late June and October (Peven 1992). Natural spawning for summer chinook salmon occurs in the lower 50 miles of the Methow River, the Wenatchee River downstream of Lake Wenatchee, the River, and the Entiat River (Chapman et al 1994a). Fall chinook are known to spawn in the Wells and Chief Joseph dam tailraces as well as the confluence of the Chelan River (Chapman et al. 1994a). Spawning begins in late September and continues into early November, with the peak occurring in October (Peven 1992). After spawning is complete, the adults die near their redds.

The Washington Department of Fisheries (WDF) first observed fall chinook redds in the Rocky Reach reservoir (Wells tailrace) in 1967 (CCPUD 1991). Chapman et al.

(1994a) suggested mainstem spawning was continuing in the Brewster Bar area following inundation by the Wells reservoir. Other surveyors have indicated potential deep water spawning near Bridgeport Bar, Washburn Island, and in areas near the Chief Joseph tailrace where substantial groundwater upwelling occurs (Hillman and Miller 1994; Chapman et al. 1994a; Swan et al. 1994; Bickford 1994).

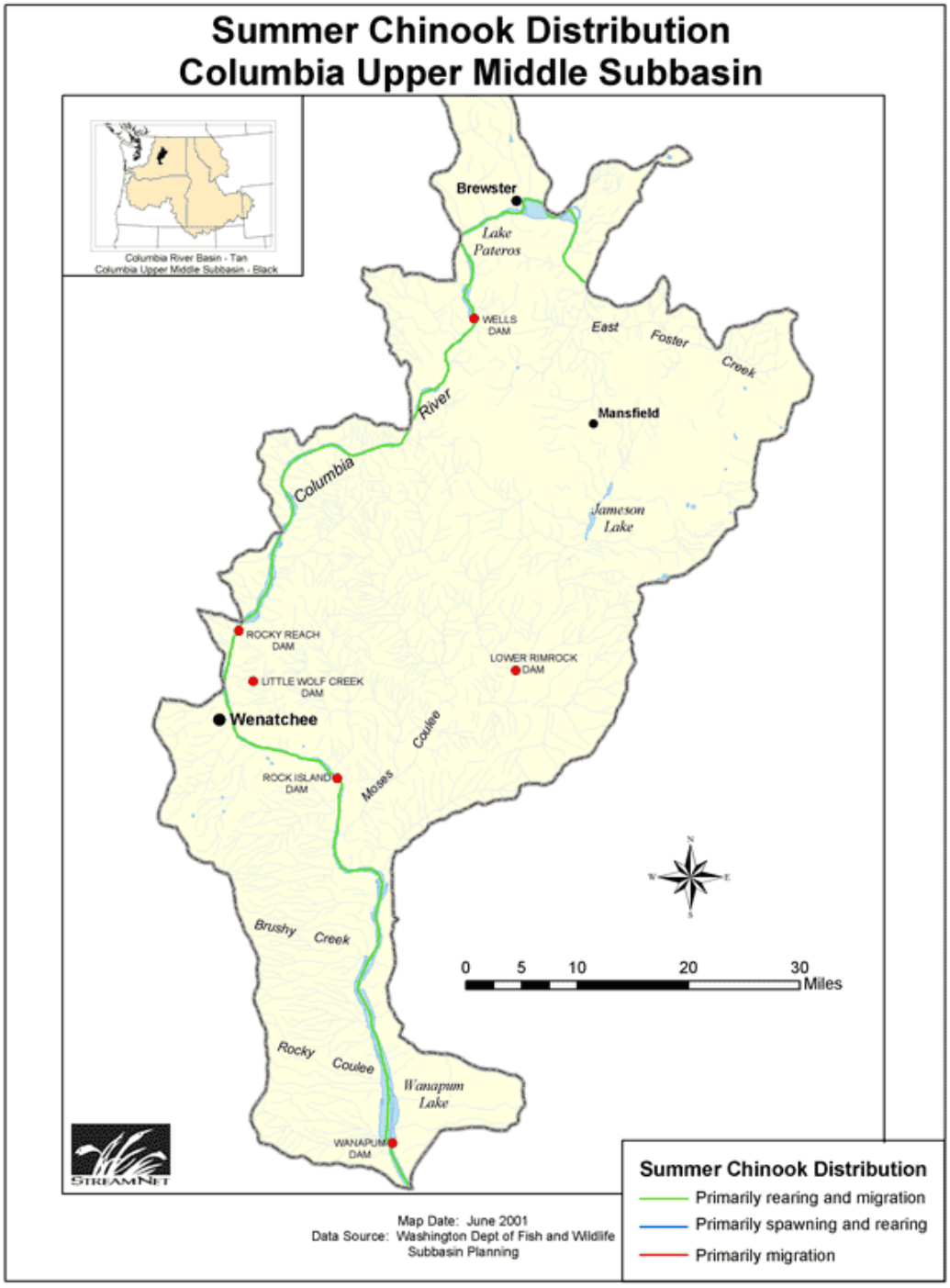

Figure 7. Summer Chinook Distribution in the Columbia Upper Middle.

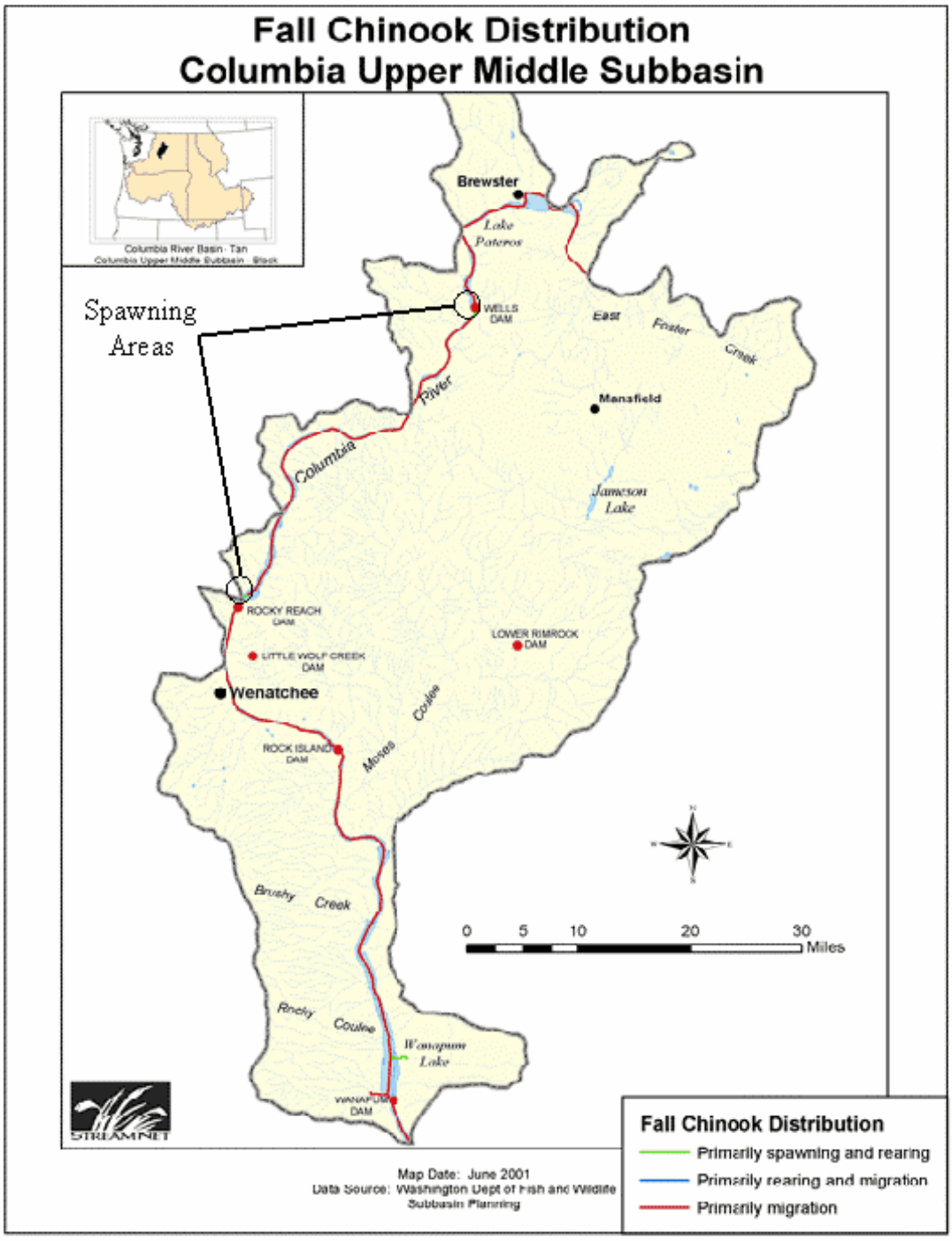

Figure 8: Fall Chinook Distribution in the Columbia Upper Middle.

Summer and fall chinook salmon have similar life history strategies in that they both exhibit rearing migrations in the mainstem (Lichatowich and Mobrand 1995), outmigrate as sub-yearlings and spend 2-4 years in the ocean before returning as adults (Peven 1992). Fry usually emerge from April through June depending on stream temperatures and spawning and incubation times (Chapman et al. 1994a). Juveniles produced in the Columbia Upper Middle tributaries, the lower Chelan River, and in reservoirs of dams tend to spend several weeks to months in the reservoirs before migrating to the ocean (Chapman et al. 1994a). Recent information from scale samples indicate that many of these juveniles have been rearing over-winter in the mainstem prior to reaching the ocean (John Sneva, WDFW, personal communication). Juvenile summer and fall chinook salmon generally outmigrate through the Columbia Upper Middle between June and August (Peven 1992; Chapman et al. 1994a). The size of juvenile summer and fall chinook during the outmigration generally ranges from 40-165 mm.

Returns of adult summer and fall chinook to the Columbia Upper Middle have also been cyclic over the past twenty years (Figure 6). Since 1980, counts of adult summer chinook at Rock Island Dam have ranged from a low of 6,874 to a high of 48,844 in 2001. Fall chinook salmon counts have ranged from 1,706 to 6,846 fish between 1980 and 2000 at Rock Island Dam. Complete counts for the fall chinook migration are not available for year 2001 as the migration is currently underway. Summer chinook populations in the Columbia Upper Middle exhibited large increases in 2000 and 2001, similar to the increases observed for most other anadromous species (Mosey and Murphy 2000, Chelan County PUD unpublished data).

Steelhead

NMFS listed Upper Columbia steelhead as endangered on August 18, 1997 and designated critical habitat for Upper Columbia steelhead to include “all river reaches accessible to listed steelhead in the Columbia River tributaries upstream of the Yakima River, Washington, and downstream of Chief Joseph Dam” (NMFS 2000). Juvenile and adult steelhead use the mainstem Columbia River as a migration corridor and many tributary streams provide spawning and rearing habitat. See Figure 9 below for steelhead distribution in the Columbia Upper Middle.

The Wenatchee, Entiat, and Methow basins and their respective tributaries support naturally spawning steelhead populations (Chapman et al. 1994b, Peven 1992). Adults begin entering the Columbia River from March through October (CBFWA 1990). Most adult steelhead migrate into or through the Columbia Upper Middle from July through late October. Adult steelhead migrations are more protracted than migrations of other anadromous salmonids in the Columbia River. Spawning occurs the following year during March through June (CBFWA 1990, Peven 1992). Unlike other anadromous salmonids, an individual steelhead may spawn more than once during its lifetime or may spawn only once and die, depending on the condition of the fish after spawning (Chapman et al. 1994b).

The average rearing time for naturally produced juvenile steelhead from the mid-Columbia in fresh water is two or three years (range: one to seven years) before outmigrating as smolts, and hatchery smolts are released as yearlings (Peven 1990). Most juvenile steelhead migrate through the Rock Island Dam between April and mid-June

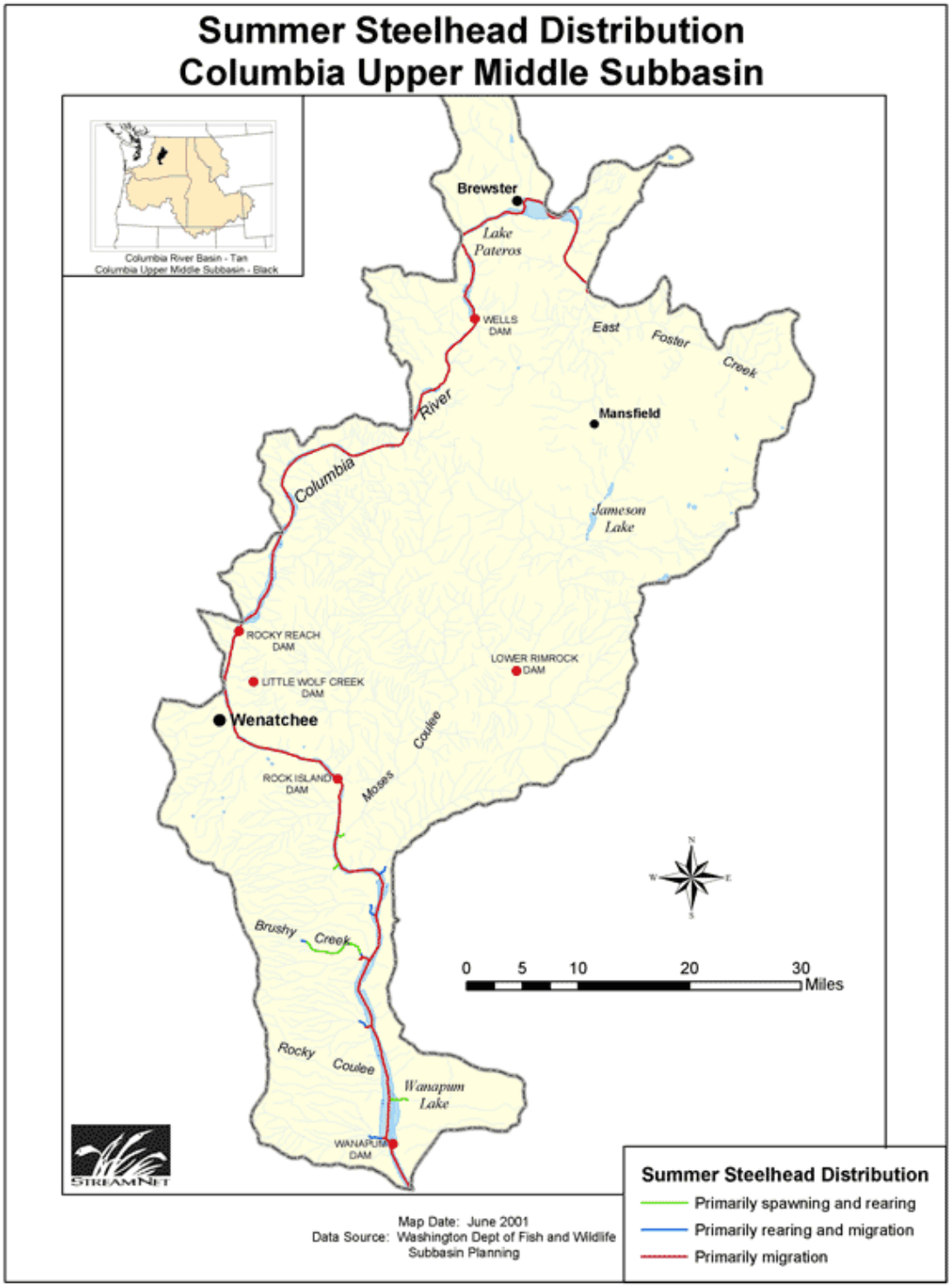

Figure 9: Summer Steelhead Distribution in the Columbia Upper Middle.

(Chapman et al 1994b, Petersen and Tonseth 1998). Hatchery produced steelhead are released into tributary streams as yearlings. Peven (1990) found that naturally produced steelhead ranged from 127 to 270 mm in length at the Rock Island bypass trap in 1988. Juvenile steelhead in the mid-Columbia reservoirs migrate actively averaging 30.4 km/day, thus the residence time is relatively short (Giorgi et al. 1997).

Returns of adult steelhead to the Columbia Upper Middle have been cyclic (Figure 10), as have the chinook salmon returns. Adult steelhead returns declined substantially in the mid-1990's and remained low for several years, then increased substantially in 2000 and 2001 (Mosey and Murphy 2000, Chelan County PUD unpublished data). Although 2001 adult steelhead counts are still in progress at Rock Island Dam, 18,012 steelhead have been counted as if September 17, 2001 making this the largest return since 1986.

Figure 10. Adult Steelhead Counts at Rock Island Dam 1980- September 17, 2001.

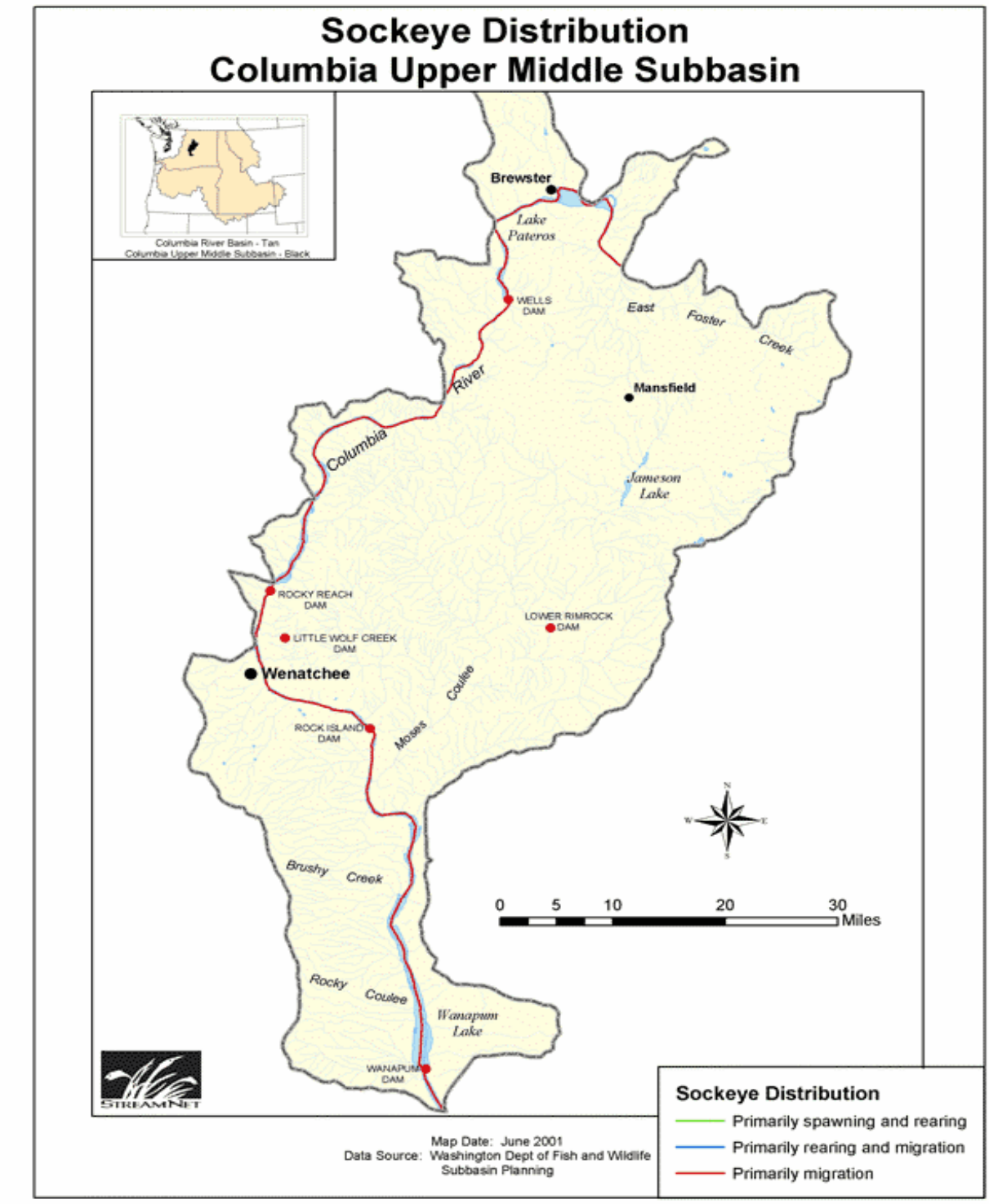

Figure 11: Sockeye Distribution in the Columbia Upper Middle.

Sockeye

Sockeye salmon use the mainstem Columbia River within the Columbia Upper Middle for migrations as adults and juveniles (Figure 11). Sockeye spawn and rear in the upper Wenatchee basin and in the Okanogan River/Osoyoos Lake area at the US/Canadian border and are not listed under the ESA. The two stocks are separable by length frequency distributions, with the Osoyoos Lake stock generally larger than 100 mm and the Wenatchee stock being less than 100 mm fork length (Peven 1987). Juvenile sockeye migrate downstream in April and May with Lake Wenatchee fish arriving at Rock Island Dam before Osoyoos Lake fish (Chapman et al. 1995b). Adults migrate upriver between June and August with the peak generally occurring at Rock Island Dam in mid-July. Since 1980, adult counts at Rock Island Dam have ranged from 9,334 to 109,074 (Mosey and Murphy 2000). In 2001, 104,842 adult sockeye have passed Rock Island Dam making it the largest return since 1984 (Figure 12).

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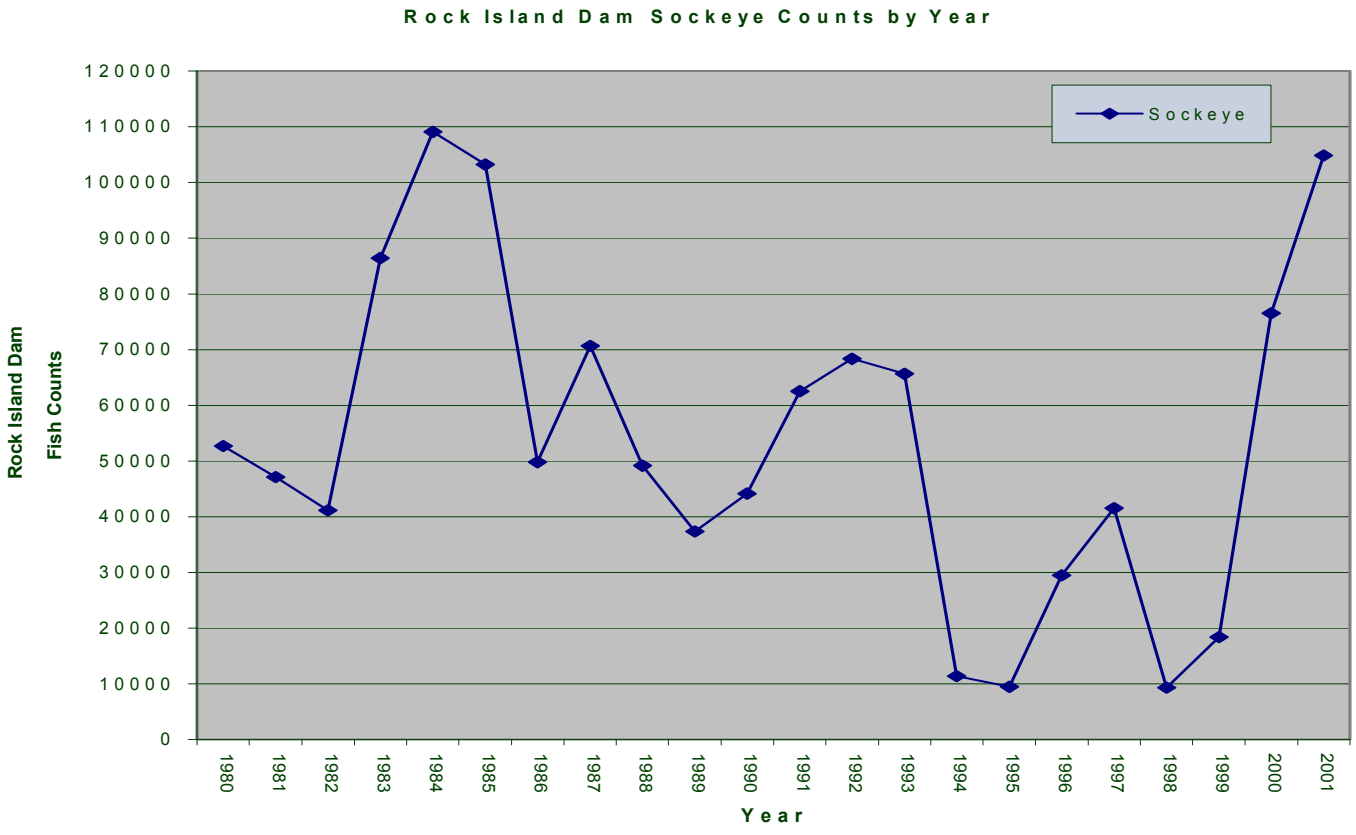

Figure 12: Rock Island Dam Adult Sockeye Counts, 1980-2001.

Coho

Coho were native to several Columbia Upper Middle tributaries, however they went extinct in this area in the early 1900's. Chelan County PUD reared and released coho from the Turtle Rock hatchery near Rocky Reach Dam in the 1980's however, adult returns were never sufficient to re-establish them. The Yakama tribe recently began reintroducing hatchery coho from lower Columbia River broodstock into the Wenatchee and Methow basins. These reintroduced runs will use the Columbia Upper Middle section of the Columbia River for migration as adults and juveniles (Figure 13). Over 2,000 adult coho returned to the Columbia Upper Middle above Rock Island Dam in 2000.

Bull trout

On June 10, 1997, the U.S. Fish and Wildlife Service (USFWS) listed bull trout (bull char) as threatened in the upper Columbia River. Bull trout occurred historically throughout the Columbia Basin, but today primarily reside in upper tributary streams and several lake and reservoir systems. See Figure 14 below for the bull trout distribution in the Columbia Upper Middle. All bull trout life stages are associated with complex forms of cover including large woody debris, undercut banks, boulders, and pools. Bull trout spawn between August and November in streams with cold, unpolluted water, clean gravel and cobble substrate, and gentle stream slopes when water temperatures range from 5-9 °C (Reiman and McIntyre 1993). Spawning areas are commonly associated with cold water streams or areas where stream flow is influenced by groundwater.

Two life history types, resident and migratory, are found within the Columbia Basin. The resident populations are typically found in headwater areas above migration barriers and occupy the same area throughout their lives. The migratory life history type is made up of fluvial, adfluvial, and anadromous forms. Bull trout of the fluvial type move between mainstem rivers and smaller tributaries. The adfluvial types live in reservoirs or lakes as adults, move to tributary streams to spawn and their young rear in those tributary streams for one to three years before they migrate to lakes or reservoirs (Fraley and Shepard 1989; Holton 1990).Bull trout generally reach sexual maturity at 5-6 years of age (Fraley and Shepard 1989). The anadromous form is migratory, using rivers for freshwater rearing and spawning, and shorelines for estuarine and marine rearing (USFWS 1998). Anadromous populations frequently migrate between lower mainstem rivers and estuaries (Platt, et al. 1993). Anadromous bull trout are not known to occur within the mid-Columbia River.

Recent counts of bull trout migrating through Rock Island Dam range from 56 in 1998 to 88 in 2000 (Chelan County PUD unpublished data). The observed peak in adult bull trout passage through Rock Island Dam occurs between the mid-May to mid-July.

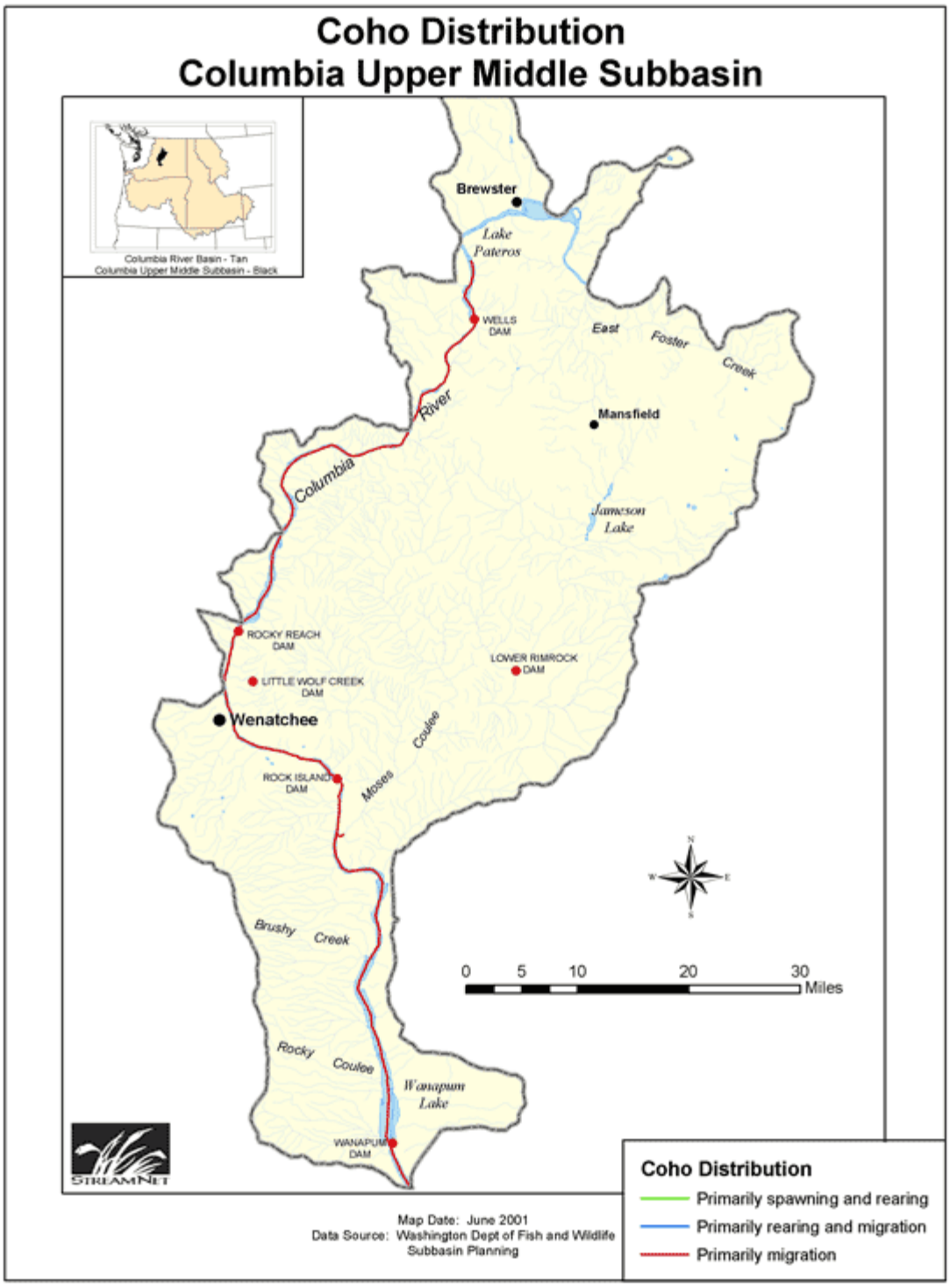

Figure 13: Coho Distribution in the Columbia Upper Middle.

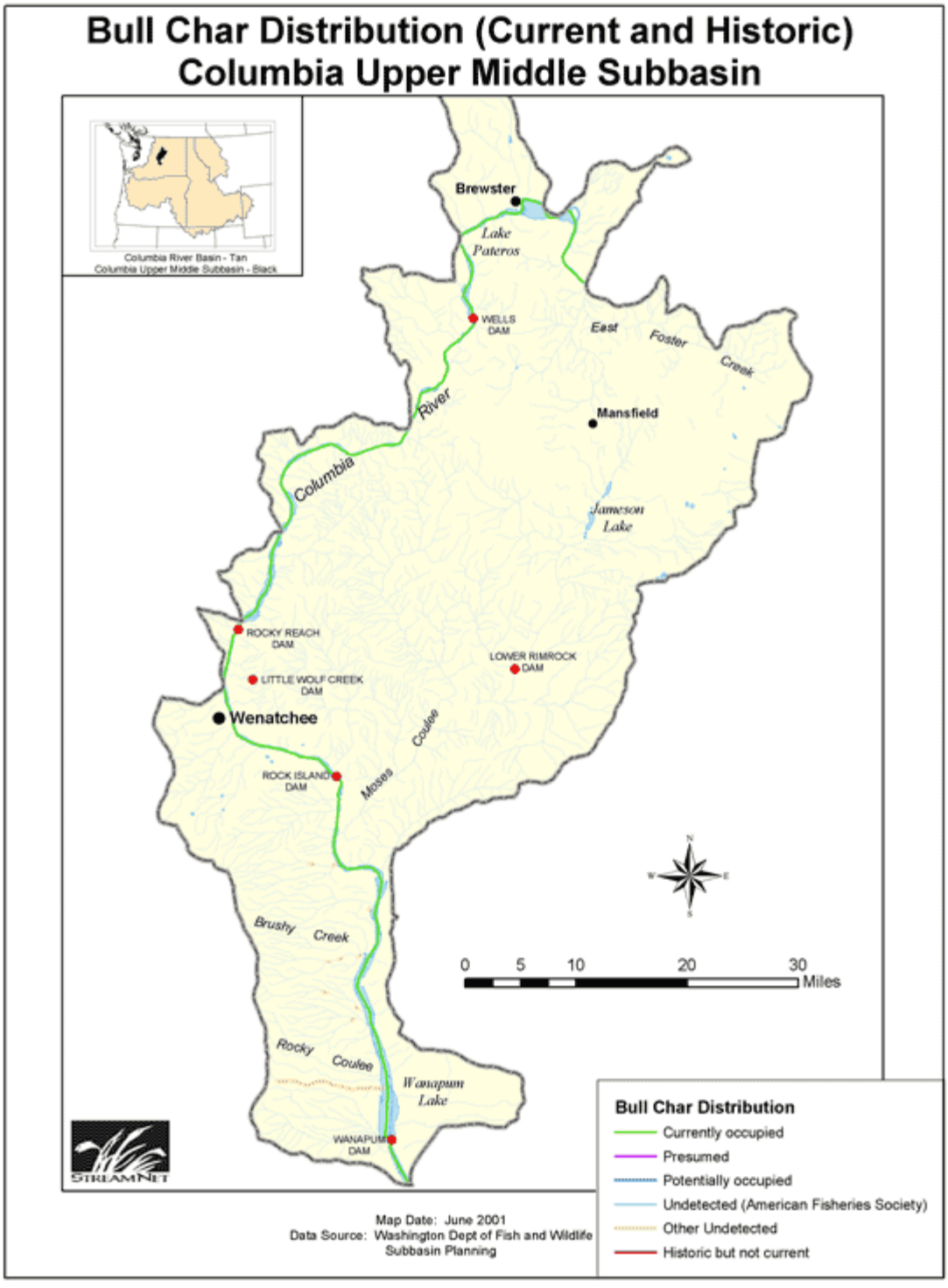

Figure 14: Bull Char Distribution in the Columbia Upper Middle.

Pacific Lamprey

Adult lamprey are parasitic on fish in the Pacific Ocean while juveniles (called ammocoetes) are filter feeders found in backwaters or quiet eddies of freshwater streams. Migration of juveniles generally occurs between March and July and can encompass large distances. Lamprey may spend 5 or 6 years in fresh water before they migrate to the ocean and transform from the ammocoete stage to parasitic adults (Wydoski and Whitney 1979). Adults spawn in mid to late summer in riffles with small gravel. Females can contribute between 35,000 and 100,000 eggs per nest and like salmon, the adult lamprey die after spawning (Wydoski and Whitney 1979). Since 1983, adult lamprey counts at Rock Island Dam have ranged from 269 to 2,319 with the high occurring in 1997.

Predatory Fish

Primary predators of juvenile salmonids in the Columbia Upper Middle include northern pikeminnow, smallmouth bass, and walleye. The northern pikeminnow has been identified as the major native predator fish on juvenile salmonids. Walleye and smallmouth bass were introduced into the Columbia River system in the 1940's and 1950's to provide sportfishing opportunities (Henderson and Foster 1956; Zook 1983). These piscivorous gamefish have become established in the Columbia Upper Middle reservoirs and prey on outmigrating juvenile salmonids.

Northern pikeminnow prey heavily upon migrating juvenile salmonids in the Columbia River system. Northern pikeminnow accounted for over 75 percent of the total catch of predator fish in the mid-Columbia during a 1993 survey (Loch et al. 1994). Research by West (1999) indicated that radio tagged northern pikeminnow tended to select areas where a point of land protrudes into the river channel. They often located themselves on the inside of the main current line, on the downstream side of the point, where the ambushing of prey would be easier. They were also found to frequently inhabit weed beds.

Smallmouth bass were introduced as a gamefish and have inhabited the Columbia Upper Middle since at least the 1940's (Henderson and Foster 1956). Preferred habitat for this species includes rocky shoals, banks, or gravel bars. In the subbasin, adults are most abundant around the deltas of warmer tributary waters. The optimal temperature range is from 21 to 27° C, which is higher than the temperatures typically observed in the subbasin.

In a 1993 survey of the mid-Columbia system conducted by the National Biological Survey (NBS) and Washington Department of Fish and Wildlife (WDFW), smallmouth bass were the second most abundant predator species captured, but accounted for only nine percent of the total catch (Sauter et al. 1994). The majority of bass caught in the 1993 NBS survey were taken from reservoir forebays, and the fewest from the tailraces (Burley and Poe 1994). The preference of smallmouth bass for low velocity shoreline areas may reduce their predation on some yearling outmigrants because many subyearling migrants use the higher velocity shoreline areas (Burley and Poe 1994). The overall abundance of smallmouth bass in the mid-Columbia system appears to be low.

Walleye are a cool water, piscivorous gamefish believed to have moved downstream into the mid-Columbia reach from a population established for recreational fishing in Lake Roosevelt in the late 1950s (Zook 1983). Walleye were the least abundant

predator encountered in the 1993 NBS survey of the mid-Columbia, accounting for only four percent of all predators caught (Burley and Poe 1994). Of the walleye captured during this survey, eighty-nine percent were caught from dam tailraces, while the remaining eleven percent were caught in mid-reservoir and forebays (Loch et al. 1994).

Wildlife

There are approximately 234 bird species, 97 mammal species, 17 amphibian species and 19 reptile species associated with a variety of habitat types in the Columbia Upper Middle (see Appendix A2, page **Error! Bookmark not defined.**) today (IBIS). The majority of the Columbia Upper Middle historically consisted of steppe and shrub-steppe (Daubenmire 1970) habitat and many wildlife species required shrub steppe habitat for all, or substantial portions of their life cycles. Conversion of shrub or shrub-steppe habitat to alternate uses, such as irrigated and dry land agriculture, water impoundment's associated with dams, and urban/residential development has negatively impacted some shrub-steppe species. Landscape level changes related to habitat conversion that may have affected shrub steppe wildlife include: fragmentation of extant shrub-steppe habitat; differential loss of deep-soil communities; and alteration of the vegetation community resulting from grazing by livestock; invasion by exotic plants; and changes in fire frequencies (Vander Haegen et al. 2001).

Birds

Sage grouse were historically found in shrub steppe habitats throughout eastern Washington. The current population in Washington is estimated to be around 1000, with about 700 of the birds residing in a contiguous subpopulation in Douglas and Grant counties within the Columbia Upper Middle (Schroeder et al. 2000b). An additional subpopulation of 300 birds is found in Yakima and Kittitas counties. The Columbia Basin Project in western Grant County largely separates the 2 populations. Their populations are continuing to decline in Washington due to long-term effects of habitat conversion, degradation, fragmentation, and population isolation (Hays et al. 1998a, Schroeder et al. 2000b). Sage grouse in Washington declined 77% between 1960 and 1999 (Schroeder et al. 2000b).

Sharp-tailed grouse were historically found in shrub-steppe and deciduous shrub communities throughout eastern Washington. The current population in Washington is estimated to be 600, with about 100 of the birds residing in the Columbia Upper Middle (Schroeder et al. 2000a). Sharp-tailed grouse populations in Washington declined 94% between 1960 and 2000. The remaining birds are found in eight relatively small, isolated, subpopulations; two subpopulations are found within the subbasin in NW and NE Douglas County. Subpopulations are separated from adjacent subpopulations by at least 20 km. Sharp-tailed grouse are continuing to decline in Washington due to long-term effects of habitat conversion, degradation, fragmentation, and population isolation (Hays et al. 1998b, Schroeder et al. 2000a).

Ferruginous hawks were historically found in shrub-steppe habitat within the Columbia Upper Middle. Three nesting territories are known to occur in Moses Coulee; however, they have not supported breeding pairs in recent years (WDFW 1996). The regional decline in abundance of ferruginous hawks has been tied to shrub-steppe habitat alteration associated with cultivation and grazing and with subsequent declines in

abundance of prey species. Historic information suggests black-tailed jackrabbits, white-tailed jackrabbits, and Washington ground squirrels were important prey for nesting ferruginous hawks in Washington (Watson and Pierce 2000). All three species of mammals currently are candidates for state listing within Washington due to their low and/or declining abundance; the Washington ground squirrel is also a candidate for federal listing. Research on the Hanford Nuclear Reservation confirmed that adult ferruginous hawks were flying up to 15 km off site to forage for pocket gophers, a small alternate prey species (Leary 1996). These long flights to foraging areas may reduce adult nest attendance and potentially may increase mortality of young.

Golden eagles are prominent raptors in shrub-steppe habitats throughout Washington. Data collected since 1987 suggests that < 50% of 200 historic golden eagle territories in Washington are currently occupied (WDFW, unpublished data). Reasons for low site occupancy in the subbasin may be related to low prey abundance in shrub-steppe habitats near nest sites. Principal prey, such as black-tailed jackrabbits, white-tailed jackrabbits, and Washington ground squirrels; have declined dramatically, largely as a result of conversion and degradation of shrub-steppe habitat. A further concern may be toxic lead poisoning, possibly associated with pesticide residues in orchards along the Columbia River (W. Yake, WDOE, personal communication) or with lead shot or bullets in the carcasses of prey (E. Stauber, Washington State University, personal communication; T. Talcott, University of Idaho, personal communication).

The sage thrasher, loggerhead shrike, sage sparrow, and Brewer's sparrow are neotropical migrants that appear to be closely associated with shrub-steppe habitat (Vander Haegen et al. 2000). Populations of most shrub-steppe associated songbirds appear to be declining (Saab and Rich 1997). Fragmentation and degradation of shrub-steppe adversely affect some species, although relatively few have been studied. Sage sparrows are less abundant (Vander Haegen et al. 2000) and Brewer's sparrows and sage thrashers are less productive (WDFW, unpublished data) in fragmented landscapes. In addition, Brewer's sparrows and sage thrashers are less abundant in shrub-steppe habitats of relatively poor quality (Vander Haegen et al. 2000). Habitat-specific population parameters, including productivity, dispersal, and adult and juvenile survival are unknown for most of these species. Numerous species, including sage sparrows and grasshopper sparrows, are not monitored adequately by the Breeding Bird Survey and will require specialized monitoring to detect and monitor population changes (Saab and Rich 1997).

Burrowing owls appear to be associated with open habitats, particularly shrub-steppe, in Washington. Although these sites are often relatively disturbed, burrowing owls appear to be declining in the subbasin, based on incidental observations and recent inventories (Bartels and Tabor 1999). Some of the declines appear to be related to long-term loss in availability of potential burrows. The decline in number of burrows may be an indirect result of declines of mammals including pygmy rabbits, badgers, and ground squirrels whose deserted burrows are readily used by burrowing owls. In some parts of the subbasin, however, burrowing owls have declined at locations where burrows were available. The explanation for these declines is not clear.

Chukar, an introduced species, is the most popular game animal in the subbasin. Chukars and other upland game birds (pheasant, gray partridge, California quail, wild

turkey) have been influenced both negatively and positively by changes in the subbasin, depending on the species, habitat, and location.

Wintering waterfowl are abundant along the Columbia Upper Middle reservoirs. They are an important wildlife species for sport hunting and non-consumptive appreciation and are a major food source for bald eagles. Many bald eagles winter along portions of the mid-Columbia River. Golden eagles are year round residents along the Rocky Reach reservoir.

Canada geese are the primary waterfowl nesters along the Columbia Upper Middle reservoirs. Mallards, wood ducks, and common mergansers sometimes nest along the reservoirs, but only in very small numbers. One or two mallard broods are sometimes seen along the reservoir, but these are rare. Mallards generally nest in upland grasslands away from the water's edge. Common mergansers nest in cavities in dirt banks, trees or rock crevices.

The number of Canada goose nests along Rocky Reach Reservoir since 1983 has ranged from 30-40 nests in the mid-1980's to a high of 80 nests in 1992 and between 39-52 since (Paul Fielder, Chelan PUD, unpublished data). A ban on rodenticides in orchards and expanding lawns and parks along the reservoirs lead to peak goose nesting populations in the early 1990's. The reopening of waterfowl hunting along the entire reservoir in the mid-1990's has reduced the nesting population to its present levels. About 40% of the goose nests along the reservoir are in man-made nesting structures. Nesting success of the man-made goose nest sites has been about 80%, compared to nesting success of 58% in the natural nest sites along the reservoir (Paul Fielder, Chelan PUD, unpublished data).

Common loons, Wilson's phalaropes, American avocets, and black-necked stilts are associated with open water and/or the shallower portions of large bodies of open water and ephemeral ponds. Although populations of these species appear to be declining throughout their broader ranges, there is little evidence that their respective declines are due to declining habitat quantity and quality within the Columbia Upper Middle. Numerous species such as the olive-sided flycatcher and willow flycatcher are associated with riparian areas during the breeding season. In contrast, sharp-tailed grouse (a shrub-steppe obligate) may use riparian areas during periods of harsh winter weather. Because of the small size, poor condition, and isolated nature of much of the riparian habitat in the Columbia Upper Middle, this habitat type is critical in its overall importance.

Mammals

Mammals inhabiting the Columbia Upper Middle require access to habitats with appropriate food sources, water and adequate cover. Species assemblages vary depending on habitat types, which include open water, wetlands, shrub or shrub steppe, grasslands, agricultural areas and forested areas. Several species have been designated by state or federal agencies as endangered or threatened, species of concern or sensitive species. A complete listing of mammal species associated with the Columbia Upper Middle can be found in Appendix A2 (page **Error! Bookmark not defined.**).

Shrub-steppe Obligates

Washington ground squirrels are endemic to Washington and Oregon (Betts 1990), and have declined dramatically in both states (Betts 1999). They are associated with relatively deep soils within shrub-steppe communities (Dobler et al. 1996, Betts 1990, 1999). Because deep soil habitats were preferred areas for conversion, most are now used for irrigated and dryland agriculture. The widespread loss and fragmentation of shrub-steppe has resulted in dramatic declines in the statewide population of Washington ground squirrels (Dobler et al. 1996). Known populations of ground squirrels occur within the Columbia Upper Middle. Recent research in Grant County may reveal additional information on the species (Sherman 1999, 2000).

Pygmy rabbit populations are associated with relatively deep soils dominated by shrub-steppe habitat (WDFW 1995a). However because the deep soil habitats were preferred areas for conversion, most are now used for irrigated and dryland crops. The widespread loss and fragmentation of shrub-steppe has resulted in dramatic declines in the statewide population of pygmy rabbits (Musser and McCall 2000). There are only three small and isolated populations of pygmy rabbits remaining in the state, all within the Columbia Upper Middle. Lack of genetic diversity in the remaining populations of pygmy rabbits may also be contributing to their decline (K. Warheit, WDFW, personal communication).

White-tailed jackrabbits and black-tailed of jackrabbits are closely associated with shrub-steppe habitats, and consequently, their populations have shown the same downward trends as other shrub-steppe obligates. White-tailed jackrabbits tend to be closely associated with the more mesic shrub-steppe habitats, and black-tailed jackrabbits with the relatively arid and/or disturbed sites.

Other species including the sagebrush vole are largely restricted to shrub-steppe habitat and populations appear to be declining. Unfortunately the population, behavior, and habitat information is insufficient to understand the long-term relationships between populations and declining quality and quantity of shrub-steppe.

Mule deer and white-tailed deer occur primarily in shrub-steppe habitat in the subbasin but also use other habitats including forest and cereal crops if the cropland is near shrub-steppe. Both species are important game species in the subbasin although whitetail deer are not as widely distributed as mule deer.

Non shrub-steppe obligates

Raccoon, coyote, bobcat, badger, mink, muskrat, beaver, and river otter are the primary furbearers in the Columbia Upper Middle. All but the coyote and muskrat are significantly lower in abundance than they were historically and declines appear to be related to an overall declines in habitat quality with an associated decline in food and/or prey abundance (J. Tabor, WDFW, personal communication)

Elk utilize portions of the Columbia Upper Middle south of Wenatchee known as the Colockum and Quilomene Wildlife areas in Chelan and Kittitas counties. Elk are an important game species in the subbasin, providing recreational opportunities and bringing additional revenue to the Wenatchee Valley. The core of elk habitat is located on the

Colockum and Quilomene Wildlife Areas and provides habitat for a herd that has varied from 4,500 to 6,500 animals over the last 20 years. Post-hunting season herd composition counts from 2001 indicated a bull:cow ratio of 6:100, far less than the current management objective of greater than 15 bulls:100 cows in spite of very restrictive bull elk harvests initiated in 1994. Additional research on population structure and nutrition is needed for this herd (T. McCall, WDFW, personal communication).

California bighorn sheep historically occurred on the eastern slope of the cascades from the Canadian border and south along the Columbia River. The entire range of the Quilomene bighorn sheep herd occurs in the Columbia Upper Middle. Historically, this area had California bighorns; however, all bighorn sheep were extirpated from Washington by 1935. The Quilomene herd was reestablished in 1993 with the release of 11 sheep from Vulcan Mountain. An additional 20 sheep were released in 1994. Currently, this herd is utilizing only ¼ of the suitable bighorn sheep habitat in this area and there is potential for the herd to reach 500 animals (WDFW, 1995b).

The Columbia Upper Middle is an important area in the state for bats because of their abundance and diversity and because of the presence of unique and/or limiting habitat features. For example, although water is the most limiting factor in the distribution of bats in arid areas, it is available adjacent to roosting, breeding, and wintering (hibernacula) sites in this subbasin. Cliffs, mines, caves, and buildings provide the structures needed to form breeding colonies and hibernacula for most species. Although some species are flexible in their use of these structural features, other species require specific elevations, aspects, and temperature ranges. Spotted Bats appear to be exclusive cliff dwellers during the young-rearing period. The Columbia Upper Middle probably represents a significant core of Washington's Spotted Bat distribution. Buildings provide a significant source of roosting habitat in areas where water occurs but no suitable geological roost features exist. Townsend's Big-eared bats are found almost exclusively roosting in buildings in cave-deficient areas. Risks to bats in the Columbia Upper Middle include loss or degradation of roosting and feeding habitat (mine closure, shrub removal), loss of available clean water, and disturbance of roost, breeding, and hibernation sites.

Reptiles and Amphibians

Reptiles and amphibians often reveal important information about the ecological condition of an area because they are predators that often rely on specific habitats and are sensitive to environmental degradation. There is global concern that amphibians are declining as the result of climate change and habitat alteration (Wake and Morowitz 1991; Stebbins and Cohen 1995). Nineteen reptile and seventeen amphibian species are thought to occur in the Columbia Upper Middle (IBIS). A list of those reptiles and amphibians that are known to or thought to occur is included in Appendix A2 on page **Error! Bookmark not defined.**.

Shrub-steppe obligates

The short-horned lizard, sagebrush lizard, side-blotched lizard, night snake, striped whipsnake, and blotched tiger salamander [formerly *A. tigrinum melanostictum*) are considered at risk. The striped whipsnake is also listed as a State Candidate species. Three cryptozoic reptiles, the ring-necked snake , the sharp-tailed snake, and the southern alligator lizard reach the northwest limits of their respective distributions in the western margin of the Columbia basin, and are likely to be particularly vulnerable at the edge of

their range. Both the blotched tiger salamander and the Great Basin spadefoot, may be especially vulnerable to the hydrological modification of their habitat.

Non Shrub-steppe obligates

The northern leopard frog has declined dramatically throughout its historic range. The historic distribution was principally along wetlands of the Columbia River and its tributaries (McAllister et al. 1999). The Columbia spotted frog is distributed within the channeled scabland flood coulees with perennial water sources.

Habitat Areas and Quality

Mainstem Columbia River-Fisheries Habitat

Within the Columbia Upper Middle, the mainstem Columbia River provides limited spawning and rearing habitat for anadromous salmonids and is a migration corridor for adults and juveniles migrating to or from tributary habitats. A wide variety of resident fish species also use the mainstem river for several lifestages such as spawning, rearing, foraging and migrations.

Spawning Habitat

Although there is little spawning habitat for anadromous salmonids in the mainstem Columbia River, fall chinook redds have been observed where streambed hydraulics and substrate composition allow. At the confluence of the Chelan River with the Columbia River and in the Wells Dam tailrace, salmon redds are observed annually during late fall aerial surveys (Murdoch and Miller 1999).

Spawning habitat types for non-anadromous resident fish that inhabit the mainstem include: rocky rubble; cobble and gravel substrates in swift water (below Wells Dam); rubble and boulder substrate in moderate to calm velocities; sand, silt and imbedded cobble substrates in moderate to calm velocities; and macrophyte beds. Walleye and suckers may spawn in the swifter upper reaches of the reservoirs. Northern pikeminnow, peamouth, and chiselmouth will use the moderate velocity areas with firm substrates ranging from sand and gravel to cobble. Carp, redside shiners and perch spawn in weedy shallows along the shorelines. White sturgeon spawning is probable in the Columbia Upper Middle due to the capture of a juvenile sturgeon (84 cm in length and less then 3 kg in weight) in the Rocky Reach Reservoir (unpublished data, Chelan PUD 2001). White sturgeons less then 90 cm have also been observed during pikeminnow removal programs (Todd West, Chelan PUD, personal communication, 2001).

Rearing Habitat

Besides the steep shorelines and sparse riparian habitat that is common along the Columbia, there are other factors that can potentially affect rearing habitat in the mainstem reservoirs. One factor is the degree of primary and secondary production that occurs in the reservoir system. The invertebrate community in the reservoirs is dominated by lower energy organisms such as chironomidae, oligochaetes and zooplankton (Falter et al. 1991; Rondorf and Gray 1987).

Submergent aquatic plants are increasing in some of the mainstem reservoirs. The benthic community in these submerged macrophyte beds is similarly increasing as riverine macrophytes effectively create substrate by velocity reduction and subsequent particle trapping, encouraging settling of organic-rich soils (Falter et. al 1991). These beds could

then eventually increase the production of benthic food organisms as well as providing surface area for algae and invertebrate growth. They may also provide cover for juvenile salmonids as well as other fish species, thereby possibly increasing rearing habitat.

Migratory Habitat

Hydroelectric project operations, agricultural practices, industrial discharge into the river, and residential developments along the Columbia River can directly influence water quality. Similarly, cumulative effects from the similar activities in nearby tributary streams can also impact water quality in the mainstem river. In terms of fisheries habitat, the levels of dissolved gases, changes in stream temperatures, turbidity levels and exposure to environmental contaminates above biological thresholds for fish species utilizing the river are of primary concern.

The Columbia River has been classified by the Washington Department of Ecology (WDOE) as a "Class A" water. On a scale ranging from Class AA (extraordinary) to Class C (fair), Class A waters are rated as excellent. State and federal regulations require that Class A waters meet or exceed certain requirements for all uses. In the Columbia Upper Middle, water quality occasionally does not meet state and federal water quality standards for certain parameters (e.g., total dissolved gas (TDG), and temperature). See Figure 15 to view impaired waters in the Columbia Upper Middle. Compared to other rivers in the United States however, the Columbia River carries a large volume of relatively unpolluted surface water and has few sources of pollution and wastewater.

The hydroelectric projects on the mainstem of the Columbia River within the Columbia Upper Middle are run-of-river with reservoirs that have little storage capacity. Water velocities are generally fast enough to prevent the formation of a thermocline and the associated depletion of oxygen in deeper waters. Water quality parameters affected by hydropower production, include total dissolved gas (TDG), water temperature, dissolved oxygen, turbidity, suspended sediments and nutrients. The status of each of these parameters in the Columbia Upper Middle is summarized below.

Total Dissolved Gas

Total dissolved gas (TDG) supersaturation often occurs during periods of high runoff and spill at hydropower projects and can be harmful to fish. Supersaturation occurs when gases, entrained by water passing over spill gates, are carried to depth by the plunging action of the spill and forced into solution by increased hydrostatic pressure (Perleberg and McDonald 2000). Fish and other aquatic organisms that are exposed to excessive TDG supersaturation can develop gas bubble trauma (GBT), a class of harmful and potentially fatal symptoms. Total dissolved gas supersaturation in the Columbia River was identified in the 1960's and 1970's as a potential detriment to salmon. Those concerns have reappeared as management agencies have reinstituted spill as a means of aiding downstream fish passage throughout the system.

The WDOE has set a TDG standard of 110 percent of saturation for all flowing waterways. The WDOE has approved an interim modification to the standard of 110 percent to allow spill for fish passage. The revisions under this modification to state water quality standards allow an average TDG level of 120 percent for the highest 12 hours of a day at the tailrace of the respective dam and allow an average of 115 percent for the highest 12 hours of the day at the forebay of the next downstream dam. The modification to state

water quality standards also incorporates a maximum one-hour average TDG reading of 125 percent in the tailrace. These standards do not apply during periods when the river flow exceeds the seven-day, 10-year-frequency flood (7Q10-the level of a flood release that could be expected to occur for a period of seven days on the average of once in ten years). Total dissolved gas at the Columbia Upper Middle hydroprojects is monitored in both the forebay and tailrace of the projects. The projects typically remain in compliance with the WDOE standards, but on occasion, TDG levels exceed the maximum allowed. This exceedance usually occurs during periods of high run-off or when the water coming into a project is nearing, or is out of compliance with WDOE standards.

Water Temperature

The effect of hydropower projects on Columbia River water temperature has been to delay the time when thermal maximums are reached and when cooling begins in late summer (BPA et al. 1994). The thermal regime of the Columbia Upper Middle is largely influenced by releases from Grand Coulee Dam, which is the main upstream deepwater storage project. The Columbia Upper Middle hydroelectric projects are run-of-river facilities with very limited capability for storage and flow regulation. In general, the low retention times of the reservoirs at these facilities limit the potential warming that can occur.

Dissolved Oxygen

Dissolved oxygen (DO) levels in the subbasin do not typically decline below the minimum Environmental Protection Agency (EPA) standard for DO in Class A waters of 8.0mg/l.

Turbidity and Suspended Sediments

Turbidity and suspended sediments in the Columbia Upper Middle are relatively low (BPA et al. 1994). The hydroelectric projects and their associated reservoirs slow the river flow and allow sediment to settle out. Turbidity and suspended sediments are commonly higher in the tributaries than in the mainstem of the Columbia River (BPA et al. 1994).

Nutrients

Water quality stations throughout the Columbia River typically show ammonia concentrations that are below the EPA chronic freshwater standard. Mean annual phosphate concentrations often exceed levels that could stimulate algal blooms. Highest phosphate levels occur at the start of spring runoff, and in the late fall at the end of the low-flow season. High levels are also encountered in winter when biological uptake is lowest (BPA et al. 1994).

Columbia Upper Middle Tributary Fisheries Habitat

Tributaries within the Columbia Upper Middle provide limited spawning, rearing and migratory habitat for resident fishes and some anadromous salmonids. In the rain shadow of the Cascade Mountains, little precipitation falls annually in the eastern portion of the Columbia Upper Middle, thus snowmelt is generally not sufficient to provide sustained flows of cooler water necessary for most salmonid species.

The Moses Coulee drainage begins in the wheat fields north of Grimes Lake in Douglas County and meanders southerly through Sagebrush Flat on the Douglas/Grant County line and continues on to join the Columbia River about 18 river kilometers(rkm) south of Rock Island Dam. Generally, surface flows that begin in Moses Coulee are uncommon. Runoff that enters the coulee tends to quickly disappear into the rocky, porous

floor. Permanent flows within upper Moses Coulee are not found until just north of Rim Rock Meadows. McCarteney Creek begins at this point and flows for approximately 6.5 km until it disappears into the Moses Coulee floor. Grimes Lake is the uppermost point of permanent water in the Moses Coulee drainage and with relatively high alkalinity, did not support fish until alkaline-tolerant Lahontan cutthroat trout were introduced by WDFW in 1981. Located 3.6 km south of Grimes Lake, Jameson Lake has a lower alkalinity level that enables the stocking of rainbow trout.

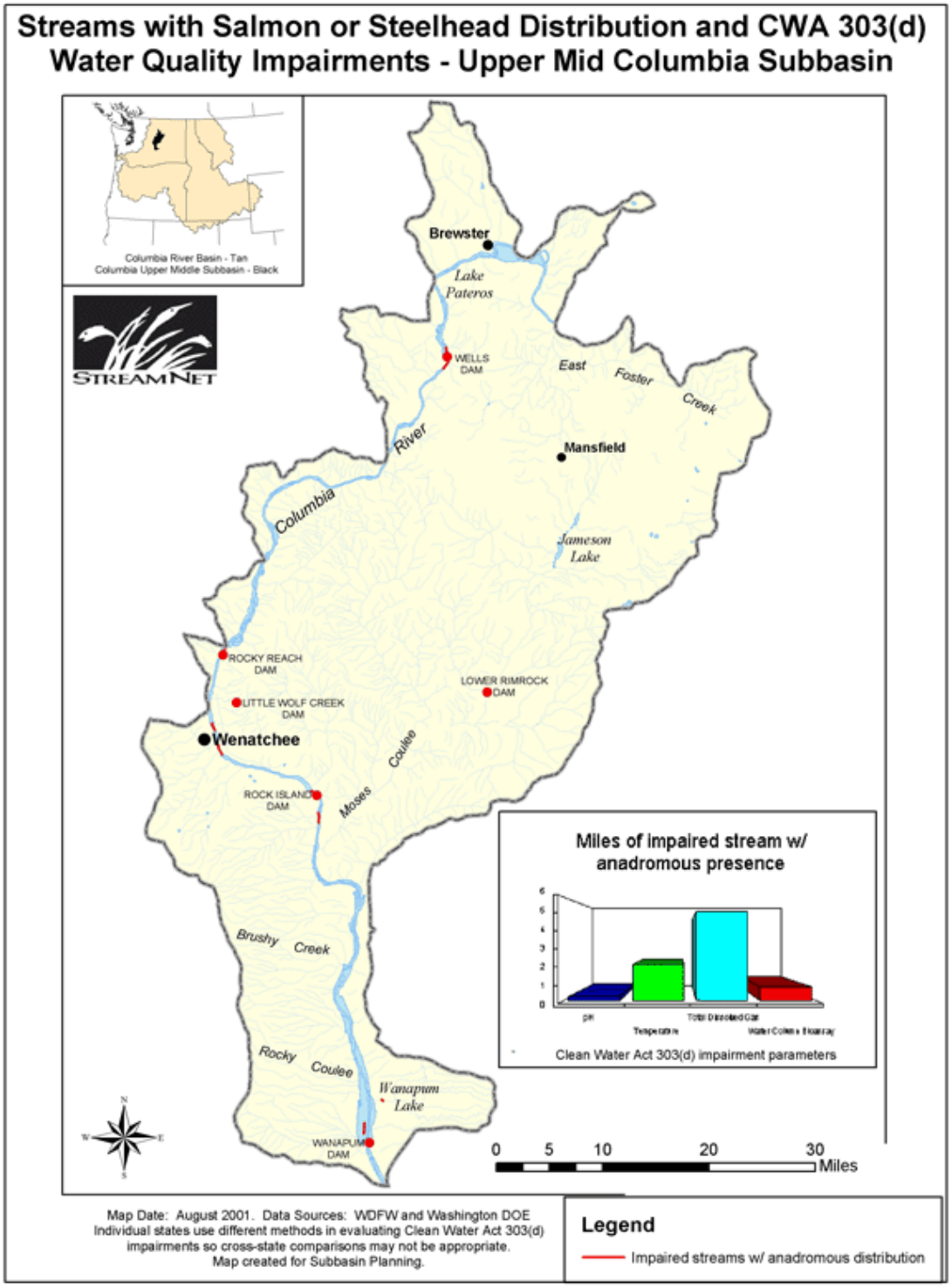

Figure 15: Map of 303(d) Water Quality Impairment Areas in the Columbia Upper Middle.

The Douglas Creek drainage encompasses approximately 131,852 acres and is the largest stream in the Moses Coulee watershed. Rainbow trout, dace, sculpins, and sucker

populations are present in the reach of Douglas Creek from Moses Coulee to just above the town of Douglas. Douglas Creek originates in the dryland wheat country just north of the town of Douglas. Flow is southeasterly, and in most years flows intermittently into the steep canyon of Douglas Creek. Once into the canyon, Duffy Creek, several small streams and ground water accretion contribute to a permanent flow year round. In most years surface flows seldom reach beyond the Palisades area.

High levels of nitrates and phosphates were observed in the upper reaches of the Douglas Creek watershed (Isasacson 1989). Conversely, water samples taken from the lower reaches were of higher quality. Bartu and Andonaegui (2001) suggested that the higher flows typical of the lower reaches of Douglas Creek may be acting to dilute the levels of nitrates and phosphates.

Foster Creek, a tributary that lies in the northeastern portion of the Columbia Upper Middle, provides limited habitat for fish, although brown trout have been observed in reaches that retain water in the Foster Creek drainage. The mouth of Foster Creek has been channelized and rip rapped with rock and wire mesh. A large gravel bed also exists at the mouth, most likely deposited during a major 1989 flood event (Bartu and Andonaegui 2001). At RM 1.5, an irrigation dam is located on top of a natural falls, that is a barrier to all fish passage. Instream flows come from yearly snowmelt and ground water supplies including natural springs. Upstream of the diversion dam there is direct solar exposure to the creek as well as low water flow (Bartu and Andonaegui 2001).

Wildlife Habitat

In the Columbia Upper Middle, a wide variety of wildlife species rely on specific habitats to provide their basic needs of food, water and cover for breeding, nesting, foraging, resting or hiding. Habitat types have changed dramatically since the mid-1800's according to data gathered by the Interior Biodiversity Information System (IBIS). Conversion of native habitat types to agricultural lands on the eastern plateau of the Columbia Upper Middle has led to a dramatic decline in upland vegetation types such as shrub-steppe, grasslands and juniper/mahogany woodlands, and altered riparian conditions as well. See Appendix B1 for a comparison of historic habitat types to current habitat types (**Error! Bookmark not defined.**).

There are nine Wildlife Areas (WA) managed specifically for wildlife within the Columbia Upper Middle. The Colockum WA, Quilomene WA, Whisky Dick WA are all located south of Wenatchee, Washington on the western side of the Columbia Upper Middle where the Cascade Mountains meet the Columbia River. The Swakane WA, Entiat WA, Chelan Butte WA and the Wells WA are located north of Wenatchee, Washington on the western side of the Columbia River. The Sagebrush Flats and Quincy WA's are located east of the Columbia River. These wildlife areas are managed by the State of Washington to protect and enhance certain wildlife species. A more detailed description for each of these areas and the management species of interest can be found in Appendix B2 (**Error! Bookmark not defined.**).

Upland Habitat

Land conversion from the shrub-steppe plant communities to monotypic agricultural or grazing units has been the primary cause for declines in many of the shrub-steppe obligate species that occur in the subbasin. At one time nearly 10.5 million acres of eastern

Washington was comprised of shrub-steppe habitat. Today, livestock grazing is the primary land use in the shrub-steppe, although more than half of the original habitat has been converted to crops (Bartu and Andonaegui 2001). Shrub-steppe habitat has also been converted to urban, commercial, and residential sites in addition to being altered by road construction, canal construction, and recreational development and use. This has led to fragmentation of the remaining shrub-steppe habitat into smaller patches that are degraded in quality (Dobler et al. 1996).

Cliffs and rock outcroppings within the subbasin are also very important and provide unique habitat for many birds and reptile species. Because vast areas of shrub-steppe habitat are virtually treeless, rock outcroppings provide critical nesting habitat for several raptor species. Rock outcroppings are also used by reptiles for thermoregulation. Barren ground such as steep canyon walls and cliffs can offer protective habitat for numerous species of wildlife. This may include nesting and roosting habitat, perches for hunting, and areas for hibernating in the winter.

Riparian Habitat

Within the Columbia Basin today, undisturbed riparian systems are rare (Knutson and Naef 1997). At lower elevations, agricultural conversions have led to altered stream channel morphology, loss of riparian vegetation and water withdrawals for irrigation. Large areas once dominated by cottonwoods, which contribute considerable structure to riparian habitats, are being lost. The implications of riparian area degradation and alteration are wide ranging for many wildlife populations that utilize these important habitats for breeding, nesting, foraging, and resting activities.

Embayments, which are shallow water habitats typically connected to the mainstem of the river via culverts or small channels, provide special wildlife values. In most embayments, water fluctuates less than in the river because of the elevation of the culvert or inlet channel. The magnitude of waves is also relatively low in embayments. The reduced water fluctuation and protection from wave action is beneficial to wildlife, directly and indirectly, and as a result those conditions promote diverse riparian and wetland vegetative communities. Embayments are of special importance to beaver and muskrats because of the reduced water fluctuations. Embayments also provide protected resting and roosting areas for waterfowl and other water birds, in addition to food resources.

Natural flooding regimes, which promote important ecological process in riparian areas, were altered by the development of hydropower on the Columbia River. In general, there has been a decline in the diversity of riparian habitats, but an increase in the amount of habitat due to the stability the upstream storage projects provide in periods of high flows. For some species of wildlife such as migrant or wintering waterfowl, suitable habitat has increased due to increased open water associated with the reservoirs.

Watershed Assessment

No formal watershed assessment has been done for the mainstem of the Columbia River between Wanapum and Chief Joseph dams; however there have been many studies done by the Mid-Columbia PUD's (GCPUD, CCPUD, and DCPUD), the Confederated Tribes of the Colville Reservation (CTCR), as well as other agencies and conservation groups. Many of the reports generated from these studies describe the area as well as the fish and wildlife resources. The Anadromous Fish Agreement and Habitat Conservation Plan

(HCP) (1998) for Wells, Rocky Reach, and Rock Island hydroelectric projects gives a description of the physical and biological features of the reservoirs associated with these projects. Grant County PUD is currently compiling information regarding physical and biological components of the Wanapum pool as part of the current relicensing process for the Priest Rapids hydroelectric project, which Wanapum Dam is part of. This information is not available at this time.

Detailed descriptions of habitat (aquatic and terrestrial), as well as surveys of fish and wildlife resources related to the Rocky Reach project are being compiled as part of the FERC relicensing process for Rocky Reach Dam. Water quality information was compiled by Parametrix (2001) in 2000. Duke Engineering conducted benthic analysis (2000), a fish habitat use survey (2001), mapping of wildlife and cover (2000) as well as an aquatic habitat report (2001). BioAnalysts (2000a) reported on sediment dynamics and Calypso Consulting (2000) described rare plants that are found along the reservoir. Additional watershed assessment information can be found in the application to raise the Rocky Reach reservoir (Chelan County PUD 1991).

Information on the Rock Island reservoir can be obtained from various documents that have been put together as assessments of impacts for various projects Chelan County PUD has undertaken. These documents include an EIS for a recreation plan (Chelan County PUD 1975), an environmental report for a recreation plan (Chelan County PUD 1978), and a revised exhibit S for the Rock Island pool fish and wildlife plan (Chelan County PUD 1984). Keesee (1989) reported on aquatic vegetation with an emphasis on the spread of Eurasian milfoil. Due to the close proximity of Rocky Reach and Rock Island dams (~20 RM), information used for the Rocky Reach pool raise application in 1991 (Chelan County PUD 1991) may also be pertinent for the Rock Island reservoir.

Other major watersheds in the Columbia Upper Middle are the Foster Creek and Moses Coulee watersheds(Table 4). Watershed assessments are in progress in the Foster Creek, Moses Coulee watersheds under the Engrossed Substitute House Bill (E.S.H.B) Watershed Management Act. A watershed assessment has not been done for the Colockum watershed. A limiting factors report by Bartu and Andonaegui (2001) for the Foster and Moses Coulee watersheds provides some watershed information for both the Foster Creek and Moses Coulee watersheds. Limited information regarding the Squilchuck, Stemilt, and Colockum drainages can also be found in a draft report by Andonaegui (2001).

Table 4. Major watersheds within the Columbia Upper Middle and associated drainage areas.

County	Watershed name	Drainage area (acres)
Douglas	Foster WRIA 50	213,639 (334 sq. miles)
Douglas/Grant	Moses Coulee WRIA 44	776,222 (1,213 sq. miles)

Limiting Factors

A formal limiting factors analysis has not been completed for the Columbia River in the Columbia Upper Middle. A list of potential limiting factors could include: 1) impacts from hydropower operations and development; 2) other human activities including agricultural practices, urban/suburban development; and 3) predation from native as well as non-native species. A limiting factors analysis for anadromous salmonid spawning and rearing habitat in the Foster Creek and Moses Coulee has been written by Bartu and Andonaegui (2001).

Fisheries-Columbia Mainstem

Hydropower

A potential limiting factor associated with hydropower development is downstream and upstream passage of anadromous salmonids. All hydroprojects in the Columbia Upper Middle currently have operational plans to aid the migrations of anadromous salmonids. Juvenile salmonid plans incorporate juvenile bypass facilities as well as spill programs. Adult migration is addressed by the operations of fishways at all hydropower projects. Presently there are juvenile salmonid survival studies being conducted by the three mid-Columbia PUDs in response to relicensing efforts (Grant PUD) or meeting proposed HCP standards (Chelan Count PUD and Douglas County PUD).

While most anadromous salmonids use the Columbia River as a migration corridor on the way to their natal streams, fall chinook use the mainstem Columbia River for spawning and rearing. It is unknown whether hydropower development and flow management practices have altered the physical habitat and species assemblages that form trophic relationships with fall chinook salmon. Flow regimes, geology of surrounding landscapes and longitudinal slope are important controlling variables in salmon habitats and operate at both the watershed and reach level (Imhof et. al 1996). In the Columbia River, flow regimes are highly regulated by the hydroelectric complex and seasonal discharge is influenced by water storage (Chief Joseph, Grand Coulee, and Canadian dams) and water use practices (Ebel et al. 1989). Upstream flood-control projects built since the 1940's have lessened the frequency and severity of high flow events that typically modify channels in less controlled circumstances. This change is important because rivers that flood frequently maintain different species and food webs from systems that are more stable (Stanford et al. 1996).

One effect Columbia River hydropower projects have had on water temperatures has been to delay the time when thermal maximums are reached and when cooling begins in late summer (BPA et al. 1994). It is not known at this time what these affects have had on spawning adults, emerging fry, or migrating juvenile salmonids. The upper temperature limit for Class A water set by the WDOE in the Columbia River above Priest Rapids Dam is 18 °C. This maximum is occasionally surpassed during the months of August through October. Effects related to infrequent exceedences of the WDOE temperature standards on juvenile and adult fish in the Columbia Upper Middle have not been evaluated.

With the transformation of the Columbia River into a series of reservoirs, the food webs that support juvenile salmonids and other resident fishes have been altered. Beak (MCMCP 1995) reported that the productivity in the Columbia Upper Middle reservoirs is now limited due to rapid flushing rates, cold temperatures, and lack of shallow water areas.

The food that is available in the Columbia Upper Middle reservoirs typically provides lower amounts of energy levels than that found in free-flowing areas such as the Hanford Reach (MCMCP 1995). Reduced productivity in the reservoir may affect feeding efficiency of fishes (Rondorf and Gray 1987) but whether or not this acts as a limiting factor in the Columbia Upper Middle is not known. Exotic fish species such as the carp, have established populations in slackwater areas of the reservoirs. However, whether or not their presence is a limiting factor for salmonids is unknown as well.

Predation

With the addition of large reservoirs associated with major hydroelectric projects, predator-prey relationships in the Columbia Upper Middle have changed. The introduction of non-native predator fish species, increase in populations of indiginous predator fish species, and the immigration of diving piscivorous birds into the Columbia Upper Middle are potential limiting factors for juvenile salmonids in the Columbia Upper Middle

Smallmouth bass and walleye are not native to the Columbia Upper Middle region of the Columbia River. They were introduced into the Columbia River system in the 1940's and 1950's to provide sportfishing opportunities (MCMCP 1995). Both species are known to prey upon juvenile salmonids when the opportunity presents itself. Research has shown that smallmouth bass however, are responsible for only a small amount of the predation on juvenile salmonids in Columbia River reservoirs (Rieman et al. 1991). Individual walleye, however, consume as many juvenile salmonids as individual northern pikeminnow (Rieman et al. 1991). Walleye are less abundant than northern pikeminnow, thus their impact on juvenile salmonids is believed to be much less (Beamesderfer and Rieman 1991).

Northern pikeminnow are native to the Columbia River and are abundant and widely distributed. Loch et al. (1994) reported that northern pikeminnow accounted for 75 percent of the total catch of predator fish in the Columbia Upper Middle region of the Columbia River in. Their widespread distribution and abundance combined with the knowledge that northern pikeminnow can consume up to 8% of the annual total number of outmigrating juvenile salmonids (Beamesderfer et al. 1996) makes them a predation threat in the Columbia Upper Middle to juvenile salmonids.

Caspian terns and double-crested cormorants have been immigrating into the Columbia Upper Middle section of the Columbia River in recent years (Todd West, Chelan County PUD, personal communication). Nesting periods for these birds is generally during the juvenile salmonid outmigration. Studies conducted in the lower Columbia from April to July on the diet composition of both bird species found that up to 95.3 percent of the double-crested cormorants diet and 99.4 percent of the terns diet by mass consisted of juvenile salmonids (Roby et al. 1997). Data from PIT tag recovery operations at nesting sites found near the Columbia Upper Middle showed that nearly 5 percent of the PIT tagged juvenile steelhead and 4 percent of PIT tagged juvenile coho tagged for the Rocky Reach fish bypass evaluations were consumed by avian predators before they reached the ocean in 2001 (unpublished data, Chelan County PUD 2001). PIT tag recovery operations in the lower Columbia River also showed that 15% of the PIT tagged juvenile steelhead that reached the estuary in 1998 were preyed upon by piscivorous waterbirds (Collis et al. 2001). Gulls are also increasing in the Columbia Upper Middle and they feed

opportunistically on the food source that is available at a given time. During salmonid outmigration in the Lower Columbia, juvenile salmonids were found to comprise 48.9% of gulls diet by mass (Roby et al. 1997). This information indicates that the immigration of piscivorous birds into the Columbia Upper Middle may be a limiting factor for juvenile salmonid survival.

Fisheries-Foster Creek and Moses Coulee Watersheds

In 2001, Bartu and Andonaegui completed a limiting factors report for salmon and steelhead habitat in the Foster and Moses Coulee (including Douglas Creek) watersheds.

Foster Creek Watershed

Loss of access to spawning and rearing habitat on Foster Creek was identified as a potential limiting factor for migrating fish. At approximately RM 1.5 an irrigation dam stands in a place where a natural falls existed. The irrigation dam is 18 inches taller then the original falls and precludes all fish passage past this point. Surveys have been conducted in the stretch of water upstream of this dam and no anadromous salmonid species were found. Low water flows and direct solar exposure also make it questionable whether or not salmonids could survive in this stretch if given access to it. The lower 1.5 miles of Foster Creek may be blocked off to anadromous salmonids due to a 1989 flood that possibly reshaped the alluvial fan at the mouth and may limit or completely block off access to this stretch. Low water may also block access to this stretch of river.

Poor quality riparian habitat in the East Foster Creek drainage may also be a limiting factor for fish. The area is largely devoid of large woody vegetation and in several places only the trunks of dead streamside trees are standing. On the mainstem of Foster Creek, above the irrigation dam, low flows and high water temperatures predominate. Although historical levels of riparian shading in this section of the Foster Creek were not mentioned in Bartu and Andonaegui (2001), lack of present day riparian shading is thought to account for increases in water temperatures. In the winter, runoff is high and the water is extremely muddy, carrying increased sediment loads associated with loss of riparian vegetation.

Water quality monitoring has been conducted in the East Foster Creek drainage. Various soil and water problems were identified in this area. Eroding stream banks, channel headcutting, and non-point-source fluvial erosion of croplands and rangelands have all contributed increased turbidity in the creek. The Foster Creek drainage receives little yearly precipitation with most occurring during winter months. Aside from spring snowmelt, flows in the Foster Creek are generally sustained by groundwater discharge from springs. Some sections of the creek have sub-surface flow. This could restrict any possible dilution of chemical contaminants. It is possible that certain chemical products such as naturally occurring salts and organic materials as well as non-natural substances such as pesticides and herbicides may appear in high concentrations in Foster Creek due to the limited precipitation and flows. Evidence of contamination, if any in Foster Creek however, is poorly recorded or not available.

Moses Coulee Watershed

Under normal runoff conditions anadromous fish most likely cannot access to Douglas Creek for spawning activities. During a high runoff period, steelhead could access Douglas

Creek from Moses Coulee Creek, but there is a natural falls barrier further upstream in Douglas Creek that would hinder further upstream migration regardless of water flows. There is no information regarding the presence or absence of substrate suitable for anadromous fish spawning in Douglas Creek. Resident rainbow trout are present and self-sustaining in the creek; therefore rearing habitat would probably not be a limiting factor for juveniles. Possible interactions (predation, competition for food supply and cover) between resident rainbow trout and juvenile steelhead were also not discussed in the limiting factors analysis.

Water quality sampling in Douglas Creek in 1989 revealed high levels of nitrates and phosphates. A large percentage of land in the watershed is routinely fertilized for agricultural use and fertilizers contain these two substances. Routine application of these chemicals as well as the arid climate allows for little dilution of the chemicals, which may account for the elevated levels observed in Douglas Creek. Douglas Creek is a small stream receiving most instream flow from springs. Two irrigation diversions are located approximately 0.25 miles from where the creek enters Moses Coulee. During the dry summer months, the lower reach is dewatered with flows either being diverted or going subsurface. Instream flows can intermittently return with a summer thundershower or during high spring run-off events, and the flow during those events can make it to the Columbia River.

Wildlife Limiting Factors

Hydropower System Development and Operations

The development and operation of the hydropower system has resulted in widespread changes in riparian, riverine, and upland habitats in the Columbia Upper Middle. Several habitat types have been reduced or altered while other habitat types, such as open water areas have increased as a result of hydropower. Effects related to hydropower development and operations on wildlife and its habitats may be direct or indirect. Direct effects include stream channelization, inundation of habitat and subsequent reduction in some habitat types, degradation of habitat from water level fluctuations and construction and maintenance of power transmission corridors. Indirect effects include the building of numerous roads and railways, presence of electrical transmissions and lines, the expansion of irrigation, and increased access to and harassment of wildlife.

Land Management/Human Disturbance

Agriculture has transformed much of the surrounding area from shrub-steppe habitat to irrigated farmland. This transformation has eliminated some lowland wintering range and has resulted in the loss of habitat and native vegetation that once provided food and cover for the native wildlife. Wildlife abundance has been adversely affected by irrigated agriculture and subsequent reduction in habitat diversity.

Livestock grazing in the Columbia Upper Middle can result in the reduction of cover that is used by wildlife such as rodents, birds, deer and elk. In grazing areas near water sources, the riparian vegetation is often trampled down, soils become compacted and this results in a loss of habitat for wildlife that utilize these areas. Bank erosion may also be increased with riparian livestock grazing and this results in increased sedimentation in streams.

Residential/urban sprawl has resulted in the loss of large areas of habitat and increased the harassment of wildlife. Specifically, sprawl in the Columbia Upper Middle has eliminated large areas of lowland wintering range of native wildlife. As the human population continues to grow, residential areas continue to spread into once wild areas that may have been prime habitat for wildlife. Disturbance by humans in the form of highway traffic, noise and light pollution, and various recreational activities have the potential to displace wildlife and force them out of their native areas or forces them to use less desirable habitat.

Exotic Species

The spread of non-native plant and wildlife species poses a threat to wildlife habitat quality and to wildlife species themselves. For example, noxious weeds can threaten the abundance of native plant species fed upon by wildlife, and introduced wildlife species can compete with native wildlife for resources, potentially leading to the decline of the native species. Eurasian water milfoil surveys conducted by Chelan County PUD during the mid 1980s found that milfoil is infiltrating native aquatic weed beds and displacing these native plant species. Diving ducks do not feed on milfoil, but they do feed on the aquatic plants which the milfoil is displacing.

Limiting Factors Conclusion

The development of hydropower in the Columbia Upper Middle has changed the habitat for both fish and wildlife. Specifically, the Columbia Upper Middle has been changed from a lotic, or free flowing river system to a more lentic environment. Whether these changes act as limiting factors has not been determined. Plans have been put into effect by all three Columbia Upper Middle PUD's that try to minimize and offset any potential losses to fish and wildlife from the operation of these projects. The introduction or increased abundance of non-native piscivorous fish and birds and the proliferation of indiginous predatory fish pose a threat to juvenile salmonids. Recent studies indicate that immigrating piscivorous birds can limit juvenile salmonid survival in the Columbia Upper Middle (Collis et al. 2001). Limiting factors for fish in the Moses Coulee and Foster Creek watersheds are generally related to low water quantity and lack of riparian habitat. Wildlife can be limited by an overall degradation of habitat. Increased population and related development continues to decrease suitable wildlife habitat and can damage riparian areas. Several wildlife management areas have been set aside to protect and provide habitat for many wildlife species.

Artificial Production

There are six hatcheries located on the mainstem Columbia River between the Wanapum Dam forebay and the Chief Joseph Dam tailrace. These hatcheries primarily rear salmon or steelhead smolts that are acclimated and released into tributary streams in nearby subbasins, not into the Columbia Upper Middle itself. A summary of hatchery operations in the Columbia Upper Middle can be found in Table 5.

Eastbank Hatchery is the central hatchery operation for the Rock Island Fish Hatchery Complex (RIFHC). The RIFHC originated from the Rock Island Settlement Agreement (1989) as part of a comprehensive mitigation agreement between the Chelan County Public Utility District, and co-managing federal, state and tribal entities. The

primary goal of the RIFHC is to mitigate for lost adult production due to mortality of juvenile salmon migrating through Rock Island Dam.

Table 5. Hatcheries located in the Columbia Upper Middle.

Columbia River Mainstem Hatcheries	Management Agencies	Species Reared For Mainstem Releases
Rocky Reach Hatchery Annex	WDFW/Chelan County PUD	Summer Chinook
Eastbank Fish Hatchery	WDFW/Chelan County PUD	Summer Chinook
Turtle Rock Hatchery	WDFW/Chelan County PUD	Summer Chinook
Chelan Falls Hatchery	WDFW/Chelan County PUD	Kokanee and Trout
Wells Hatchery	WDFW/Douglas County PUD	Summ./Fall Chinook
Colville Tribal Hatchery	CTCR	unknown

Satellite rearing facilities associated with the RIFHC include: the Lake Wenatchee net pens; Chiwawa River Ponds; Dryden Ponds; Carlton Ponds; and Similkameen Ponds; as well as broodstock collection facilities at Dryden Dam and Tumwater Dam. The RIFHC is funded by Chelan County PUD and currently operated by WDFW.

The Chelan Falls Fish Hatchery is also funded by Chelan County PUD and operated by WDFW. This hatchery produces summer steelhead trout, rainbow trout, resident cutthroat trout and kokanee salmon. The summer steelhead are transferred to Turtle Rock Ponds for additional rearing before final release into tributaries in other subbasins. The rainbow and cutthroat trout and kokanee are reared and planted into local lakes including Lake Chelan.

Wells Hatchery is funded by Douglas County PUD and operated by WDFW for the production of summer and fall chinook salmon, summer steelhead and rainbow trout. Rainbow trout and fall chinook salmon are planted into local lakes including Lake Chelan (MCMCP, 1995). Summer steelhead are released into upriver tributaries upstream of Wells Dam rather than directly into the Columbia River.

The only direct mainstem Columbia River releases between the Wanapum Dam forebay and the Chief Joseph Tailrace occur from the Turtle Rock Ponds near Rocky Reach Dam and at Wells Hatchery immediately downstream of Wells Dam. Hatchery Genetic Management Plans (HGMP's) for these hatcheries will be attached to this document.

The Colville Tribal Hatchery rears only resident trout and does not contribute fish directly to the mainstem Columbia River.

Existing and Past Efforts

Chelan PUD

Chelan County PUD has conducted a large number and variety of fish and wildlife studies. Due to the scope of the reports that have been generated, literature citations are included in Appendix C1. Below is a general summary of the types of studies that have been or are

currently being conducted. Citations in Appendix C1 are categorized under these same headings.

Rocky Reach Fish Passage/Guidance

Between 1985 and 1994, Chelan PUD studied the feasibility of using rotating and passive diversion screens in the intakes of Rocky Reach Dam to guide fish away from turbines and around the dam. Both forms of screens were deemed unsuccessful in providing satisfactory fish guidance efficiencies (FGE). Since 1995, Chelan PUD has tested prototype surface collectors designed to guide juvenile salmon and steelhead away from turbine intakes at Rocky Reach Dam. The first prototype (surface collector 1; SC1) was tested in 1995 to see if the concept of surface collection was feasible. Approximately 900,000 fish were guided through the prototype, and the District concluded the concept could work. Between 1995 and 1999, several changes to the prototype bypass system were made. The changes included extending the floor and adding a sloping wall at SC1, altering the SC1 entrance configuration, adding a Unit 1 gatewell collector, adding a second surface collector (SC2) and a Unit 2 gatewell collector; altering the SC2 entrance configuration, adjusting diversion screen hydraulics; and improving hydraulics within both surface collectors.

Except for altering the entrance configuration at SC2, the physical structure of the surface and gatewell collectors remained unchanged from 1999 to 2001. Since 1995, progress has been made in the fish passage efficiency (FPE; PIT tags) and passage route efficiency (PRE; radio telemetry) of the juvenile bypass system. Progress has also been made in decreasing fish descale and injury due to modifications of the diversions screens which have created favorable screen hydraulics.

Rock Island Fish Passage/Guidance

In 1988, Chelan PUD installed and tested the fish guidance efficiency of bar screens on Powerhouse (PH) 2, but the guidance was not very successful. After further investigation and model testing, independent consultants found that the velocities at PH2 were too high to allow the prototype screens to guide fish efficiently.

Between 1992-1994, the FGE of various forms of fish guidance equipment were tested at PH1. The FGE for this equipment was promising, however, at the most effective screen operating conditions some early migrant sub-yearling chinook were impinged on the screen. At the joint request of the Fisheries Agencies and Tribes, Chelan PUD has agreed to suspend further modification, testing or installation of the prototype fish guidance device at Rock Island PH1.

It was determined that the most efficient method of fish passage at Rock Island was via spill. In 1996, three spill gates were modified by cutting notches into existing spill gates and tested the fish passage efficiency of the notched gates. It was determined that these notched gates had a higher fish/flow ratio than full gates. Because of the higher fish/flow ratio of notched gates, six more notched gates were constructed and installed in 1997. These notched spill gates remain the primary means of non-turbine fish passage at Rock Island Dam at this time.

Rock Island Trap

In coordination with the Fish Passage Center (FPC), Chelan PUD began a smolt-monitoring program at Rock Island Dam in 1985. This program was designed to index the

daily number of emigrating juvenile chinook, sockeye, coho, and steelhead collected to report the numbers of adipose fin clipped, floy tagged, freeze branded, visual implant elastomer tagged, and previously passive integrated transponder (PIT) tagged juvenile salmonids by species. A PIT tagging program was implemented with a goal of tagging a random sample from the middle 80% of the emigration of yearling and subyearling chinook, sockeye, and hatchery and wild-origin steelhead. The data collected under these programs allows for the comparison and evaluation of year to year migration timing, magnitude, and travel time of different species and races of juvenile salmonids, both naturally and hatchery produced. Both programs are ongoing.

Gas Abatement at Rock Island

Spill has been shown to be the most effective means of non-turbine fish passage at Rock Island. However, spill for fish passage has been shown to increase levels of TDG in the river below Rock Island. Therefore, it has become necessary to develop a gas abatement program at Rock Island Dam to spill for fish passage and remain in compliance with WDOE water quality standards. After a considerable modeling effort, the District constructed a prototype spill deflector ramp for installation below spillbay 29 in Sept. 2000. The TDG characteristics of the prototype were tested prior to and after installation of the prototype flow deflector. Biological testing was done after installation of the prototype to estimate potential impacts of the ramp on juvenile salmonid survival. Although biological testing of the prototype flow deflector indicated that it was safe for fish passage, the physical testing indicated that it was only moderately effective as a gas abatement device. District Staff feels that the gas abatement characteristics of the prototype could be improved by reducing the submergence of the prototype. A new prototype with less submergence will be installed and tested in the Fall of 2001.

Survival Studies

Early survival studies were conducted in the mid-Columbia using freeze brand technology in the early to mid-eighties. Biological problems encountered during the testing and problems in obtaining representative data, caused the abandonment of these studies. Although PIT tag technology was developed and used to estimate the survival of fish in the Snake River in the early to mid 1990's, it was not possible to use this technology on the mainstem of the Columbia until 1998 when PIT tag detectors were installed at John Day and Bonneville dams. In 1998, Chelan and Douglas PUD's began survival studies in the Columbia Upper Middle. In 1999, PIT tags and radio tags were used to estimate the survival of hatchery and run-of-river steelhead passing Rock Island. Radio tags were used to estimate the survival of run-of-river steelhead at Rocky Reach in 1999.

In 2000, Chelan County PUD attempted to estimate the survival of run-of-river chinook and steelhead at Rocky Reach using radio tags. At Rock Island in 2000, PIT tags and radio tags were used with promising results. A pilot study was initiated to determine the viability of using acoustic tags to estimate survival 2001.

Wildlife Studies

Bald eagles are a threatened species that occur in the Columbia Upper Middle area and could potentially be affected by the presence of people and their related recreational and development activities. With this in mind several bald eagle studies have been conducted in this area. Studies include perch site use in eastern Washington, winter abundance in

eastern Washington, effects of recreational use on bald eagles, and biological analyses done in preparation of projects that include wastewater facilities, expansion of resort properties, and effects of hydropower operational changes.

Chelan County PUD currently conducts annual wood duck and goose nesting surveys. Nesting structures are provided for both species in the Rock Island reservoir with nest use and reproductive success recorded in annual reports (Goose nests since 1975, wood ducks since 1983). In the Rocky Reach reservoir goose nests have been maintained and surveys conducted and reported on since 1982.

Since 1999, Chelan PUD has been working in a multi-agency effort in order to develop a mule deer carrying capacity model for wintering areas purchased by Chelan PUD. The entire County of Chelan will be included in the study. However, primary focus for deer marking and other field studies will be on those lands purchased by the PUD and managed by the state. The lands are situated along the Columbia River breaks and include the Swakane, Entiat, Oklahoma Gulch, Chelan Butte, Navarre Coulee and Knapp Coulee habitat management areas. The objectives include gaining information on population dynamics and regulation, and landscape level habitat use patterns. This information will be used to determine optimum mule deer carrying capacities for these areas that should lead to recommendations for habitat and other management methods to achieve those levels.

Total Dissolved Gas

Total dissolved gas monitoring began at both Rocky Reach and Rock Island dams in 1982 with the installation of monitors in the forebay of each hydroproject. To measure compliance with DOE water quality standards, the District began monitoring TDG in the tailrace of each project in 1996. Total dissolved gas monitoring is ongoing at both projects.

Gas Bubble Trauma-Rocky Reach Dam

The District began examining fish for gas bubble trauma (GBT) in 1997 as an independent project and continued through 2000.

Gas Bubble Trauma-Rock Island Dam

In coordination with the Fish Passage Center (FPC), the District began GBT monitoring in 1995. Monitoring at Rock Island is ongoing and is currently being conducted by WDFW personnel.

Turbine Survival Testing-Rocky Reach Dam

Chelan County PUD first utilized the HI-Z Turb'N Tag (Normandeau) recapture technique (balloon tag) in 1994. In 1996 balloon tags were used to estimate the survival probability and study the condition of hatchery chinook salmon passing through two turbines at three power loads at Rocky Reach. Fish were released at two depths into Unit 5, an older Kaplan turbine, and Unit 6, recently refit with a new blade design. The primary purpose of the study was to assess fish survival and condition differences between the new and old runner designs. The overall average fish survival was the same between turbines, although the estimated 48 hour survival probabilities varied with depth, power load, and turbine.

Turbine Survival Testing-Rock Island Dam

In 1997, the survival of hatchery chinook salmon smolts through PH1 Units 4 (Nagler turbine) and 5 (conventional Kaplan) and PH2 Unit 5 (Bulb turbine) at Rock Island Dam

was estimated. Like the study at Rocky Reach, balloon tags were used. The primary objective of the investigation was to provide a comparative assessment of immediate fate of salmonid emigrants entrained in different turbine types for potential use in developing mitigation strategies at the project.

Fish Behavioral Studies

Behavioral studies have been conducted on anadromous juvenile salmonids by Chelan PUD. Early studies involving radio telemetry and passive acoustics were able to tell that a fish passed the project but did not provide data regarding the 3-dimensonal position of the fish. The active acoustic tags that have been used in recent studies have been able to track the fish 3-dimensionally within a meter of its actual location giving a much more precise passage route description. The studies lead to a better understanding of fish distribution and behavior as they come into the direct influence of Rock Island and Rocky Reach dams under a variety of hydraulic conditions. The information gained from the studies has been used to help develop and operate efficient bypass systems.

Pacific Lamprey

A status report for the pacific lamprey in the Mid-Columbia Region (BioAnalysts 2000c), summarizes information on the biology of pacific lamprey in the Mid-Columbia. The report integrates and synthesizes the information, with special reference to dam passage. Information includes abundance and distribution, descriptions of fresh and saltwater life history characteristics, followed up by a discussion on possible causes for the species population decline.

Resident Fish Projects

Northern Pikeminnow

Northern pikeminnow are an indigenous fish species that prey on juvenile salmonids. Since 1994 and 1995 northern pikeminnow reduction programs have been instituted at Rocky Reach and Rock Island dams respectively. The method of removal has been hook and line angling using artificial and natural baits. Over the years the size and numbers of fish caught have been decreasing showing a potential impact on recruitment. In 1999 movements of northern pikeminnow upstream and downstream of Rock Island Dam were studied using radio telemetry. The objectives of the study were to determine were the fish congregate during pre, peak, and post spawning periods.

A report (BioAnalysts 2000b) describing the fish species assemblages within the Rocky Reach project area and the effects of resident predators on anadromous fish in this area was completed in 2000. The report reviews and summarizes existing information. The report focuses on piscivorous fish species, though a brief discussion on avian predators and their presence in the area was also included.

Bull Trout

Currently a bull trout movement/migration study is being conducted. The project area includes the Columbia River from the Priest Rapids tailrace to the tailrace of Chief Joseph Dam. Important bull trout rearing basins (i.e., Wenatchee, Entiat, Methow, and basins) are also included. Radio telemetry is being used to track the movements and migrations of bull trout in the project area. If possible, the movements and distribution of the bull trout will be correlated with the operations of the PUD hydroelectric projects.

Status Reports for Anadromous Salmon

Status reports for summer/fall chinook salmon, spring chinook salmon, sockeye salmon, and summer steelhead in the mid-Columbia were prepared for the Chelan, Douglas, and Grant County PUD's by Don Chapman Consultants in the mid 1990's. The reports summarize information on the biology, ecology, and status of each species.

Douglas County PUD

No information on past and present efforts was received.

Grant County PUD

Current fish and wildlife programs for the Wanapum Development include: fish spill for downstream anadromous fish passage, installation of flow deflectors to reduce TDG levels, TDG monitoring, gull wiring and northern pikeminnow removal projects to reduce predation on salmon and steelhead smolts, and the operation and maintenance of 2 fishways for upstream passage. Most Grant PUD mitigation efforts and other programs are located outside of the geographical scope of this summary.

Conservation Reserve Program

Conservation Reserve Program (CRP) is a federal program with contracts of at least 10 years that resulted in the 'set-aside' of dryland cropland in permanent vegetative cover. These habitats were planted with perennial grasses starting in the mid-1980's. Although most of the earlier CRP was planted in a monoculture of crested wheatgrass (*Agropyron cristatum*), most of the recent CRP includes a diversity of native grasses, forbs, and shrubs. Research has indicated that CRP may benefit key species of wildlife within the Columbia Upper Middle including sage grouse and sharp-tailed grouse (Schroeder et al. 2000a, b). This benefit appears be due, in part, to a synergistic relationship between CRP and native shrub-steppe habitat. The quality of CRP appears to be improved when it's adjacent to shrub-steppe and the quality of shrub-steppe appears to be improved when the remaining native habitat is interconnected by CRP.

Foster Creek Conservation District

Douglas County Watershed Planning Association

The Association has established an action plan, is conducting a watershed assessment, and will complete a comprehensive watershed management plan that addresses water quantity, instream flows, water quality, and fish habitat issues in Douglas County.

Douglas County Habitat Conservation Plan for the Agricultural Community

The Habitat Conservation Plan (Plan) will offer protection to private landowners in exchange for a commitment to manage land in a way that minimizes impacts to habitat, fish, and wildlife. 63 species have been identified to be included in the Plan based on their listing status under the ESA or by their state of Washington designation. Species identified include the spring chinook and summer steelhead (both ESA listed) and the bull trout (federally threatened). Two working committees (Private Landowner and Technical Advisory) have been established to develop and negotiate the Plan document. Committees have defined management activities of orchard, dryland cropping, and grazing of range land and documented impacts on species of concern. Species accounts are being developed to identify habitat requirements. Committees have developed goals and objectives to address the agricultural impacts.

Washington Department of Ecology

WDOE has ongoing streamflow and water quality monitoring and management on the mainstem Columbia River. Instream flows for the mainstem Columbia River were first established in 1980 under the Instream Resources Protection Program (codified in Chapter 173-563 WAC). From 1980 to 1997, any water rights issued were made subject to interruption should Columbia River Instream Flows not be met. In response to the federal protection of salmonids in the Columbia and Snake River Systems through Endangered Species Act listings in December of 1991, in the spring of 1992 the WDOE issued an order placing a moratorium on further allocation of water from the Columbia River. Legislative action in 1997 eliminated Columbia River instream flows and moratorium for all future water resource decisions. However, streamflow monitoring continues for the management of hundreds of water use authorizations with priority dates between 1980 and 1997. In water year 2001, enforcement and other management actions were taken by the WDOE as, for the first time, instream flows were not met. Monitoring and management of streamflow will continue as these water rights will continue to be subject to the 1980 instream flows. WDOE and partner governments and agencies are monitoring many water quality attributes on the mainstem Columbia River. Region 10 of the U.S. Environmental Protection Agency is leading efforts to address temperature listings under section 303-d of the Clean Water Act listings for temperature through a Total Maximum Daily Load (TMDL) process. WDOE and Oregon Department of Environmental Quality (ODEQ) are leading the efforts to address TDG on the mainstem Columbia River though a total TMDL process.

The National Marine Fisheries Service (NMFS) in the Columbia River biological opinion (bi-op) and the Upper Columbia Regional Technical Team (RTT) in its July 2000 report and draft Regional Recovery Strategy recognize that the establishment and protection of instream flows in the Upper Columbia is of paramount importance. WDOE agrees that instream flows must be established and protected to enable restoration of salmonids and other instream values. However there are not adequate state resources to address instream flows throughout the province. Therefore, WDOE is concentrating its efforts on updating the mainstem Columbia River management program, and is assisting groups organized under the Watershed Planning Act with development of instream flow analyses and plans as part of their watershed plans.

Washington Department of Fish and Wildlife

Upland Wildlife Restoration

Fifty years ago the Washington Department of Fish and Wildlife implemented the Upland Wildlife Restoration Program in response to the loss of wildlife habitat occurring on private agricultural land. The program was and still is based on building partnerships with farmers and ranchers to restore and enhance wildlife habitat on private property. Incentives to landowners include the Department providing materials and labor for enhancement projects. Landowners enter into 10 - 15 year agreements with Fish and Wildlife to protect the enhancements and to allow reasonable public access for wildlife related recreation. In Douglas County 196 landowners have entered cooperative agreements for habitat enhancement or protection and recreational access on over a half million acres.

Wildlife Areas

The Washington Department of Fish and Wildlife manages nine areas in the Columbia Upper Middle for wildlife habitat. Description's of these areas and the wildlife in these areas are covered in Appendix B2.

Bonneville Power Association Funded Efforts

Sagebrush Flat Wildlife Area

The 3,487 hectare (8,616 acres) Sagebrush Flat Wildlife Area (SFWA) is located in Douglas County, Washington and is comprised of four separate parcels (Units) owned and/or managed by the Washington Department of Fish and Wildlife. The SFWA includes the 1,515 hectare (3,740 acres) Sagebrush Flat Unit, the 130 hectare (320 acres) Dormaier Unit, the 893 hectare (2,206 acres) Chester Butte Unit, and the 951 hectare (2,350 acres) West Foster Creek Unit.

The Bonneville Power Association (BPA) funded Sagebrush Flat Wildlife Area mitigation project was included in the Crab Creek Sub-basin Summary because only one Management Unit (West Foster Creek) lies within the Mainstem Columbia Sub-basin (three of the four wildlife area Management Units are located within the Crab Creek Sub-basin). As a result, only a cursory description of the wildlife area is included in this document. A project proposal to continue BPA funding of operation and maintenance (O&M) and enhancement activities on the Sagebrush Flat Wildlife Area was submitted to BPA under the Columbia Plateau project proposal solicitation process. Detailed information on the Sagebrush Flat Wildlife Area mitigation project is located in the Crab Creek Sub-basin Summary and on the Columbia Basin Fish and Wildlife Authority (CBFWA) website at: www.cbfwa.org.

Present Subbasin Management

Existing Management

Various federal and state agencies, tribes, and PUD's within the subbasin have developed plans to protect and manage fish and wildlife and their habitats. Local governments have an increasing role in fish and wildlife management issues through current, and changes in, Washington State law. Several planning documents, policies, and management guidelines are briefly described below.

Federal Government

United States Army Corps of Engineers

The USACE owns 640 acres directly downstream of Chief Joseph Dam, part of a larger block of land that extends up to Grand Coulee Dam. The land and waters downstream of the dam are managed according to federal and state legislation, and USACE policies. The USACE is the responsible agency for Section 404 (of the Clean Water Act) permits for a variety of activities that affect waterways (including most wetlands). In Washington State this is typically through the use of a Joint Aquatic Resource Permit Application (JARPA)- a permit that includes State and Federal agency review.

United States Department of the Interior, Bureau of Land Management

The Bureau of Land Management (BLM), in accordance with Federal Land Policy and Management Act of 1976 (FLPMA), is required to manage public lands to protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use. The BLM is required by the Clean Water Act to ensure that activities on administered lands comply with requirements concerning the discharge or run-off of pollutants.

The BLM manages 73,014 acres in the UMM subbasin. There is an additional 6,227 acres of private lands, and 1,920 acres of WA DNR lands that the BLM will acquire through two land exchanges in the fall of 2001. The BLM lands that will be traded in these exchanges are outside of the Columbia Upper Middle boundary, so there will be a net increase of BLM lands within the Columbia Upper Middle. Most of the BLM lands within the UMM subbasin are shrub-steppe habitat. The Spokane Resource Management Plan provides the general management direction for BLM administered lands within the subbasin as required by FLPMA.

United States Department of the Interior, Bureau of Reclamation

No information on present subbasin management was received.

United States Department of the Interior, Bureau of Indian Affairs

The U. S. Bureau of Indian Affairs (BIA) possesses limited regulatory authority within the Colville Reservation or elsewhere in the subbasin. One area where the BIA has specific authority is over the approval of leases of trust lands within the Reservation, and in acting on such leases the BIA is under a trust responsibility to ensure that fish and wildlife conditions are not impaired. In addition, all federal agencies have a trust responsibility to ensure that their actions do not harm the rights and interests of the Confederated Tribes of the Colville Reservation (CTCR) in the anadromous fish resources of the subbasin.

United States Department of the Interior, 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. The USFWS reviews and comments on land use activities that affect fish and wildlife resources such as timber harvest, hydroelectric projects, flow alterations, and dredging and filling wetlands. The biological opinion for bull trout specifies needed actions for their recovery. The federal Migratory Bird Act also protects migratory birds and their habitats.

National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) administers the ESA as it pertains to anadromous fish only. Two listed ESU's migrate through the mainstem: upper Columbia River spring chinook salmon and upper Columbia River steelhead. Through Biological Opinions, Recovery Plans, and Habitat Conservation Plans for federally listed species, appropriate watershed protection and restoration measures are identified.

Under Sections 7 and 10 of the ESA, "take" of listed species is prohibited and permits are required for handling. Special permit applications have been pursued for

research and management activities in the Columbia Upper Middle. Recovery actions for listed species also require Fisheries Management and Evaluation Plans.

Biological Opinions, recovery plans, and habitat conservation plans for federally listed fish and aquatic species help target and identify appropriate watershed protection and restoration measures.

The recent Federal Columbia River Power System (FCRPS) Biological Opinion and the Basinwide Salmon Recovery Strategy (All-H Paper) contain actions and strategies that are specific to the Columbia Upper Middle. Other aspects of hatchery and harvest management apply as well. Action Agencies are identified that will lead fast-start efforts in specific aspects of restoration on nonfederal lands.

Bonneville Power Administration

The Bonneville Power Administration has mitigation responsibility for fish and wildlife restoration under the Fish and Wildlife Program of the Northwest Power Planning Council as related to hydropower development. It is also accountable and responsible for mitigation related to federal Biological Opinions and Assessments for recovery of threatened, endangered, and sensitive species. The recently released FCRPS Biological Opinion calls for the BPA to expand habitat protection measures on non-federal lands. BPA intends to rely on the Council's program as its primary implementation tool for the FCRPS BiOp off-site mitigation requirements.

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) grants licenses to the three public utility districts that operate the hydroelectric projects in the Subbasin. Details concerning each of these licenses is described below, under each PUD.

United States Department of Agriculture

The U.S. Department of Agriculture (USDA) oversees several conservation programs to help solve natural resource concerns. The Environmental Quality Incentives Program (EQIP), established in the 1996 Farm Bill, provides a voluntary conservation program for farmers and ranchers who face serious threats to soil, water, and related natural resources. EQIP offers financial, educational, and technical help to install or implement structural, vegetative, and management practices called for in agricultural land contracts. The Conservation Reserve Program (CRP) puts sensitive croplands under permanent vegetative cover.

USDA Forest Service

The Forest Service manages land in the Entiat Ranger District, on the Wenatchee portion of the Wenatchee National Forest. The land is managed according to the Wenatchee National Forest Land and Resource Management Plan (the Forest Plan) (USDA, 1989), as amended by the Northwest Forest Plan (USDA, USDI, 1994). The 1989 Forest Plan divides the land into management areas, each with a management prescription based on unique habitat conditions. The majority of National Forest land in the Columbia Upper Middle is managed for multiple uses, including deer and elk winter range, timber production, livestock grazing, recreation, and research.

Tribes

Confederated Tribes of the Colville Reservation

The Colville Reservation was established by an executive order in 1872. Under the Executive Order, the purpose of the Reservation was to protect Indian rights to occupy some of the lands in their aboriginal territories to provide or the development of agriculture, and to preserve access to traditional fisheries in the upper Columbia and basins. In 1891, the United States and the Colville Indians entered into an agreement under which the tribes ceded land to the United States for an agreed upon price. The CTCR's reserved rights under the 1872 Executive Order and the 1891 Agreement provide the basis for a wide range of rights and interests for protection, enhancement, management, and harvest of anadromous fish in the upper Columbia basin.

Columbia River Inter-Tribal Fish Commission

The Columbia River Inter-Tribal Commission (CRITFC) represents the combined interests for the Nes Perce, Umatilla, Warm Springs, and Yakama Tribes. The tribal Columbia River Anadromous Fish Restoration Plan, or *Wy-Kan-Ush-Mi Wa-Kish-Wit*, was developed by CRITFC in 1995. Recommendations set forth in this plan for salmon recovery address three types of actions: institutional, technical, and watershed, with the over-riding goal of simply putting fish back in the river (gravel to gravel management).

Yakama Tribe

See Columbia River Inter-Tribal Fish Commission

State Government

Washington Department of Fish and Wildlife

The Washington Fish and Wildlife Commission is directed by the Washington State Legislature (RCW77.04.055) to establish policies to preserve, protect and perpetuate fin fish, shellfish, and wildlife and their habitats to maximize fish and wildlife recreational opportunities compatible with healthy and diverse fish and wildlife populations. The Mission of WDFW is: "Sound stewardship of fish and wildlife". In pursuit of this mission, WDFW strives to maximize fishing, hunting and non-consumptive recreational opportunities compatible with healthy, diverse fish and wildlife populations. A few of the important policies, plans, and guidelines that drive WDFW management in the Columbia Upper Middle include a statewide strategy to recover salmon, a wild salmonid policy, management plans for steelhead and bull trout, and salmon, steelhead, and bull trout stock inventories.

The Wild Stock Restoration Initiative (WSRI); (ESHB 1309) in 1993 initiated a commitment to salmonid protection and recovery that has led to more recent salmon recovery legislation. Recently enacted state legislation (1998-1999) designed to guide salmon recovery in the state of Washington includes the Salmon Recovery Planning Act (ESHB 2496), Watershed Planning Act (ESHB2514), and Salmon Recovery Funding Act (2E2SSB 5595). Stock inventories were the initial commitment of state and tribal fishery managers to the WSRI that complemented and strengthened ongoing programs to protect salmonid stocks and habitats. The Salmon and Steelhead Inventory and Assessment Program (SSHIAP), is an integral part of WSRI, is a partnership-based information system that characterizes freshwater and estuary habitat conditions and distribution of salmonid

stocks in Washington. SSHIAP is designed to support regulatory, conservation, and analysis efforts such as Washington State Watershed Analysis, State Salmon Recovery, Habitat Conservation Planning, Ecosystem Diagnosis and Treatment.

The Salmon Recovery Planning Act provides the framework for developing restoration projects. It requires a limiting factors analysis and establishes a funding program for local habitat restoration projects. It also creates the Governor's Salmon Recovery Office. As a result of this bill, an Independent Scientific Panel was created to provide scientific review for salmon recovery projects.

Washington Department of Natural Resources

The Washington Department of Natural Resources (DNR) is responsible for managing state forest and mineral resources, including fire prevention and suppression and administers the state's Natural Areas Program.

Washington Department of Natural Resources land ownership west of the Columbia in Kittitas County and Chelan County is rangeland/shrub steppe. East of the Columbia, in Grant, and Douglas Counties, DNR lands are primarily range, with a small amount of dryland crop ground.

Washington Department of Ecology

The Washington Department of Ecology oversees and administers key laws dealing with the integrity and use of land, air, and water including the State Environmental Policy Act, Shoreline Management Act, Floodplain Management Act, Water Pollution Control Act, and Water Resources Act. The department permits dischargers of air and water pollution, oversees toxic cleanup and has enforcement authority to administer these laws.

The department also oversees the Watershed Planning Act, which encourages voluntary planning by local governments, citizens, and tribes for water supply and use, water quality, and habitat at the Water Resource Inventory Area level. Grants are available to conduct assessments and to develop strategies to ensure adequate flows for fish and out-of-stream use. There are 40 Water resource inventory areas engaged in watershed planning across Washington state.

The WDOE is the regulatory agency responsible for implementing the 1972 federal Clean Water Act and enforcing state water quality standards for protection of aquatic life and other beneficial uses. The department has the only state certification authority over re-licensing of major hydropower projects to ensure they meet state water quality standards. The agency is also instrumental in designating 303(d) water quality limited streams and in carrying out the TMDL process.

Washington State Growth Management Act

Various provisions of the Washington State Growth Management Act (GMA) require local Comprehensive Plans to address planning issues of statewide importance. It is a characteristic of GMA that depending upon the issue the state purposes for local plans can be either general or very specific. Relative to natural resource lands (mineral, agricultural and forestry lands), and "critical areas" (wetlands and fish and wildlife conservation, frequently flooded, critical aquifer recharge, and geologically hazardous areas), the expression of state interest is clear and specific. These must be designated and "protected"

(critical areas) or "conserved" (agriculture, minerals and forestry) by regulation (36.70A.060). Currently, all five counties and the major municipalities in the Subbasin have growth management plans that include provisions for areas along the Columbia River in their respective jurisdictions.

The "Goals, Policies, and Actions," within the plan are the primary directives for land use decision-making and long range planning. They are also the principal directives to county decision-makers and staff relative to what planning and public works actions, studies, and other projects, have to be undertaken during the plan's 20 year horizon in order to address current and future growth and development, and resource issues.

The Shorelines Management Plans cover, as applicable, all marine waters; streams with a mean annual flow greater than 20 cubic feet per second; and lakes 20 acres or larger. See RCW 90.58.030, Definitions and concepts. The Shoreline Act also states that "the interests of all the people shall be paramount in the management of shorelines of statewide significance."

- Pacific Coast, Hood Canal and Puget Sound shorelines;
- all waters of Puget Sound and the Straight of Juan de Fuca;
- lakes or reservoirs with the surface acreage of 1,000 acres or more;
- larger rivers (1,000 cubic feet per second or greater for rivers in Western Washington, 200 cubic feet per second and greater east of the Cascade crest).
- wetlands associated with all of the above

Regional Government

Upper Columbia Salmon Recovery Board

The Upper Columbia Salmon Recovery Board (UCSRB), a regional cooperative comprised of Chelan, Douglas, and Counties, the Yakama Nation, and the Colville Tribes, formed in early 1999 to address regional fish and wildlife recovery issues. The UCSRB is currently developing a "Coordinated Regional Strategy" that will integrate federal, state, and local salmon recovery planning and project implementation.

The Nature Conservancy of Washington

The Nature Conservancy (TNC) is a nation-wide non-profit agency with the goal of protecting biological diversity. Protection and restoration of healthy shrub-steppe ecosystems is a priority for TNC of Washington. Some of the largest and highest quality examples of this habitat type remain in the North Central portion of the state. The Conservancy has been purchasing land within Grant and Douglas County to help meet this conservation goal since 1997. The non-profit organization currently owns 19,500 acres within Moses Coulee, 325 acres on Badger Mountain, and 5,000 acres in Beezley Hills along with a 2,800-acre conservation easement within Moses Coulee near Sagebrush Flat (Rimrock Meadows). The condition of these lands ranges from some of the finest examples of shrub-steppe community types remaining in the state (Beezley Hills) to those that have been moderately to highly degraded and invaded by a variety of weeds (Moses Coulee). Together these holdings build on the conservation ownership of other landowners in the

area and provide the kind of connectivity needed to protect a wide range of shrub-steppe dependent species.

Conservation priorities for these lands include the deep-soil and thin-soil shrub-steppe plant communities, rare plants, obligate bird, reptile, mammal and insect species along with habitat provided by springs and seeps, riparian corridors, and cliffs and talus. The Conservancy is working with public and private partners to learn more about their lands and to develop and implement restoration plans needed to enhance the ecological health of the region. Providing opportunities for applied research, passive recreation, and education within the Moses Coulee/Beezley Hills region and using the lands to complement other community-based planning efforts are also part of the Conservancy's long range plan.

Local Government

Local public utility districts, conservation districts, water boards, noxious weed boards, county commissions, and city governments conduct various forms of resource planning within the Columbia Upper Middle.

Most counties and cities within the Columbia Upper Middle adopted comprehensive plans pursuant to the GMA between 1994 and 1998. A five-year process to update many of the comprehensive plans to review and revised as necessary is presently underway. There are numerous elements; two specific areas/elements directly related to natural resource management are Resource and Critical Areas Conservation and the Shorelines Management Plan.

The GMA requires every county and city in Washington to adopt policies and development regulations that designate and protect critical areas. Critical areas are defined as:

(a) Wetlands

(b) Areas with a critical recharging effect on aquifers used for potable water

(c) Frequently flooded areas

(d) Geologically hazardous areas, and

(e) Fish and wildlife habitat conservation areas.

Public Utility District No. 1 of Chelan County (Chelan PUD)

Chelan PUD owns and operates the Rocky Reach and Rock Island dams and associated reservoirs and project works. The project was authorized by Congress under Public Law 83-544 and is regulated by the Federal Energy Regulatory Commission under License Numbers 2145 and 943 respectively. The Rocky Reach license is up for renewal in 2006. The Rock Island license is up for renewal in 2029.

Presently, protection for anadromous salmonids through the Rock Island and Rocky Reach reservoirs is guided by the proposed Anadromous Fish Agreement and Habitat Conservation Plan. The HCP is in regulatory review, and is scheduled to be completed by spring 2002. The plan has an outcome-based approach and is designed to protect spring

chinook salmon, fall/summer chinook salmon, sockeye salmon, steelhead, and coho salmon (after naturally spawning populations are reestablished).

Wildlife habitat management along the Rock Island Reservoir has been addressed in the FERC operating license for Rock Island Dam. The FERC document, *Revised Exhibit S Fish and Wildlife Plan 1984,* lists the actions that Chelan PUD will carry out to mitigate for any potential losses to wildlife or associated habitats with regards to the operation of Rock Island Dam.

Public Utility District No.1 of Douglas County (Douglas PUD)

Douglas PUD owns and operates the Wells Dam and associated reservoir and project works. The project was authorized by Congress under Public Law 83-544 and is regulated by the Federal Energy Regulatory Commission under License No. 2149. The FERC license provides the terms and operating conditions for the project. The license is up for renewal in 2012.

Public Utility District No. 2 of Grant County (Grant PUD)

Grant PUD owns and operates the Priest Rapids Project (PRP), which consists of 2 developments, only one (Wanapum Dam) of which is covered by this summary. More detailed information on the PRP is available in the Columbia Plateau subbasin summary. The project was authorized by Congress under Public Law 83-544 and is regulated by the Federal Energy Regulatory Commission under License No. 2114. The FERC license provides the terms and operating conditions for the project. Requirements related to fish and wildlife include Article 39, which requires that Grant PUD construct, operate, and maintain fish ladders, fish traps, fish hatcheries, or other fish facilities or fish protective devices for the purpose of conserving the fishery resources.

Future fish and wildlife programs for the Wanapum Development and Priest Rapids Project will be developed through the relicensing process under the statutory requirements imposed by the Federal Power Act. The process for developing these programs is currently underway and Grant PUD will be filing its relicensing application with FERC by October of 2003.

Existing Goals, Objectives, and Strategies

The goals, objectives and strategies that follow are taken directly from documents prepared by the federal, tribal, state, and other entities present in the subbasin.

National Marine Fisheries Service Objectives

The following objective is located in the Mainstem Habitat section of the All-H Paper:

Objective 1 Between 2001 and 2012, restore habitat, acquire riparian corridors, modify flow regimes, reduce non-point pollution, develop improvement plans for all reaches

.

Objective 2 Beginning in 2001, identify sampling reaches, survey conditions, describe cause-and-effect relationships, identify research needs.

Washington Department of Ecology

Goal: Ensure State water quality standards to protect beneficial uses are met. (John Stormon, WDOE, personal communication).

Strategy 1: Reduce water temperatures to meet water quality standards. Research and pursue methods for providing cooler waters to anadromous fish at critical stages in their life cycles.

Strategy 2: Reduce the high dissolved gas concentrations caused by dams during high flows, to meet water quality standards. Pursue identification of consistent and defensible points to measure compliance with water quality standards in the Columbia and Snake River both in the forebays and tailraces of each dam.

Washington Department of Fish and Wildlife

Sage grouse

Goal 1: Increase the population size and distribution of sage grouse (WDFW 1995d).

Objective 1: Conduct research on sage grouse through 2005 as part of the WDFW's statewide sage grouse research program.

Strategy1: Monitor population size, determine population viability, and evaluate population responses to habitat alteration.

Objective 2: Increase the breeding population of sage grouse to more than 1,500 distributed throughout six management zones

Goal 2: Protect, enhance, and increase shrub-steppe habitat (WDFW 2000).

Objective 1: Improve shrub-steppe habitat quality and configuration in the Columbia Upper Middle by 2005. This objective is consistent with the statewide objective to protect >16,000 (40,000 acres) of high quality, relatively contiguous habitat that is currently occupied (WDFW 1995d).

Strategy: Base habitat management activities on sage grouse habitat research results and 'best science' principles.

Objective 2: Monitor wildlife and habitat response to protection, maintenance, and enhancement measures annually.

Sharp-tailed grouse

Goal: Recover populations of sharp-tailed grouse in the Columbia Upper Middle to the level where populations are viable (WDFW 1995c).

Objective 1: Conduct research on sharp-tailed grouse through 2005 to monitor population size, determine population viability, and evaluate population responses to habitat alteration.

Strategy 1: Monitor all traditional sharp-tailed grouse display sites (leks) on an annual basis throughout the Columbia Upper Middle.

Strategy 2: Collect and examine tissue samples of sharp-tailed grouse to monitor genetic heterogeneity and population viability.

Strategy 3: Evaluate movement of radio-marked sharp-tailed grouse in the Columbia Upper Middle to examine population viability and habitat connectivity.

Strategy 4: Monitor changes in sharp-tailed grouse populations in relation to habitat restoration activities.

Objective 2: Improve quantity, quality, and configuration of the shrub-steppe habitat necessary to support a viable population of sharp-tailed grouse by 2010.

Strategy1: Improve CRP plantings throughout the subbasin so that they meet standards for plant composition and for distribution and configuration in relation to shrub-steppe habitat.

Strategy 2: Continue restoration of habitat on public lands and education of private landowners about restoration opportunities on private land.

Strategy 3: Purchase properties or easements based on their applicability to published objectives for management and recovery plans for sharp-tailed grouse.

Objective 3: Use translocations of sharp-tailed grouse into Washington from populations in other states so that a population of at least 1,000 is supported in the Columbia Upper Middle by 2010.

Strategy 1: Select a source population in another region based on genetic similarity to birds in Washington.

Strategy 2: Translocate sharp-tailed grouse into portions of the Columbia Upper Middle where they are currently absent, such as the Lincoln County area.

Strategy 3: Translocate sharp-tailed grouse into portions of the Columbia Upper Middle where population and/or genetic augmentation will be useful for long-term improvement in population viability.

Strategy 4: Monitor and evaluate the success and/or failure of all translocation activities.

Pygmy Rabbit

Goal: Recover and maintain a viable pygmy rabbit population in Washington (WDFW 1995a).

Strategy 1: Protect and increase the remaining pygmy rabbit population and associated habitats on the Sagebrush Flat and Dormaier (may not have any rabbits currently) Units. This strategy is consistent with the statewide objective to establish and maintain four populations with at least 500 adults each and eight populations with at least 100 adult rabbits each for a minimum 5-year average total of 2,800 pygmy rabbits (WDFW 1995a).

Strategy 2: Monitor and conduct research on pygmy rabbit populations, determine population viability, and evaluate population responses to habitat alteration and other management activities. This strategy is consistent with statewide objectives to: 1) investigate genetic similarities and differences between pygmy rabbits in Oregon, Idaho, and Montana; 2)

determine if the genetic diversity of Washington's pygmy rabbit population is sufficient for the species to persist for a long time period; 3) evaluate the effectiveness of rearing pygmy rabbits in captivity; 4) monitor existing pygmy rabbit populations and survey areas of potential pygmy rabbit occurrence; and 5) monitor the effectiveness of translocation techniques (WDFW 1995a).

Strategy 3: Manage and improve the quantity, quality, and configuration of shrub-steppe habitat as needed to benefit pygmy rabbits. This strategy is consistent with the statewide objective to protect and manage pygmy rabbit habitat to increase their abundance and distribution (WDFW 1995a).

Strategy 4**:** Conduct searches on the Dormaier and Chester Butte Units to locate additional pygmy rabbit populations and/or suitable habitat for relocations. Augment existing pygmy rabbit populations and establish new populations in suitable habitat through captive rearing or translocations. This strategy is consistent with the statewide objective to establish pygmy rabbit populations in new areas (WDFW 1995c).

Burrowing Owl

Goal: Halt the decline of burrowing owls, increase distribution of burrowing owls to include many of the historic regions occupied in the Columbia Basin, and maintain a stable population of burrowing owls in Washington ((Mark Quinn, WDFW, Personal Communication).

Objective 1: Determine factors limiting burrowing owl populations in Washington.

Strategy 1: Investigate burrowing owl habitat selection in native habitats. Determine factors influencing burrow occupancy and burrow fidelity in native habitats.

Strategy 2: Investigate winter habitat and survival of burrowing owls on winter ranges.

Strategy 3: Evaluate nesting productivity, natal recruitment, and annual survival in eastern Washington. Compare these parameters between large, stable colonies and more ephemeral sites. Also compare these parameters between native and disturbed habitats used.

Strategy 4: Monitor year round movements and long-term survival through marking and radio- telemetry. Determine dispersal distances and colonization potential of adjacent areas.

Objective 2: Develop conservation measures to protect burrowing owls.

Strategy 1: Develop management strategies for continued occupancy and enhancement of both native and disturbed habitats, like irrigation canals, golf courses, and other disturbed habitats.

Strategy 2: Evaluate the usefulness of artificial burrows in enhancing and re-establishing burrowing owl colonies in both native and disturbed habitats.

Strategy 3: Determine management strategies for re-establishment, augmentation, and re-colonizing unoccupied habitats.

Ferruginous Hawk

Goal: Recover ferruginous hawks from threatened status by maintaining a population of at least 60 nesting pairs statewide, including at least 10 pairs in the North Recovery Zone (WDFW 1996a).

Objective 1: Improve our understanding of the suitability and security of ferruginous hawk nesting habitats (see Goal 3.1 and research topics in section 7 of Recovery Plan, WDFW 1996a).

Strategy 1**:** Investigate ferruginous hawk occupancy and productivity characteristics in relation to jackrabbit and ground squirrel distribution and abundance in shrub-steppe habitats.

Strategy 2**:** Investigate rates of prey delivery, food habits, and adult nest attendance to nestling survival through video monitoring.

Strategy 3: Evaluate habitat alteration and human activity relationships to ferruginous hawk productivity and occupancy, including the efficacy of existing platform nests erected to enhance nesting.

Objective 2: Assess the importance of survival rates and contaminants of adult and juvenile ferruginous hawks to low rates of nest occupancy, and relate these to hawk movements (see Goal 3.1 and research topics in section 7 of Recovery Plan, WDFW 1996a).

Strategy 1: Capture and take blood samples from adult and juvenile hawks for pesticide analysis.

Strategy 2: Monitor year round movements and long-term survival through marking and satellite telemetry.

Objective 3: Improve ferruginous hawk nest occupancy by identifying and promoting protection and enhancement (i.e., erect nest platforms) of the highest quality nesting habitats based on assessment of prey, survival, and human activity. Refine recommended spatial and temporal management buffers around nests and provide site specific recommendations for nest protection.

Washington Ground Squirrel

Goal: Recover populations of Washington ground squirrels in the Columbia Upper Middle to the level where populations are viable (Mark Quinn, WDFW, Personal Communication).

Objective 1: Determine distribution and abundance of Washington ground squirrels the Columbia Upper Middle.

Strategy 1: Monitor all known Washington ground squirrel populations annually.

Strategy 2: Conduct regular searches for 'new' and or additional populations of Washington ground squirrels.

Strategy 3: Determine habitat characteristics at occupied and unoccupied colonies.

Strategy 4: Evaluate the effects of habitat management on Washington ground squirrels.

Objective 2: Develop habitat management strategies for Washington ground squirrels and incorporate specific management objectives into Wildlife Area and landscape plans.

Northern Leopard Frog

Goal: Conserve the remaining populations of northern leopard frogs in Washington and reestablish additional populations (WDFW, 1996b).

Objective 1: Develop needed information on distribution, habitat and relationships with other species, and implement recovery of leopard frogs.

Strategy 1: Complete surveys and determine specific distribution of northern leopard frogs in the Columbia Upper Middle.

Strategy 2: Investigate breeding, migratory, and over-wintering habitat relationships of northern leopard frogs.

Strategy 3: Evaluate range of suitable habitats, juxtaposition of habitats, and appropriate conditions for northern leopard frogs.

Strategy 4: Determine effects of non-native fish and introduced bullfrogs on northern leopard frogs.

Strategy 5: Determine effects of wetland restoration projects for waterfowl on northern leopard frogs.

Objective 2: Plan and implement recovery programs, translocations and re-establishment of leopard frogs throughout the historic range of the species.

Colockum Elk Herd

Goal 1: Meet herd objectives of greater than 15 bulls:100 cows in post hunting season herd composition counts (Ron Fox, WDFW, personal communication).

Objective1: Determine the nutritional health of the Colockum elk herd.

Strategy : Assess fat reserves of cow elk during the fall hunting season.

Objective 2: Determine predation rates and sources of predation on elk.

Strategy : Place radio transmitters on a sample of elk, including calves, to assess mortality rates.

Objective 3: Reduce damage to agricultural crops by elk.

Strategy 1: Develop new techniques and implement existing techniques to minimize damage to agricultural crops.

Strategy 2: Construct additional fence around crops in high damage areas.

Strategy 3: Build an 8-foot tall drift fence along the north boundary of the Colockum elk herd range from the Columbia River to Naneum Ridge.

Chelan County PUD

The following goals and objectives are stated in the HCP, due to be completed in 2002

Goal 1: Protect species of concern (spring chinook salmon, fall/summer chinook salmon, sockeye salmon, steelhead, and coho salmon (after naturally spawning populations are reestablished)).

Objective 1: Insure that the operation of Rock Island and Rocky Reach dams have no net impact (NNI) on the salmonid species of concern. The NNI concept takes into account the fact that 100 percent survival cannot be achieved at the projects alone, but must also include off-site measures to increase salmonid productivity. The NNI standard consists of two components.

Strategy 1: Meet a survival standard that mandates a 91 percent project (defined as the area that encompasses 1000 ft below a hydropower project to a point 1000ft below the next upstream dam) survival rate for adults and juveniles be achieved within the geographic area of the projects by fish survival improvements measures, including an independent 95 percent juvenile dam (500 ft upstream to 1000 ft downstream of a dam) passage survival.

Strategy 2: Compensate for the 9 percent unavoidable project mortality through hatchery programs (7%) and tributary habitat improvements (2%). The survival standard, hatchery compensation, and habitat improvement combine to provide a 100 percent no net impact on the species of concern.

Chelan County PUD's goals and objectives regarding wildlife are as follows:

Goal 1: Mitigate for any potential losses to wildlife or associated habitats with regards to the operation of Rock Island Dam (FERC 1984). Although there are no operational requirements for Rocky Reach with regards to wildlife, Chelan County PUD has implemented some of the same strategies for the Rocky Reach Reservoir.

Objective 1: Enhance habitat for a variety of wildlife species.

Strategy 1: Provide nesting structures on or adjacent to the reservoir for Canada geese and wood ducks. Kestrel nest boxes are provided and maintained along the Rock Island Reservoir and on Turtle Rock Island.

Strategy 2: Plant and maintain trees and shrubs to increase cover and provide winter forage for wildlife.

Strategy 3: Maintain upland bird feeders, 4 each along the Rock Island and Rocky Reach reservoirs.

Strategy 4: Provide manpower and irrigation pipe to expand wildlife habitat in the Swakane Wildlife Area. Projects have included the development of springs, building of guzzlers, and the planting of 53,000 trees and shrubs.

Strategy 5: Develop wetlands and maintain 129 acres located around the north and south shores of the confluence of the Wenatchee River.

Strategy 6: Preserve 1,000 acres of wildlife habitat west of Wenatchee (Home Water Property).

Objective 2: Monitor wildlife populations.

Strategy 1: Conduct bald eagle surveys to monitor and maintain a population, age composition, distribution and perch type use record of the reservoir area to help assess potential impacts of project or operational changes.

Strategy2: Conduct wood duck and Canada goose nest surveys.

Foster Creek Conservation District

Goal 1: Protect natural resources and enhance sustainable, profitable agriculture; and improve the quality of life in Douglas County (Long Range Plan 2001 Update).

Objective1: Facilitation and negotiation of a county-wide habitat conservation plan to address ESA listings in the agricultural community. The District's mission in undertaking this project is to enhance the local quality of life in Douglas County by protecting and increasing wildlife species habitat while at the same time providing regulatory certainty and protection from incidental takings for local farmers, ranchers, and orchardists.

Objective 2: Serve as lead entity for salmon recovery activities in the Foster and Moses Coulee watersheds.

Strategy 1: Administer and facilitate a Citizen Advisory Group in soliciting and prioritizing salmon recovery projects (E.S.H.B. 2496).

Objective 3: Serve as lead entity for the Watershed Planning under E.S.H.B. 2514.

Strategy 1: Facilitate, administer, and provide technical support to the Douglas County Watershed Planning Association in conducting watershed assessments.

Strategy 2: Complete a comprehensive watershed management plan that addresses water quantity, instream flows, water quality, and fish habitat issues in Douglas County.

Douglas County PUD

No information with regards to existing goals objectives and strategies was received.

Grant County PUD

No information with regards to existing goals objectives and strategies was received.

Research, Monitoring, and Evaluation Activities

Research and monitoring activities are ongoing for numerous species of wildlife in the Columbia Upper Middle (Table 6). Despite the relatively thorough list, many of the listed activities are temporary and/or project related. In addition, many of the activities are influenced by annual variations in the availability of personnel and/or budget.

Table 6. Effort to monitor wildlife and habitat in the Columbia Upper Middle

Surveys and research projects	**Agency conducting survey or research**
Eastern Washington mule deer study	WDFW, CTCR, Chelan County PUD
Pre-season aerial and/or ground surveys for deer	WDFW
Post-season aerial and/or ground surveys for deer	WDFW
Columbian sharp-tailed grouse lek surveys	WDFW, CTCR
Sage grouse lek surveys	WDFW
Upland game bird brood counts	WDFW
Waterfowl pair and brood counts	WDFW, USFWS
Bald eagle nest surveys	WDFW, Douglas County PUD
Peregrine falcon survey	WDFW, National Park Service
Columbian sharp-tailed grouse lek surveys	WDFW, CTCR
Ferruginous hawk nest occupancy and productivity surveys	WDFW
Ferruginous hawk ecology study	WDFW
Monthly waterfowl surveys	WDFW, USFWS
Mid-Winter waterfowl survey	WDFW, USFWS
Pygmy rabbit burrow survey	WDFW, WSU, TNC
Pygmy rabbit habitat evaluation	WDFW, WSU
Burrowing owl surveys	WDFW, WSU, BLM, USFWS
Northern leopard frog habitat and movement	Central Washington University
Washington ground squirrel social interaction study	Cornell University
Washington ground squirrel surveys	Eastern Oregon University
Amphibian and reptile surveys	DNR
Bat Surveys	TNC
Shrub-steppe breeding bird surveys	WDFW
Shrub-steppe bird response to habitat and landscape variables in Eastern Washington	WDFW
Parasitism by brown-headed cowbirds in the shrub-steppe of Eastern Washington	WDFW
Pacific salmon and wildlife: ecological contexts, relationships, and implications for management	WDFW
Migration and winter ranges of ferruginous hawks from Washington	WDFW
Fragmentation effects on migratory songbirds	WDFW

Abstracts and progress reports for several of these research projects can be found at the WDFW website (wa.gov/wdfw).

A cooperative study (including Washington State University (WSU), WDFW, BPA, DNR, and local cattlemen) has been funded by BPA to examine vegetation differences between grazed and ungrazed areas on the Sagebrush Flat Unit and the potential impacts to pygmy rabbits resulting from grazing or lack of grazing.

A BPA-funded mitigation project provides habitat for several threatened and endangered species and is an important link in WDFW's ongoing efforts to reverse downward population trends in shrub-steppe obligate wildlife species such as pygmy rabbits, sharp-tailed grouse, and sage grouse. Continued funding and support for the SFWA is crucial to addressing impacts caused by fragmentation, degradation and conversion of shrub-steppe habitat.

Counties and Public Utility Districts

Although counties, and municipalities within them, do not typically do research, monitoring and evaluation of fish and wildlife populations, they do monitor development growth, land consumption, human population trends, critical areas, and many other demographics, within the context of comprehensive planning (GMA). This is typically, by law, a review and revise process every five years. Recent changes in Washington State law, for example shoreline regulation and 4(d) rules (An ESA mechanism for protecting threatened as opposed to endangered species. They propose a means by which non-federal entities can obtain assurances that the activities they authorize or conduct are permissible under the Act.), have increased the burden of monitoring certain aspects of fish and wildlife populations and habitat to local governments. See Section I, Past and Present Efforts in this document and Appendix C1 for a list of PUD activities.

Statement of Fish and Wildlife Needs

Fish

- Research the effects of flow on salmonid travel time and survival, and how flow interacts with other behavioral, biological, and environmental factors. River flow is one of few variables that can be managed for juvenile salmonids, but much remains to be learned of its role as a limiting factor.
- Monitor the incidence of *Flexibacter columnaris* and other pathogens in the main-stem Columbia River. Little is known about the environmental and biological conditions that contribute to large-scale infections that could decrease fish performance and survival.
- Continue removal of predaceous northern pikeminnow.
- Determine habitat use of adult and juvenile Pacific lamprey in the Columbia River.
- Evaluate control programs for predators including terns, seagulls, bass, and walleyes.
- Inventory and obtain baseline information on resident fish populations in each mainstem reservoir.
- Assess the population size and reproductive success of white sturgeon in the Columbia Upper Middle.

- Develop, implement, and evaluate a management plan for white sturgeon in the Columbia Upper Middle Columbia River reservoirs.
- Obtain baseline information on status of native fish communities.
- Inventory exotic fish species in the subbasin.
- Identify the combined effects of stressors on the physiology, performance, and survival of juvenile salmonids.
- Assess the response of aquatic ecosystems to temperature and TDG regimes in the Columbia Upper Middle.
- Determine whether there is a need to provide cooler water for migrating salmonids.
- Determine the location and effects of ground water input, tributary input, and cold water habitat.

Wildlife

Birds

- Assess the affects of water fluctuations on mudflat habitat availability and shorebird foraging and migration timing
- Inventory all colonial nesting birds.
- Research waterfowl use of irrigation projects
- Maintain or improve availability of field grains
- Restore agricultural habitats for nesting and brood rearing
- Inventory quality of waterfowl reserve areas
- Manage and protect nesting, roosting, and foraging habitat for raptors
- Protect peregrine falcon habitats, especially nest sites, potential nest sites and areas of prey concentrations
- Breeding and wintering surveys of peregrine falcons
- Research population dynamics, movements, and contamination of peregrine falcons
- Inventory nest occupancy and success for ferruginous hawks
- Assessment of possible affects of contaminants on survival and nest occupancy rates for ferruginous hawks
- Improve understanding of golden eagle baseline ecology - specifically food habits and the relationship of shrub-steppe prey to nest occupancy and productivity
- Assess possible contaminant loads in raptors
- Monitor burrowing owl populations
- Inventory occupied burrows in areas of high burrowing owl densities
- Identification of habitat needs for burrowing owls
- Protect and manage songbird nesting habitat. Monitor long-term population trends
- Provide and protect conifer forests, riparian habitats and oak woodlands habitats that include major components of large diameter trees
- Inventory and monitor cavity excavator populations

- Inventory and Monitor sage grouse and sharp tailed grouse populations
- Inventory and evaluate potential habitat that is currently unoccupied
- Continue and/or expand surveys to monitor distribution, abundance, and viability of species of interest including sage grouse, sharp-tailed grouse, ferruginous hawk, golden eagle, and neotropical migrants.

Mammals

- Inventory and monitor beaver populations
- Improve demographic and population monitoring of deer and elk
- Decrease level of damage to agricultural crops by elk.
- Inventory and monitor pygmy rabbit, black-tailed, and white-tailed jackrabbit populations
- Protect key roost and hibernacula habitats for bats
- Conduct baseline studies of bats to determine species presence and habitat associations
- Provide a suitable matrix of breeding, feeding, drinking, and hibernacula for bats
- Protection from introduced species such as bullfrogs
- Continue and/or expand surveys to monitor distribution, abundance, and viability of species of interest including pygmy rabbit, Washington ground squirrel.

Hydropower System Development and Operations

- Evaluate the relationship and relative importance of habitat patches and identify locations of critical habitat that supports all life history stages (e.g., spawning, rearing, adult holding) of fall chinook.

Water Quality

- Assure that current methodology for measuring both temperature and total dissolved gas levels in the Columbia River are representative of the overall conditions.
- Obtain baseline information on water quality and quantity of tributaries within the Columbia Upper Middle.

Instream Habitat

- Conduct stream habitat surveys on tributaries to the Columbia River to identify current conditions, areas in need of improvement and where land practices may be negatively impacting those resources.
- Research surface/ground water interactions.
- Conduct a fish passage barrier inventory.

Wetlands and Riparian

- Inventory wetland and riparian areas as to condition and function
- Protect and restore riparian habitat
- Manage wetland areas to maintain fish, wildlife and cultural benefits
- Conduct a shoreline resource inventory for those designated in local shoreline master plans.
- Restore vegetation on canal and drain right-of-ways,
- Restore wetlands throughout the agricultural zone

Shrub-steppe

- Obtain detailed distribution and description of shrub-steppe habitats with reference to dominant plant species, vegetative condition, and habitat potential.
- Evaluate shrub-steppe habitat characteristics in relation to use by shrub-steppe obligates such as sage grouse, sharp-tailed grouse, pygmy rabbits, Washington ground squirrels, and neotropical migrants.
- Evaluate shrub-steppe restoration activities in relation to wildlife potential; including activities associated with BPA, WDFW, BLM, USFWS, Natural Resource Conservation Service (NRCS), and private land.
- Evaluate landscape configuration in relation to population viability for species of interest including sage grouse, sharp-tailed grouse, pygmy rabbits, Washington ground squirrels, and neotropical migrants.
- Expand shrub-steppe quantity with the aid of acquisitions, easements, and landowner incentives such as the Conservation Reserve Program.
- Restore shrub-steppe habitat with deep soils
- Reduce and prevent degradation and fragmentation of large contiguous blocks of shrub-steppe habitat
- Evaluate shrub-steppe restoration techniques
- Monitor periodic changes in shrub-steppe habitat distributions
- Develop and implement shrub-steppe restoration techniques that are economically feasible over large landscapes (e.g. establishing sagebrush by seed rather than by hand-planted rooted seedlings).
- Develop restoration guidelines for shrub-steppe habitats that include grazing management, seed mixtures for revegetation efforts, weed control methods and considerations for landscape configuration.

Forest

- Protect remaining old forest stands, particularly ponderosa pine
- Re-introduce fire to dry forests

General Habitat

- Protect and enhance wildlife species habitat on private agricultural lands.
- Map all habitat within the Columbia Upper Middle using a method that permits the evaluation of habitat potential, habitat condition, and endemic features of the landscape such as slope, aspect, soil, and weather by 2005.
- Control invasive-exotic vegetation throughout the subbasin to improve nesting habitats, food sources, and reduce nest-predator habitat.
- Initiate, and document existing, studies that examine wildlife species and habitat use with varying types and intensities of land use practices (urban development, agricultural, rural) in non-forested (shrub-steppe) landscapes.
- Initiate, and document existing, studies that examine wildlife species and habitat use with road types, density and use in non-forested (shrub-steppe) landscapes.
- Development of wildlife habitat on edge, fence row and economically marginal lands
- Utilize tillage and harvest methods that allow waste grain to remain available to wildlife throughout the winter months

- Identify key lands for conservation easements and/or acquisition
- Integrate subbasin needs with those of adjacent subbasins.
- Obtain financial support to continue operation and management of existing government property that is critical for wildlife.
- Reduce and mitigate impacts from crop production and livestock grazing activities where they occur.
- Coordinate with multiple agencies, groups, and individuals to achieve goals, objectives, and strategies

Columbia Upper Middle Subbasin Recommendations

Projects and Budgets

The following subbasin proposals were reviewed by the Columbia Cascade Province Budget Work Group and are recommended for Bonneville Power Administration project funding for the next three years.

Table 1 provides a summary of how each project relates to resource needs, management goals, objectives, and strategies, and other activities in the subbasin.

New Projects

Project: 29009 - Acquire Dole-Beebe Property and Associated Water Rights

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Protect and enhance rare Columbia River frontage habitat through acquisition of Dole Northwest, Inc. Beebe orchard property and associated water right.

Abbreviated Abstract

Undeveloped, low-bank riparian habitat is an extremely rare commodity along the mainstem Columbia River. Washington Department of Fish and Wildlife (WDFW) has an extraordinary opportunity to acquire and protect approximately 6,000 feet of some of the last remaining, largely undisturbed, Columbia River mainstem riparian habitat in the Columbia River Basin. WDFW is requesting funding to acquire and enhance this unique "at-risk" property that includes over a mile of mainstem shoreline. The 227-acre property, the Dole-Beebe property, is comprised of two parcels located in the Upper Middle Mainstem Subbasin approximately 3 miles east of Chelan, Washington. One of the Dole-Beebe parcels is also adjacent to the WDFW Chelan Fish Hatchery complex. In addition to the land itself, two valuable water rights are attached to the property, one for 10 cfs (of which WDFW currently uses 4 cfs for its WDFW Chelan Fish Hatchery operations) and another for 15 cfs.

The Dole-Beebe parcels exhibit a distinctive and fairly condensed array of terrestrial and aquatic habitat types including segments of relatively intact mainstem riparian corridor, steep shrub-steppe, steep hillsides characterized by cliffs and rocky outcrops, and two springs with associated riverine habitat. An established run of endangered summer steelhead spawn and rear in the creek/spring system located on the property. In addition, endangered spring chinook salmon and coho salmon (once extirpated from this stretch of the Columbia River and its tributaries, but recently reintroduced by the Yakama Nation) have also been documented in the property's creek/spring system. The land provides important habitat, breeding and nesting areas, as well as forage, for a variety of wildlife including big game, upland gamebirds, waterfowl, shorebirds, raptors, numerous small mammals, and songbirds. The riparian habitat along the Columbia River

also constitutes a vital migration corridor for neotropical birds. Both the western gray squirrel, which is listed by Washington State as threatened and as a federal species of concern, and bald eagles, which are state and federally listed as threatened, have been documented on the Dole-Beebe property.

Dole Northwest, Inc., the current owner of the property, has expressed interest in selling the two parcels to WDFW. However, due to a state budget freeze, WDFW does not currently have funds available to purchase the property and may not in the foreseeable future. There is a real urgency connected to acquiring and protecting this unique property and the two associated water rights since many of the same features that identify the Dole-Beebe property as an exceptional acquisition for habitat preservation and restoration, also make the property an enticing real estate investment. While the immediate priority is to protect and secure this singular property, there are innumerable potential long-term benefits associated with this acquisition. The location and habitat characteristics of the Dole-Beebe property offer multifaceted opportunities to promote and enhance fish, wildlife and habitat restoration efforts in the upper Columbia River Basin.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9609400	WDFW Habitat Unit Acquisition. Restore and enhance 27,600 acres of wildlife habitat in Washington to mitigate for losses associated with the construction of Grand Coulee, Chief Joseph, McNary, and John Day dams.	Land acquisition in Cascade Columbia Province
9604000	Mid-Columbia Coho Feasibility Reintroduction Study. Determine the feasibility of re-establishing a naturally spawning coho population within the mid-Columbia tributaries. Focus on Methow and Wenatchee Subbasins in the Cascade Columbia Province	Reintroduced coho would use mainstem Columbia for migration, and possibly spawning and rearing
1996042	Restore & Enhance Anadromous Fish Populations in Salmon Creek. Increase instream flows in order to accommodate the year-round life cycles of anadromous fish.	ESA and non-listed salmonids use the mainstem Columbia River as a migration corridor.
26033	Okanogan Watershed Land and Water Rights Acquisition. Protect and enhance listed and non-listed salmonid habitat in the Okanogan Watershed through the acquistion of land with river frontage and water and/or water rights.	Land and water right acquisition in Cascade Columbia Province. ESA and non-listed salmonids use the mainstem Columbia River as a migration corridor.

Review Comments

WDFW is going to contribute $500,000 towards the purchase of this property in FY03, the budget has been modified to reflect this action. Question cost of the property because appraisal is not completed Fair Market Value. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $396,500 Category: High Priority	Rec: $23,200 Category: High Priority	Rec: $10,000 Category: High Priority

Project: 29025 - Columbia Cascade Province Pump Screening

Sponsor: Washington Department of Fish and Wildlife, Yakima Screen Shop (WDFW-YSS)

Short description:

Comprehensive re-assessment, re-inventory, and mitigation of previously inventoried pump screen sites in these three subbasins.

Abbreviated abstract

The Washington Department of Fish and Wildlife (WDFW), Yakima Screen Shop (YSS), proposes to initiate a systematic pump-screen mitigation program. This program would use existing pump screen inventory information that resides with WDFW, YSS to provide reassessment, design, and correction, (i.e. new screen devises that meet current state and federal fish screening criteria), in the Methow, Entiat, and Wenatchee river sub basins during the next four years. The project objective is to provide 100 percent protection from mortality and/or injury for all species and life stages of anadromous and resident fish, including ESA listed spring Chinook, bull trout and steelhead that come in contact with pump diversions.

Relationship to other projects

Project ID	Title	Nature of relationship
26015	Methow Basin Screening, "2001 Action Plan", screening four gravity diversions.	Complimentary to gravity diversion screening completed in this subbasin
199105700	Yakima Phase II Fish Screen Fabrication, joint effort with BOR to upgrade Yakima Basin gravity diversions to current screening criteria.	Complimentary to Columbia River Basin screening efforts for salmon recovery.

Review Comments

How many screens will be addressed during the assessment portion of this project? Is this project addressing a compliance and enforcement issue? If so, is this the responsibility of BPA (RPA language?). NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $218,918 Category: High Priority	Rec: $232,408 Category: High Priority	Rec: $232,408 Category: High Priority

Project: 29037 – Ecosystem Diagnosis and Treatment in the Columbia Cascade Province

Sponsor: Washington Department of Fish and Wildlife (WDFW), Yakama Nation, (YN) Confederated Tribes of the Colville Reservation (CTCR)

Short Description:

Provide an analytic foundation, including refinement of the coarse screen EDT, needed for the aquatic assessment and management components of subbasin plans in the Columbia Cascade Province.

Abbreviated Abstract

Subbasin Planning has been identified as a key to achieving the Northwest Power Planning Council's 2000 Columbia Basin Fish and Wildlife Program's basinwide vision of "a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife…and [provides] the benefits from fish and wildlife valued by the people of the region." Subbasin plans are also identified in RPA action 154 as providing "an important context for classifying and prioritizing watersheds for protection and restoration" and "the foundation for ESA recovery planning." Meeting this goal will require extraordinary levels of institutional, political and social cooperation. Additionally, the 2000 Program is unique from previous iterations in its structural commitment to scientifically based, clearly articulated goals, objectives and implementation strategies. Development of reliable communication and information infrastructures and a scientifically sound conceptual framework within which to sort, prioritize and translate to implementation, available information and knowledge, is essential to the long-term success of this undertaking.

The Washington Department of Fish & Wildlife (WDFW), the Yakama Nation, and the Confederated Tribes of the Colville Indian Reservation are embracing this challenge by jointly requesting funding to conduct a coordinated evaluation of anadromous salmonid habitat conditions in the Columbia Cascade Province using the Ecosystem Diagnosis and Treatment methodology (EDT). The project proponents recognize that Subbasin plans play a pivotal role in the Council's 2000 Fish and Wildlife Program; they also note that access to, and development of, shared, verifiable, comprehensive, and comprehensible ecosystem assessment data and knowledge is at the heart of Subbasin planning. Additionally, project proponents recognize the import of a transparent analytic framework, such as EDT, to developing and maintaining the levels of scientific, social, institutional and economic support necessary to implement Subbasin plans and overall regional salmon recovery strategies.

The proposed evaluation of four of the Cascade Columbia Province's six constituent subbasins (Entiat, Wenatchee, Methow and Okanogan) will include refinement of the coarse screen EDT analysis conducted by the NWPPC, development of working hypotheses on subbasin ecosystems, and a series of interactive workshops in which technical and policy representatives will define and evaluate alternative strategies for meeting biological objectives and identifying potential risks. Sensitivity analysis will be used to evaluate the effects of uncertainty in habitat conditions and model assumptions. Sensitivity analysis will also aid in the development and refinement of a prioritized list of protection and restoration activities and an identification of related research and monitoring needs. Assessment needs of critical priority will be addressed through real time allocation of project personnel. The project completion date is anticipated to integrate well into

Cascade Columbia subbasin planning efforts and will coincide with initiation of the next round of provincial reviews (currently scheduled for March 2005).

Relationship to Other Projects

Project ID	Title	Nature of relationship
200020033	Rehabilitate Instream and Riparian Habitat on the Similkameen and Okanogan	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200126033	Okanogan Watershed Land and Water Rights Acquisition	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200126008	Omak Creek Relocation Implementation	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
199604200	Okanogan Focus Watershed	EDT results will allow watershed assessments to be more focused and complete in evaluating habitat conditions and in establishing monitoring framework.
20001300	Evaluation Sockeye Re-introduction into Skaha Lake	EDT assessment may be useful in describing potential limiting factors for sockeye production.
200000100	Fish Habitat Improvement; Omak Creek	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200126017	Stream Gaging Installation and Operations	Information collected by these devices will be important to continue to refine EDT data in the future.
200020042	Integrating Okanogan and Methow Watershed Data for Salmonid Restoration	A continuation of data collection and synthesis will continue to augment and refine EDT inputs and provide more reliable outputs.
199603401	Methow River Valley Irrigation District	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
199802500	Early Winters Creek Habitat Restoration	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
9604000	Mid-Columbia Coho Feasibility Reintroduction Study, Yakama Nation	EDT assessment may be useful in helping define carrying capacities for individual species and providing a means for evaluating species interactions.
23024	Hancock Springs Passage and Habitat Restoration Improvements, Yakama Nation	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
199802900	Goat Creek Instream Habitat Restoration	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200123012	Arrowleaf/Methow River Conservation Easement	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200126015	Methow Basin Screening	EDT outputs may be useful in describing increases in salmon productivity as a result of improvements in irrigation systems.
	Methow Watershed Project II	EDT assessment could be used to estimate benefits

Project ID	Title	Nature of relationship
		of this work to overall watershed productivity, carrying capacity and life history diversity.
199803500	Measure Mine Drainage Effects of Alder Creek	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
91999155	Establish the Methow Watershed Council	EDT results will allow watershed assessments to be more focused and complete in evaluating habitat conditions and in establishing monitoring framework.
19999046	Identify Res.Fish & Macroinvertebrate Taxa & Function in Anad Fish Habitat	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200123027	Methow Basin Floodplain and Riparian Land Acquisitions	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
26029	Stream Gaging Installation and Operations - Wenatchee	Information collected by these devices will be important to continue to refine EDT data in the future.
199604000	Wenatchee and Methow River Coho Restoration	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200126036	Chumstick Creek (North Road) Culvert Replacement	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200020001	Remove 23 Migrational Barriers and Restore Instream and Riparian Habitat on Chumstick Creek	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200123023	Stormy Creek High Priority Culvert Replacement	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
200123055	Acquire Prime Salmonid Spawning and Rearing Habitat on Entiat River	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.
19999031	Implement Entiat Model Watershed Plan	EDT assessment could be used to estimate benefits of this work to overall watershed productivity, carrying capacity and life history diversity.

Relationship to Existing Goals, Objectives and Strategies

Subbasin plans are becoming a focal point for Columbia Basin planning. For instance, the Subbasin planning process will incorporate mandates related to implementation of the NMFS' FCRPS Reasonable and Prudent Alternatives. Completion of subbasin planning in a timely and coordinated manner is essential to achieving the goals of the Fish and Wildlife Program (Program). The Program relies on a collaborative subbasin planning process to develop, evaluate, and recommend management strategies consistent with a basinwide vision for fish and wildlife restoration. These strategies will subsequently play a pivotal role in shaping implementation plans that identify specific projects for potential funding by the BPA.

The EDT process proposed in the Cascade Columbia Province is also aligned with NMFS 2000 FCRPS Biological Opinion Action 154 states: "BPA shall work with the NWPPC to ensure development and updating of subbasin assessments and plans; match

state and local funding for coordinated development of watershed assessments and plans; and help fund technical support for subbasin and watershed plan implementation from 2001 to 2006. Planning for priority subbasins should be completed by the 2003 check-in. The action agencies will work with other Federal agencies to ensure that subbasin and watershed assessments and plans are coordinated across non-Federal and Federal land ownerships and programs."

Completing scientifically defensible, practical subbasin plans on schedule requires that planning groups have at their disposal a foundation of analytic tools supplemented by technical expertise. This foundation should be consistent with the Scientific Principles identified in the Program, and must be able to withstand the scrutiny of the Independent Scientific Advisory Board and other peer reviewers. The "Technical Guide for Subbasin Planners" (NWPPC 2001) identifies an approach to subbasin planning that builds upon the coarse scale EDT analysis conducted by the NWPPC to develop working hypotheses on the condition and processes affecting a subbasin ecosystem, and to evaluate alternative management strategies.

WDFW, the Yakama Nation, and the Confederated Tribes of the Colville Indian Reservation believe that a consistent, integrated approach to subbasin plan development in the Columbia Cascade Province will maximize the value of effort involved and enhance the utility of the final product, while minimizing confusion, duplication of effort time required for plan completion, and overall costs. Our proposal to cooperatively develop an appropriate analytic foundation complements the high level of policy and technical coordination already occurring in this subbasin, such as that facilitated by the Upper Columbia Salmon Recovery Board (UCSRB), a partnership among Chelan, Douglas, and Okanogan counties, the Yakama Nation, and the Confederated Tribes of the Colville Indian Reservation in cooperation with local, state, and federal partners.

The project proponent's primary objective is to provide the analytic foundation for the aquatic component of subbasin plans on a timely basis, consistent with the NWPPC subbasin planning guidelines, in order to maximize the likelihood that defensible subbasin plans are completed on schedule. However, this evaluation will provide and receive multi-dimensional synergistic benefits in relating to the concurrent regional activities listed below:

Tributary Habitat Assessments and the Technical Recovery Team: The National Marine Fisheries Service is establishing Technical Recovery Teams (TRT's) for specific geographic regions that encompass particular salmonid Evolutionarily Significant Units (ESU's). These teams consist of scientists with a high level of expertise from within NMFS, state and tribal resource agencies, academia and environmental consulting firms. The TRT's are charged with identifying specific population units within ESU's, establishing biological delisting criteria, describing key fish/habitat relationships, characterizing factors that are limiting or responsible for declines, and providing examples of combinations of populations at particular status that could allow delisting. The TRT's role in developing a recovery plan will depend upon the specific region and the particular policy level processes that may be required in those circumstances.

Characterizing the factors affecting particular populations will require combining results of habitat assessments with knowledge about how the particular fish population relates to habitat. The TRT's are ultimately responsible for producing a rigorous,

scientifically based assessment of what factors, if addressed, would have potentially high benefits to the population(s) within a particular ESU. Doing such a detailed assessment on a reach-by-reach basis within the TRT process would be neither cost effective nor productive. As a result, NMFS has encouraged the Council to fund regional teams of experts to provide tributary level planners with expert help in developing and interpreting tributary habitat assessments. NMFS has developed a set of key questions an assessment should address those questions are captured in the subbasin planning guidance provided by the Northwest Power Planning Council. There are several opportunities for coordination and further development of habitat assessment tools. NMFS and the TRT will be most interested in ensuring that regional subbasin assessments relate to specific populations and the habitat they rely on, that assessment efforts to the extent possible use available data from the target subbasins to characterize habitat conditions and fish responses, and that the results of quantitative assessments be expressed simply and clearly in terms of key assumptions. NMFS Science center staff and the TRT's will be encouraged to work through detailed case studies with regional technical experts to ensure that desired levels of scientific rigor and detail are well understood.

The Upper Columbia Salmon Recovery Board (UCSRB and the Regional Technical Committee (RTT): The UCSRB is a partnership among Chelan, Douglas, and Okanogan counties, the Yakama Nation, and the Confederated Tribes of the Colville Indian Reservation in cooperation with local, state, and federal partners. The mission of the UCSRB is to restore viable and sustainable populations of salmon, steelhead, and other at-risk species through the collaborative efforts, combined resources, and wise resource management of the Upper Columbia Region. To better meet its mission, the UCSRB wishes to ensure that actions taken to protect and restore salmonid habitat in the region are based on sound scientific principles.

The RTT: To meet its mission, the UCSRB intends to ensure that actions taken to protect and restore salmonid habitat in the region are based on sound scientific principles. The RTT consists of scientific representatives from many of the region's agencies, Tribes and Public Utility Districts. The UCSRB maintains the RTT to: 1) recommend region-wide approaches to protect and restore salmonid habitat, 2) develop and evaluate salmonid recovery projects to forward to the UCSRB, and 3) develop and implement salmonid recovery monitoring plans as appropriate.

An important function of the RTT is to review the technical merits of projects to be submitted by project sponsors in the Upper Columbia Region for funding by the Washington State Salmon Recovery Funding Board (or other funding sources). The UCSRB directs the RTT to establish a scientific foundation for this process, with the premise that it will enable them to identify projects that will best contribute to the recovery of salmonids listed under the ESA.

State 2514 Process: The Watershed Management Act: The 1998 Legislature passed the Watershed Management Act (Chapter 90.82 RCW) to provide a framework for local citizens, interest groups, and government organizations to collaboratively identify and solve water-related issues in each of the 62 Water Resource Inventory Areas (WRIAs) in the State. The Watershed Management Act enables local groups called "Planning Units" to form for the purpose of conducting watershed planning.

Under the law, citizens, local governments, tribes, and other members of the Planning Unit must assess water resources and needs and recommend management strategies for the watershed. The Planning Unit may also assess habitat, water quality and instream flow requirements. In the Columbia Cascade Province, development and progress for each of the Okanogan (not yet formed), Methow, Entiat (well under way) and Wenatchee Planning Units vary widely. However, the existing Planning Units have chosen to assess the habitat component of this planning process. The EDT methodology is providing the basis for habitat evaluation in the Entiat subbasin and could well provide the same for the other subbasins.

Review Comments

The budget for this project has been reduced to reflect ecosystem diagnosis but not treatment and salmon recovery funding is being pursued. Funding was not provided through the WA SRFB process. NMFS has identified this project as a BiOp project.

Budget

FY02	FY03	FY04
$500,000 Category: High Priority	$150,000 Category: High Priority	$150,000 Category: High Priority

Project: 29041 - Evaluate Distribution, Abundance, Genetic Structure, and Habitat Use of Bull Trout Populations in the Columbia Cascade Province

Sponsor: U.S. Fish and Wildlife Service (USFWS)

Short Description:

Evaluate distribution, abundance, genetic structure and habitat use of bull trout in the Wenatchee, Entiat, and Methow Rivers. Identify habitat limiting factors for bull trout.

Abbreviated Abstract

Uncertainty about distribution, abundance, genetic structure, and habitat use of bull trout populations constrains effective management and contributes to regulatory uncertainty. The status of bull trout populations is difficult to assess because bull trout are rare and they exhibit a diversity of life history strategies within populations. Consequently, accurate population assessments require long-term monitoring using a variety of techniques. The objectives of this project are to evaluate the status of bull trout populations in the Methow, Entiat, and Wenatchee subbasins and mainstem Columbia River within the Cascade Province and to identify habitat limiting factors for bull trout. We propose to use multiple approaches to enhance ongoing assessments of population status:

(1) determine population genetic structure using non-lethal tissue sampling;
(2) evaluate connectivity, locate spawning and wintering areas, and identify migratory patterns using radio telemetry;
(3) estimate abundance using redd surveys, snorkel surveys, and video surveys, and cross-calibrate these methods; and
(4) identify habitat limiting factors using habitat surveys and archival temperature tags.

Together with already completed and ongoing studies, this effort will provide a comprehensive view of bull trout populations and habitat use in three subbasins and the mainstem Columbia and will provide the methodological framework necessary for improving the reliability and practicality of bull trout population assessments.

This effort will address information needs identified in National Marine Fisheries Service and U.S. Fish and Wildlife Service (FWS) biological opinions, sub-basin plans, Washington State watershed plans, US Forest Service (USFS) watershed assessments and could be used to relate population status to current management strategies and to identify relevant watershed restoration needs. Our efforts to compare methods will have relevance across the range of bull trout. We will present results of this work in guidance to fisheries managers, annual reports, presentations at professional and public meetings, and publications in peer-reviewed journals.

Relationship to Other Projects

Project ID	Title	Nature of relationship
	NMFS BO	Provides information necessary in order to develop plans to implement BO including offsite mitigation, population monitoring, and data management
	USFWS BO	Provides information that can be used to develop measures for monitoring and adaptive management and meeting criteria for bull trout
	BPA SubBasin Plans	Provides data for gaps in information and for limiting factors such as connectivity, temperatures, bull trout dist. in lower tributares, baseline populations
	USFWS Recovery Plan	Proposal gathers data for determining research need, for connectivity of core areas, baseline populations for recovery
	Non-BPA Project. Genetic Analysis of Bull Trout	Provides data for determining population assemblages and baselines for comparison, connectivity of populations

Review Comments

Supplies and equipment could be available at the research station and genetics cost seem high. Could other cost reductions be achieved? USFWS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $186,366 Category: High Priority	Rec: $282,800 Category: High Priority	Rec: $80,976 Category: High Priority

Project: 29043 - SSHIAP - Columbia Cascade Province

Sponsor: Washington Department of Fish and Wildlife (WDFW)

Short Description:

Project will provide routed & segmented hydro-layer, and collate and synthesize data on 19 aquatic habitat variables over an estimated 22,500 mi of streams in the subbasins of the Columbia Cascade Province.

Abbreviated Abstract

The Salmon and Steelhead Habitat Inventory and Assessment Project (SSHIAP) is a partnership-based information system that characterizes freshwater and estuary habitat conditions and distribution of salmonid stocks in Washington. The SSHIAP system provides a consistent residence, tracking, and data delivery mechanism for these key habitat data elements. To date, SSHIAP efforts have been focused in western Washington; this project reflects the expansion of SSHIAP to the Columbia Cascades Province of eastern Washington. Work under this project will:

1) update the base USGS hydrolayer to reflect current water channel locations;
2) utilize a recently developed GIS program to automate stream segmentation based on physical characteristics, gradient, and habitat type;
3) assemble existing current and historic salmonid habitat in the Columbia Cascades Province; and
4) deliver web-based and hardcopy products to users.

Project Partners on this effort include: Upper Columbia River Watershed Planning Team, Yakama Nation, Foster Creek Conservation District, USFWS, Washington Conservation Commission-Limiting Factors Analysis, Washington Department of Ecology, and the Washington Department of Fish and Wildlife (lead).

Relationship to Other Projects

Project ID	Title	Nature of relationship
	StreamNet	SSHIAP fish distribution and fish passage barriers feed into StreamNet

Review Comments

NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $390,000 Category: Recommended Action	Rec: $50,000 Category: Recommended Action	Rec: $50,000 Category: Recommended Action

Project: 29052 - Spatial and Temporal Occurrence of Salmonid Pathogens in the Upper Middle Mainstem Subbasin of the Columbia Cascade Province

Sponsor: Washington State University

Short Description:

Monitor the occurrence of salmonid pathogens and assess sources, fate, and transport throughout the subbasin.

Abbreviated Abstract

The recently published National Marine Fisheries Service Biological Opinion on Operation of the Federal Columbia River Power System (21 December 2000) identified a range of factors that may affect fitness of salmonid populations. Besides physical detriments related to dam passage, the review identified illegal harvest, predation, gill-net interactions, and disease as potentially important factors influencing mortality. Despite the potential importance of disease, there is very little information available on the distribution and ecology of infectious disease agents relative to watersheds and fish populations. We surmise that the lack of published data on disease ecology reflects the fact that fish pathogen assays, typically culture-based, are too cumbersome to apply to large numbers of samples. In the study outlined herein, we propose to develop and implement a monitoring protocol to assess the occurrence of fish pathogens in the Upper Middle Mainstem Subbasin of the Columbia Cascade Province using polymerase chain reaction (PCR) coupled with a DNA array-based reporting system. In addition, the proposed monitoring protocol provides a framework for quantifying the detection limit and the health risks associated with positive and negative results, key aspects for interpreting assay results relative to in-stream salmonid populations.

The specific objectives of the proposed research are:

(1) Develop a DNA micro-array coupled with PCR for multiplex detection of salmonid pathogens,

(2) Characterize the spatial and temporal occurrence of salmonid pathogens and associated fluctuations in selected water quality parameters within the Upper Middle Mainstem Subbasin of the Columbia Cascade Province, and

(3) Identify possible sources of salmonid pathogens and relationships between the occurrence of pathogens and specific water quality parameters.

The proposed study will provide critical information on the temporal and spatial occurrence of planktonic salmonid pathogens within the Columbia Cascade Province. These findings alone are directly applicable in addressing key areas outlined in the NMFS' and USFWS' 2000 Biological Opinion and Action Agencies Implementation Plan. In addition, if salmonid pathogens are identified in the water column, the sampling methodology has been specifically designed to provide information on possible sources, fate, and transport as well as possible relationships with specific water quality characteristics. This additional information will be critical in identifying immediate needs

for future research, including the development and implementation of best management practices.

Relationship to Other Projects

Project ID	Title	Nature of relationship
	See Project description	

Review Comments

NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $220,832 Category: Recommended Action	Rec: $255,145 Category: Recommended Action	Rec: $263,107 Category: Recommended Action

Project: 29055 - Columbia Cascade Water Rights Acquisition

Sponsor: Washington Department of Ecology

Short description:

Acquire senior water rights for instream flows in targeted small streams and tributaries to restore critically needed water for spawning, rearing and migration of listed and depressed species within the Wenatchee, Methow, Okanogan and Entiat subbasins.

Abbreviated abstract

The Department of Ecology (Ecology) intends to increase and protect instream flows to benefit at risk salmonid populations and allow stream habitat to recover. Ecology will target streams and tributaries with a history of flow problems and focus on areas with listed species. The following factors will be examined on each target stream and tributary:

- the importance of the area for spawning, rearing or migration;
- relative condition of the habitat in the stream or reach;
- number of water diversions; the size of stream and amount of water needed to improve flow conditions; and
- opportunities for water rights acquisition.

Under this proposal, Ecology will lease or purchase water rights in the Methow, Wenatchee, Entiat and Okanogan Subbasins, to restore and enhance instream flows where significant needs of listed fish have been identified in those subbasins. The water obtained through the program will be placed in the state's water trust—assuring that the water is "wet," and that it stays in the rivers and streams.

This water rights acquisition proposal is consistent with the FCRPS Biological Opinion, particularly Habitat RPA Action 151, and the NWPPC Fish and Wildlife Program.

In addition, the Entiat, Methow and Wenatchee Subbasins have been identified as priority subbasins in the All-H Paper.

Ecology is requesting funding from BPA for approximately half of the program costs over the next three years i.e., $1.6 million for three years. BPA funding will be matched by approximately $1.6 million in state funds for the same period. This proposal is a great opportunity to develop a partnership between BPA, NPPC and the State of Washington and to establish a long term and effective water rights acquisition program throughout the Columbia Cascade Province.

Review Comments

M&E not adequately described. Is the water guaranteed to remain in streams? What is the criteria for purchasing rights? The priority of this project depends on the status of the development of the BPA water banking strategy. Subbasin planning will also help guide the implementation of this effort. Capital funds should be removed from the first year and focus should be applied to reviewing the database and prioritizing purchases for the out years. The budget has been reduced to reflect this. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
Rec: $154,875 Category: High Priority	Rec: $534,875 Category: High Priority	Rec: $534,875 Category: High Priority

Table 7. Subbasin Summary FY 2003 - Funding Proposal Matrix

Project Proposal ID	29009	29025	29037	29041	29043	29052	29055
Provincial Team Funding Recommendation	High Priority	High Priority	High Priority	High Priority	Recomm. Action	Recomm. Action	High Priority
National Marine Fisheries Service Objectives							
Objective 1. Between 2001 and 2012, restore habitat, acquire riparian corridors, modify flow regimes, reduce non-point pollution, develop improvement plans for all reaches	X	X					X
Objective 2. Beginning in 2001, identify sampling reaches, survey conditions, describe cause-and-effect relationships, identify research needs.			X		X	X	
Washington Department of Ecology							
Goal: Ensure State water quality standards to protect beneficial							X

Project Proposal ID	29009	29025	29037	29041	29043	29052	29055
uses are met.							
Washington Department of Fish and Wildlife							
Sage grouse							
Goal 1: Increase the population size and distribution of sage grouse.							
Objective 1. Conduct research on sage grouse through 2005 as part of the WDFW's statewide sage grouse research program.							
Objective 2. Increase the breeding population of sage grouse to more than 1,500 distributed throughout six management zones							
Goal 2: Protect, enhance, and increase shrub-steppe habitat.							
Objective 1. Improve shrub-steppe habitat quality and configuration in the Columbia Upper Middle by 2005.							
Objective 2. Monitor wildlife and habitat response to protection, maintenance, and enhancement measures annually.							
Sharp-tailed grouse							
Goal: Recover populations of sharp-tailed grouse in the Columbia Upper Middle to the level where populations are viable.							
Objective 1. Conduct research on sharp-tailed grouse through 2005 to monitor population size, determine population viability, and evaluate population responses to habitat alteration.							
Objective 2. Improve quantity, quality, and configuration of the shrub-steppe habitat necessary to support a viable population of sharp-tailed grouse by 2010.							
Objective 3. Use translocations of sharp-tailed grouse into Washington from populations in other states so that a population of at least 1,000 is supported in the Columbia Upper Middle by 2010.							
Pygmy Rabbit							
Goal: Recover and maintain a viable pygmy rabbit population in Washington.							
Burrowing Owl							
Goal: Halt the decline of burrowing owls, increase distribution of burrowing owls to include many of the historic regions occupied in the Columbia Basin, and maintain a stable population of burrowing owls in Washington.							
Objective 1. Determine factors limiting burrowing owl populations in Washington.							
Objective 2. Develop conservation measures to protect burrowing owls.							
Ferruginous Hawk							
Goal: Recover ferruginous hawks from threatened status by maintaining a population of at least 60 nesting pairs statewide, including at least 10 pairs in the North Recovery Zone.							
Objective 1. Improve our understanding of the suitability and security of ferruginous hawk nesting habitats.							
Objective 2. Assess the importance of survival rates and contaminants of adult and juvenile ferruginous hawks to low rates of nest occupancy, and relate these to hawk movements.							
Objective 3. Improve ferruginous hawk nest occupancy by identifying and promoting protection and enhancement (i.e., erect nest platforms) of the highest quality nesting habitats based on assessment of prey, survival, and human activity.							

Project Proposal ID	29009	29025	29037	29041	29043	29052	29055
Washington Ground Squirrel							
Goal: Recover populations of Washington ground squirrels in the Columbia Upper Middle to the level where populations are viable.							
Objective 1. Determine distribution and abundance of Washington ground squirrels the Columbia Upper Middle.							
Objective 2. Develop habitat management strategies for Washington ground squirrels and incorporate specific management objectives into Wildlife Area and landscape plans.							
Northern Leopard Frog							
Goal: Conserve the remaining populations of northern leopard frogs in Washington and reestablish additional populations.							
Objective 1. Develop needed information on distribution, habitat and relationships with other species, and implement recovery of leopard frogs.							
Objective 2. Plan and implement recovery programs, translocations and re-establishment of leopard frogs throughout the historic range of the species.							
Colockum Elk Herd							
Goal 1: Meet herd objectives of greater than 15 bulls:100 cows in post hunting season herd composition counts (Ron Fox, WDFW, personal communication).							
Objective1. Determine the nutritional health of the Colockum elk herd.							
Objective 2. Determine predation rates and sources of predation on elk.							
Objective 3. Reduce damage to agricultural crops by elk.							
Chelan County PUD							
Fish Goal 1: Protect species of concern (spring chinook salmon, fall/summer chinook salmon, sockeye salmon, steelhead, and coho salmon (after naturally spawning populations are reestablished)).							
Objective 1. Insure that the operation of Rock Island and Rocky Reach dams have no net impact (NNI) on the salmonid species of concern.							
Wildlife Goal 1: Mitigate for any potential losses to wildlife or associated habitats with regards to the operation of Rock Island Dam.							
Objective 1. Enhance habitat for a variety of wildlife species.							
Objective 2. Monitor wildlife populations.							
Foster Creek Conservation District							
Goal 1: Protect natural resources and enhance sustainable, profitable agriculture; and improve the quality of life in Douglas County (Long Range Plan 2001 Update).							
Objective 1. Facilitation and negotiation of a county-wide habitat conservation plan to address ESA listings in the agricultural community.							
Objective 2. Serve as lead entity for salmon recovery activities in the Foster and Moses Coulee watersheds.							
Objective 3. Serve as lead entity for the Watershed Planning under E.S.H.B. 2514.							

Project Proposal ID	29009	29025	29037	29041	29043	29052	29055
These projects are referenced by ID above: 29009 – Acquire Dole-Beebe Property and Associated Water Rights 29025 – Columbia Cascade Province Pump Screening 29037 – Ecosystem Diagnosis and Treatment in the Columbia Cascade Province 29041 – Evaluate Distribution, Abundance, Genetic Structure, and Habitat Use of Bull Trout Populations in the Columbia Cascade Province 29043 – SSHIAP - Columbia Cascade Province 29052 – Spatial and Temporal Occurrence of Salmonid Pathogens in the Upper Middle Mainstem Subbasin of the Columbia Cascade Province 29055 – Columbia Cascade Water Rights Acquisition							

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