



5. Ecological Rationale





Ecological Rationale

5.1 UPPER COLUMBIA RIVER ESU SUMMER/FALL CHINOOK SALMON

5.1.1 CURRENT POPULATION STATUS

The NOAA Fisheries 1997 Status Review of Chinook salmon from Washington, Idaho, Oregon, and California, identifies the Upper Columbia River summer/fall Chinook ESU as not currently in danger of extinction, and not expected to become so in the foreseeable future (Meyers et al. 1998). In recent decades smolt-to-adult survival of Okanogan River summer/fall Chinook salmon has varied widely due largely to freshwater and marine conditions, but also due to mortalities associated with the nine downstream Columbia River hydropower projects. Early-arriving adult summer/fall Chinook counts at Wells Dam between 1980 and 2001 ranged from 1,343 to 33,244 [see SF HGMP, p.87 for associated table].

In the last two years returns of summer/fall Chinook to the Similkameen River and upper Okanogan River have increased substantially due in large part to improved ocean conditions. However, records from the years 1987 to 1996 show the long-term trend for the Okanogan population is -5.2% with a short-term trend of -8.8% (Brown, 1999). Based on these negative escapement trends, the Methow and Okanogan river summer/fall Chinook stocks are considered depressed.

5.1.2 LIFE HISTORY

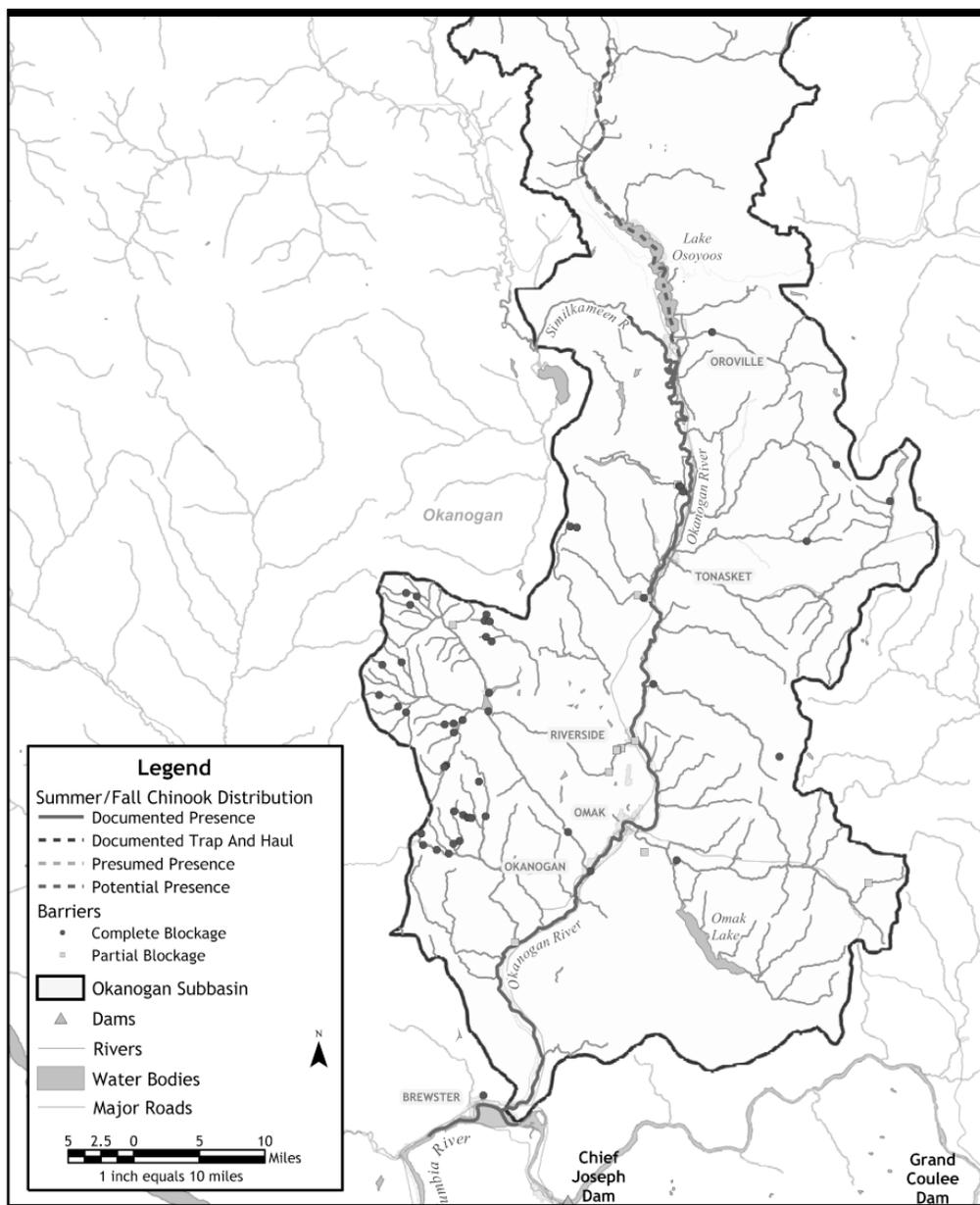
Upper Columbia River summer/fall Chinook migrate past Wells Dam and enter the Okanogan River from mid-July through November. They are considered to have an ocean-type life history. The Upper Columbia River summer/fall Chinook run includes an “early-arriving” and a “later-arriving” component. For the purposes of this CJDHP the early-arriving component is defined as those fish passing Wells Dam from July 10 to August 28, while the later-arriving component consists of fish passing the Wells Dam between August 29 and November 15.

Adult summer/fall Chinook spawn in the Okanogan subbasin from late September through early November, with spawning peaking in mid-October (Peven and Duree 1997; Murdoch and Miller 1999). Peak spawn timing is a continuum, occurring later in the season in the lower Okanogan River, and earlier in the upper Okanogan and Similkameen rivers.

Approximately 50% of the spawning adult summer/fall Chinook in the Okanogan subbasin are 5-year old fish, with the remainder predominantly 4-year old fish (Murdoch and Miller 1999). Emergence timing is thought to occur from January through April, although specific data is not currently available. Summer/fall Chinook juveniles generally emigrate to the ocean as subyearling fry, leaving the Okanogan River from 1 to 4 months after emergence. There is evidence that some fish may undergo an extended residence period, including a protracted downstream migration. Many subyearlings rear in the mid-Columbia impoundments for various periods of time during their outmigration (Peven and Duree 1997). Additionally, some migrants over-winter in these impoundments and enter the ocean as yearlings.

5.1.3 CURRENT AND HISTORICAL DISTRIBUTION

Contemporary summer/fall Chinook spawning generally occurs in spatially discontinuous areas along the Okanogan River from just below the town of Malott (RM 14.5) to an area located below Zosel Dam at approximately river mile 77 near the outlet of Osoyoos Lake (Murdoch and Miller 1999). Spawning also occurs in the Similkameen River (which enters



Courtesy KWA Ecological Sciences, Inc.

FIGURE 12: Okanogan Subbasin Summer/Fall Chinook Distribution

the Okanogan River at approximately river mile 76 just south of the town of Oroville) up to Enloe Dam at river mile 8.8. Distribution of summer/fall Chinook salmon in the Okanogan River extends upstream as far as McIntyre Dam, which is located 12.5 miles upstream of Osoyoos Lake in Canada. It is possible that during high flow periods some fish may pass beyond McIntyre Dam (Entrix and Golder 2002).

The majority of spawning in the Okanogan subbasin is at present heavily concentrated in the Similkameen River. From 1998 through 2002 the proportion of

hatchery-origin fish spawning in the Similkameen River averaged 57%, while in the Okanogan River, hatchery-origin fish averaged 51% of the natural spawners.

Between 1995 and 2000, approximately 78% of the returning adult hatchery Okanogan summer/fall Chinook spawned in the Similkameen River. This localized activity is associated primarily with WDFW’s artificial production program at Similkameen Pond. Summer/fall Chinook spawning in the Similkameen River is largely concentrated within an 8.7-mile stretch of river between Enloe Dam and Driscoll Island. The

high rate of smolt-to-adult survival of summer/fall Chinook from Similkameen Pond has resulted in spawner densities in the Similkameen River greater than 400 redds per .62 mile (400 redds/km). As a result, habitat capacity in much of the Similkameen River is currently at its limit with redd superimposition occurring in much of the available habitat.

Summer/fall Chinook historically provided an important tribal fishery in the Okanogan subbasin. Members of the Colville Tribes are known to have constructed fishing weirs at

numerous sites including locations near the current towns of Monse, Malott, Omak and Oroville. However, as noted previously, by 1874 more than half of the historical salmon run that entered the Okanogan subbasin had been destroyed by lower river commercial fisheries and by 1890 runs of salmon to the Okanogan subbasin were almost completely destroyed (Ray 1972).

Bryant and Parkhurst (1950) in *Survey of the Columbia River and its Tributaries, Part IV*, commented, "In recent years the runs of Chinook salmon entering the Okanogan River have not been large. The chief Chinook spawning areas are located in the lower 16 miles up to the town of Malott, and for a distance of a few miles downstream from Lake Osoyoos." Dense spawning also occurred historically in the Okanogan River near the towns of Riverside (RM 49), and Omak (RM 32) where habitat is currently under-seeded (French & Wahle 1960, 1965). Today the lower 16 miles of the Okanogan River are inundated by Wells Pool and are thus unavailable for spawning. Bryant and Parkhurst's observation suggests that the Chinook spawning in the lower river (most likely the later-arriving summer/fall Chinook) were once a major portion of the Okanogan River population.

With the exception of the Similkameen River, much of the historical summer/fall Chinook spawning habitat in



FIGURE 13: Photo of Falls Below Enloe Dam on Similkameen River

the Okanogan River has been largely underused for many decades. Of the hatchery fish that do spawn in the Okanogan River, 76% spawn above the city of

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Riverside (RM 40.3) leaving substantial habitat in the lower reaches of the Okanogan largely unseeded. As noted earlier, at present only the early-arriving portion of the summer/fall Chinook run is propagated. A central objective of the CJDHP is to increase use of available spawning habitat on the lower reaches of the Okanogan River and particularly, to restore the later-arriving component of summer/fall Chinook, which may be

better suited to the conditions likely to be encountered in this reach of the River.

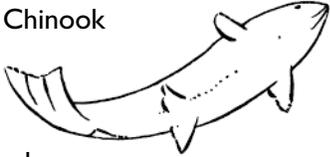
5.1.4 HABITAT CAPACITY

Accurate estimates of habitat carrying capacity are notoriously difficult to gage. In 1998, as part of development of the Mid-Columbia PUD HCPs a document titled, *Biological Assessment and Management Plan: Mid Columbia River Hatchery Program (BAMP)*, was produced with cooperation from National Marine Fisheries Service (now NOAA Fisheries), USFWS, WDFW, Confederated Tribes of the Yakama Indian Nation, Colville Tribes, Confederated Tribes of the Umatilla Indian Reservation, Chelan County PUD, and Douglas County PUD. The BAMP included a plan for operation and evaluation of anadromous salmonid hatcheries in the Columbia River upstream of the Yakima River confluence, and included genetic and ecologic assessments of summer/fall Chinook, spring Chinook, sockeye and steelhead.

As part of the development of the BAMP, a Hatchery Work Group was established to specifically address production issues. This group, using a variety of state of the art methods, provided estimates of the carrying capacity of the Cascade Columbia subbasins, including the Okanogan. The Okanogan subbasin results are summarized in Table 2.

Table 2: Estimated Carrying Capacity of Natural-origin Anadromous Fish in Okanogan Subbasin (Bugert 1998)

| | SMOLT CAPACITY | RECENT 10-YR AVERAGE | PERCENT OF CAPACITY |
|---------------------|----------------|----------------------|---------------------|
| Summer/fall Chinook | 1,440,000 | 475,000 | 33% |
| Sockeye | 4,000,000 | 990,000 | 25% |
| Steelhead | 17,600 | 15,700 | 89% |
| Spring Chinook | Not reported | 0 | 0% |



At the time these estimates were developed in 1998, the Hatchery Work Group estimated the Okanogan subbasin was at 33% of capacity. In the last few years, substantial returns of Chinook largely related to improved ocean conditions have likely increased use of available habitat somewhat above the identified 33%.

It is important to note the very low carrying capacity for Okanogan steelhead (Table 2) is a result primarily of degraded habitat in tributary streams in both the U.S. and Canadian portions of the subbasin, as well as impediments to passage in some of the tributaries. The tributary habitats critical to steelhead will not be used by hatchery-origin summer/fall Chinook. Substantial ongoing efforts are underway to restore select tributary habitat in the Okanogan subbasin [see Chapter 6].

5.1.5 CURRENT AND HISTORICAL ARTIFICIAL PRODUCTION

Summer/fall Chinook populations in the Okanogan subbasin are currently supplemented by a single hatchery program, which releases 576,000 yearling smolts annually from the Similkameen Pond. WDFW operates this facility, which is located on the Similkameen River at river mile 3.1 (the Similkameen enters the Okanogan at RM 77). The Similkameen Pond program was developed to “mitigate for the loss of summer Chinook salmon adults that would have been produced in the region in the absence of Wells, Rocky Reach, and Rock Island hydroelectric projects” (WDFW 1999).

Propagation of summer/fall Chinook in the upper Columbia began in 1967 with operation of the Wells

Dam spawning channel. Historically the entire run of summer/fall Chinook passing Wells Dam from July 10 through November 15 was used to propagate the Upper Columbia River Summer/Fall Chinook ESU. Broodstock for Okanogan River summer/fall Chinook was diverted from ladders at Wells Dam and/or derived from volunteers that entered a trap located at the hatchery discharge. The major populations intercepted at Wells Dam were summer/fall Chinook from the Methow and Okanogan subbasins. Regional experts generally agree that over the years only about 3% of non-indigenous stocks have been incorporated into this current broodstock (Brown 1999). Beginning in 1987, broodstock collection after August 28 was terminated to avoid the possible inclusion of stray fall Chinook from downriver production programs (Turtle Rock was at that time using fall Chinook broodstock collected at Priest Rapids). Since that time, early-arriving summer/fall Chinook broodstock for the Rocky Reach/Turtle Rock program and the Similkameen Pond program have been obtained from the trap at Wells Dam (Brown 1999). Under the existing program, early-arriving summer/fall Chinook broodstock destined for the Okanogan and Methow subbasins are collected each year from the run at large reaching Wells Dam. Trapping in the Wells Dam east ladder begins on July 10th and ends on August 28th [see SF HGMP, p. 51].

Current broodstock collection aims to achieve a minimum natural escapement of 2,000 adults and jacks past Wells Dam, and when possible to reach an escapement level of 3,500 fish. In low run years, hatchery programs are reduced or deferred to increase escapement. During those years, the order of elimination in hatchery programs is: 1) Wells subyearlings, 2) Wells yearlings, 3) the Carlton

Table 3: Survival Rates for Early-Arriving Summer/Fall Chinook (1983-1987 Brood Years)

| HATCHERY SURVIVAL RATE | AGE | RELEASE YEARS | RELEASE-ADULT |
|------------------------|-------------|---------------|---------------|
| Rocky Reach | Yearling | 1984-1989 | 1.4% |
| Wells | Subyearling | 1976-1979 | 0.1% |
| Wells | Yearling | 1976-1979 | 0.41% |



(Methow) and Similkameen (Okanogan) programs. Later-arriving summer/fall Chinook broodstock are not currently collected. The contemporary stocks in the Okanogan subbasin are considered a mix of summer and fall stocks (Miller and Hillman 1994, 1996, 1997, 1998).

Table 3 presents historical survival rates from WDFW’s programs in the Columbia Cascade Province (Bugert 1998).

Due in large part to the reliance on early-arriving summer/fall Chinook for hatchery broodstock since 1987, combined with mortalities associated with nine downstream dams, the natural-origin later-arriving Okanogan summer/fall Chinook populations in the Okanogan subbasin have declined to significantly lower levels than their early-arriving counterparts. It is probable that the current overall summer/fall Chinook population of the Okanogan and upper Columbia rivers is not representative genotypically, phenotypically, or behaviorally of the historical, indigenous population.

The Similkameen summer/fall Chinook program has not been able to consistently produce sufficient fish to meet its limited program objectives. In recent years the Similkameen production program has lost substantial numbers of fish due to cold-water disease, BKD, and Ich. Water quality problems including high water temperature, pollution, and heavy loads of fine sediments have also posed challenges for the program’s operators [SF HGMP, p.49].

5.1.6 HARVEST

The Colville Tribes currently manage a ceremonial and subsistence fishery in the tailrace immediately below

Chief Joseph Dam. The fishery uses hook-and-line gear to snag summer/fall Chinook and is designed to harvest summer/fall Chinook in excess of the current escapement objective of 3,500 fish. The fishery historically began on July 1 and ended no later than September 30. In 2002, the duration of the fishery was extended, and the location expanded 12 miles to the confluence of the Okanogan River.

In the past, the Colville Tribes have targeted summer/fall Chinook in this Chief Joseph Dam tailrace fishery, harvesting an average of 650 adults annually (1980-2003). The 1982-89 brood year average ocean fisheries exploitation rate was 39%, with the total exploitation rate of 68% estimated for the same years (Brown 2001). Because the Colville Tribes’ tailrace fishery is located in a terminal site and uses hook-and-line gear, the capacity to harvest large numbers of Chinook surplus to escapement needs is very limited. From 1980 - 2000, tribal members harvested 200 to 1,100 summer/fall Chinook and between 12 to 819 steelhead. Even with the extraordinary record run of summer/fall Chinook past Wells Dam of 47,700 fish in 2001, the Colville Tribes’ harvest was estimated at only 3,400 Chinook.

Historically, parties to the *U.S. v Oregon* agreement, in determining harvest levels, have not taken into account the need to provide for escapement of summer/fall Chinook to the upper Columbia sufficient to ensure the sustainability of naturally-spawning populations in the Okanogan subbasin, and provision of adequate ceremonial and subsistence fisheries for the Colville Tribes. Early-arriving summer/fall Chinook from the mid-Columbia region have in the past been heavily exploited in the ocean fisheries, although in recent years these fisheries have been restricted. The exploitation rate of summer/fall Chinook in the lower

Columbia River is not as great.

Recreational fisheries for summer/fall Chinook in the Okanogan and upper Columbia rivers are opened when forecasted runs of summer Chinook indicate a significant surplus to broodstock and escapement needs. A surplus is calculated as the anticipated run at Priest Rapids Dam less 5,750 fish required for broodstock at hatchery programs upstream of the Priest Rapids Dam, less 2.5% of the Priest Rapids count for lower-river recreational fisheries, less 5% harvest by the Wanapum Tribe, less an allocation for natural escapement in the Wenatchee, Methow, Similkameen, Okanogan, Entiat, and Chelan rivers. As escapement goals for each of these rivers has not yet been established, WDFW has conservatively used the sum of the maximum annual escapements to each river for 1996-2000, about 11,000 fish at Priest Rapids Dam as the trigger to open recreational fisheries.

The recreational fishery in the Okanogan River has been very infrequent due to the consistently poor runs of summer Chinook until recent years. Anglers are currently allowed to harvest hatchery-origin and natural-origin Chinook.

5.2 FACTORS LIMITING UPPER COLUMBIA RIVER SUMMER/FALL CHINOOK

5.2.1 OUT-OF-SUBBASIN LIMITING FACTORS

The most significant factor limiting productivity of naturally-spawning populations of upper Columbia River summer/fall Chinook in the upper Columbia River and Okanogan subbasin is the juvenile and adult mortalities associated with passage through nine downstream dams on the mainstem Columbia River.

Significant improvements have been made in system survival in recent years through increases in spring and summer flows, spill programs, improved juvenile bypass systems and transportation of juvenile fish at McNary Dam. In addition, performance standards for adult and juvenile passage have been developed as part of the Council's Fish and Wildlife Program, FERC licensing

requirements, and NOAA Fisheries' ESA regulation. Basinwide monitoring and evaluation programs are being developed which, once implemented, will compare actual performance measures against the performance standards.

Actions to improve juvenile and adult salmon passage through the hydroelectric system are critical to the long-term viability of natural-origin summer/fall Chinook populations in the Okanogan subbasin. Increased survival of juvenile fish is particularly important for both yearling migrants in the spring and subyearling migrants in the summer months. The results of current decisions regarding spill and implementation of new surface bypass technology at downstream hydropower facilities will also have impacts on the survival of juvenile summer/fall Chinook from the Okanogan subbasin. Progress in passage survival will affect the abundance and productivity of summer/fall Chinook – as well as life history diversity. The ability to successfully transition yearling programs to the natural, subyearling life history types is substantially dependent on survival improvements made at the downstream dams and associated reservoirs.

Other out-of-subbasin factors limiting productivity of naturally-spawning populations of upper Columbia River summer/fall Chinook in the upper Columbia River and Okanogan subbasin include: the effect of *U.S. v Oregon* established harvests on levels of escapement to the upper Columbia basin; habitat degradation throughout the downstream portions of the Columbia Basin and estuary; and broad ecological influences including ocean conditions, human population growth, and global warming.

The carrying capacity of the Columbia River and its estuary for migrating smolts and rearing subyearlings is at present unknown. Basinwide research addressing this critical question has been proposed. It is anticipated that the capacity of the Columbia River and its estuary to support additional hatchery-origin fish produced through the CJDHP will fluctuate due to the highly variable returns from natural-origin populations and existing hatchery programs, highly variable hydrologic conditions (spring and summer flows and temperatures), and the ongoing reduction of releases from other (mostly lower river) hatchery programs.

5.2.2 LOCAL WITHIN-SUBBASIN LIMITING FACTORS

An assessment of the factors limiting productivity of natural populations of the Upper Columbia River summer/fall Chinook ESU in the Okanogan subbasin is presented in reach-by-reach detail in *Salmon and Steelhead Habitat Limiting Factors Assessment Watershed Resource Inventory 49: Okanogan Watershed* (Entrix and Golder 2002). In addition, the draft *Okanogan Subbasin Plan* (to be completed May 28, 2004) has identified summer/fall Chinook as one of the focal species and will include relevant EDT assessments for the mainstem Okanogan River and key tributaries.

In their discussion of limiting factors, the authors of the draft *Okanogan Subbasin Plan* note that a number of key documents and reports have addressed factors affecting the decline of Chinook and steelhead in the upper Columbia, but that among these documents there is not always clear agreement regarding the importance of various limiting factors. The Colville Tribes hope the *Okanogan Subbasin Plan*, once complete, will contain an effective synthesis of some of the central findings and conclusions offered in the primary assessment reports. The completed EDT analysis is expected to add quantitative value to the discussion of Okanogan subbasin limiting factors.

Based on existing assessment information, the primary limiting factor for summer/fall Chinook in the Okanogan subbasin is the uneven and inadequate distribution of spawning activity through available and historically important Okanogan River habitat. In summary, the other major local factors limiting productivity of Upper Columbia River summer/fall Chinook in descending order of importance include: agricultural water withdrawals from the mainstem Okanogan River; elevated summer water temperatures, sedimentation, and loss of riparian vegetation.

5.3 SUMMARY ECOLOGICAL RATIONALE

Although Upper Columbia River summer/fall Chinook summer/fall Chinook are not considered endangered, their status is depressed based on short- and long-term trends. The most significant factor limiting productivity of naturally-spawning populations of summer/fall Chinook in the upper Columbia River and Okanogan subbasin is the juvenile and adult mortalities associated with passage through nine downstream dams on the mainstem Columbia River. Until substantial improvements to downstream passage and river operations are achieved, it is unlikely that naturally-spawning populations, adequate to meet ceremonial and subsistence needs of the Colville Tribes, and adequate to restore naturally-spawning populations to sustainable levels can be achieved.

Additionally, due in large part to the reliance on early-arriving summer/fall Chinook for hatchery broodstock since 1987, combined with mortalities associated with nine downstream dams, the natural-origin, later-arriving Okanogan summer/fall Chinook populations in the Okanogan subbasin have declined to significantly lower levels than their early-arriving counterparts.

The current artificial production program at Similkameen Pond is unable to meet conservation and harvest objectives necessary to address the troubled status of current Chinook populations in the upper Columbia River and the high mortalities exacted by nine downstream hydroelectric facilities. The proposed CJDHP will provide necessary facilities to improve the distribution, abundance and life history diversity of summer/fall Chinook in the Okanogan subbasin.