Draft

Harvest Framework for Non-treaty Fisheries directed at Salmonids originating above Priest Rapids Dam

April 2006

Draft

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Purpose

This plan provides a framework for managing fisheries in waters above Priest Rapids Dam that are directed at salmon and steelhead populations originating from the upper Columbia (above Priest Rapids Dam) tributaries. The harvest rates described in this plan are intended to be consistent with:

- Conservation and recovery objectives;
- Actions taken in the other sectors including habitat, hydro and hatcheries, to promote recovery;
- U.S. v. Oregon allocation principles and court orders;
- Reserved fishing rights of the Colville Confederated Tribes;
- Non-treaty allocation policies adopted by the Washington Fish and Wildlife Commission; and
- A diverse array of fishing opportunities including recreational fisheries in the waters above Priest Rapids Dam.

The fishery management plan was developed with a consideration towards current Endangered Species Act (ESA) listing status for populations within the region, and a science-based understanding on mortality factors affecting the salmonid populations of the upper Columbia River. However, population status should be expected to improve into the future commensurate with implementation of identified habitat, harvest, hatchery and hydropower actions to improve productivity and spatial distribution. Therefore, intermittent modifications may be appropriate for the described fisheries to remain consistent with the above objectives. The Plan is a "living document", thus relying upon adaptive management to be responsive to changes in knowledge and status.

The Plan reflects recovery of depressed stocks, through its abundance-based approach to harvest management. However, it is also structured to be consistent with legal requirements of the ESA. Changes in ESA listing status (down listing or de-listing) may change the structure of some of the fisheries and conceivably provide additional flexibility. Our scientific knowledge of the mortality factors affecting these populations may change, triggering the need to evaluate the specific parameters of the abundance-based frameworks. The plan may also be affected by changes to the natural and artificial production levels of fish that support the upper Columbia River populations, in agreements with the Tribes or court orders arising from ongoing litigation, in non-treaty allocation policies established by the Fish and Wildlife Commission, and in our ability to monitor these fisheries and their impacts.

Upper Columbia summer/fall Chinook

Background –
Available historical information indicates that chinook salmon entered the Columbia River from early spring through early fall, with peak abundance in July, suggesting the summer chinook component was the heart of the run. As the most abundant, the late spring and summer components of the Columbia River chinook populations were also the most heavily fished (Thompson 1951 and Chapman 1986). Summer/fall chinook counts at Rock Island Dam from 1933 through 1942 averaged 5,658 adults and jacks. Based on dam counts and catch information in WDF/ODFW (1992), harvest rates on summer chinook salmon below McNary Dam (zones 1 – 6) could have ranged as high as 90% during that time period. Annual summer/fall chinook counts at Rock Island remained less than 9,000 fish until 1951, when harvest rates in zones 1 – 6 were reduced. Thereafter, escapements rose sharply, ranging most often between 20,000 and 35,000 fish, although a decade covering the late 1950s through 1960s saw counts exceeding 60,000.

Artificial production programs associated with summer chinook in the region began in the early 1900s. Initial production programs consisted of fry releases supplied from hatcheries in the lower Columbia River. Production of summer chinook through artificial propagation was intermittent in time and place between the early 1900s through the 1940s, and was supported mostly by federal hatchery facilities. Beginning in the late 1960s, hatchery propagation of summer chinook has taken place at several facilities operated by the state and federal fisheries agencies. Focus of the releases was into the mainstem Columbia River to support harvest. The Okanogan River was the only river system in the region that did not receive any hatchery-produced summer chinook through the 1980s. Production of summer chinook for release into the large tributary streams of the upper Columbia River basin, including the Okanogan River, began with the 1989 brood year.

ESA listing status –
In the WDFW 1992 Salmon and Steelhead Stock Inventory (SaSSI), the population had an overall rating of depressed as a result of short-term severe declines and a long term negative trend. In addition, the population(s) was proposed for listing in the early 1990s, but a final determination by NOAA Fisheries concluded a listing was not warranted. Total spawner abundance has continued to increase from the low levels experienced in the early 1990s to the currently strong returns. The 2002 Salmonid Stock Inventory (SaSI 2002) identifies the Upper Columbia River summer Chinook aggregate population as healthy and not ESA listed.

Management strategy -
Prior to the most recent *United States v. Oregon* Agreement, the harvest management strategy implemented to protect the ESA listed Snake River spring/summer run through the lower river greatly restricted harvest rates on Upper Columbia summer chinook as well. In fact, the last time this component of the Columbia River chinook run had a directed lower river commercial harvest was in 1964. Protections for Snake River fall chinook and other stocks in ocean fisheries have and continue to provide similar protections for Upper Columbia River summer chinook. Current harvest management strategies consider the upper Columbia summer chinook as an

aggregate population in mixed stock fisheries, although the Salmonid Stock Inventory (SaSI 2002) identifies three populations; the Wenatchee, Methow and Okanogan summer chinook.

The WDFW hatcheries currently producing summer chinook smolts were constructed in the mid-1960s (Turtle Rock - mainstem), 1967 (Wells - mainstem), 1989 (Eastbank), and 1990 (Similkameen Pond, Dryden Pond, and Carlton Pond – all tributary releases from Eastbank Hatchery). Artificial production programs, using a supplementation strategy directed in the tributary streams utilize some proportion of wild fish in the broodstock i.e. Wenatchee (Dryden), Methow (Carlton), and Okanogan (Similkameen). Supplementation programs need to ensure adequate wild fish within the hatchery broodstock to maintain the genetic integrity of the single population (hatchery and wild), as well as meet the objective of increasing the number of successful natural spawners. Mainstem programs, although genetically homogenous to the tributary supplementation programs (Chapman et al. 1994a) utilize volunteers to the hatchery outfall channel. The tributary programs place more emphasis on increasing natural production although harvest remains an objective, while the mainstem programs are intended for harvest only. Management of the artificial production programs is further described in NOAA Fisheries Permit #1347 and Hatchery Genetic Management Plans (HGMP). Good ocean conditions, coupled with the success of the supplementation production programs, realized through adult returns (hatchery and naturally produced) have afforded the opportunity to revisit harvest, production and escapement objectives.

Escapement objective -
The *U.S. v Oregon* process has established a combined spawning escapement goal of 20,000 hatchery and natural-origin adult chinook above Priest Rapids Dam, which is equivalent to 29,000 fish passing Bonneville Dam in order to account for passage mortalities. The escapement goal is based upon natural spawning objectives of 13,500 fish for the Wenatchee, Entiat and Chelan rivers, 3,500 for the Methow and Okanogan river systems, and 3,000 fish necessary to meet hatchery broodstock collection goals (Table 1). With approval and implementation of the Chief Joseph Dam Hatchery Program, the hatchery broodstock requirements will increase from 3,000 to 4,100. When that occurs, an increased escapement objective above Priest Rapids Dam of 22,500 upper Columbia River summer chinook will be sought. Concomitantly, this action will conceivably trigger an increase in the escapement objective above Wells Dam (Methow and Okanogan river systems) from 3,500 to 4,700 adult summer/fall chinook. The cumulative natural escapement objective of 3,500 summer chinook above Wells Dam represents an estimate of maximum sustainable yield (MSY) for the two large tributary streams and portion of the mainstem Columbia River. The increased objective of 4,700 adults is intended to allow fish to exploit previously unavailable tributary habitat realized through habitat improvement actions, as well as provide an increase in mainstem spawners. Monitoring results will be used to refine both the broodstock needs and natural escapement objectives. Furthermore, escapement objectives could be refined consistent with Ecosystem Diagnosis and Treatment (EDT) values, carrying capacity and habitat improvement projects implemented upstream of Wells Dam.

Table 1. Upper Columbia River Escapement Objectives for Summer Chinook

Stock Component	Current spawning escapement objective[2]	Potential spawning escapement objective[3]
Wenatchee/Entiat/Chelan natural	13,500	13,500
Methow/Okanogan natural	3,500	4,700
Hatchery broodstock	3,000	4,140

Harvest Management -
WDFW fishery objectives for Upper Columbia summer chinook are to support:

- Recreational fisheries from the Columbia River mouth upstream to the Okanogan, Wenatchee and Methow rivers (Figure 1);
    - Priority is for full season (July through October) with two adult chinook limit for waters above Priest Rapids Dam.
    - Length of season, daily limits, and fishery type for fisheries below Priest Rapids Dam will be subject to abundance and adjusted as necessary to meet upriver harvest objectives.
- Wanapum and Colville ceremonial and subsistence harvest, accounted as part of the non-treaty share; and
- Commercial fisheries below Bonneville Dam.

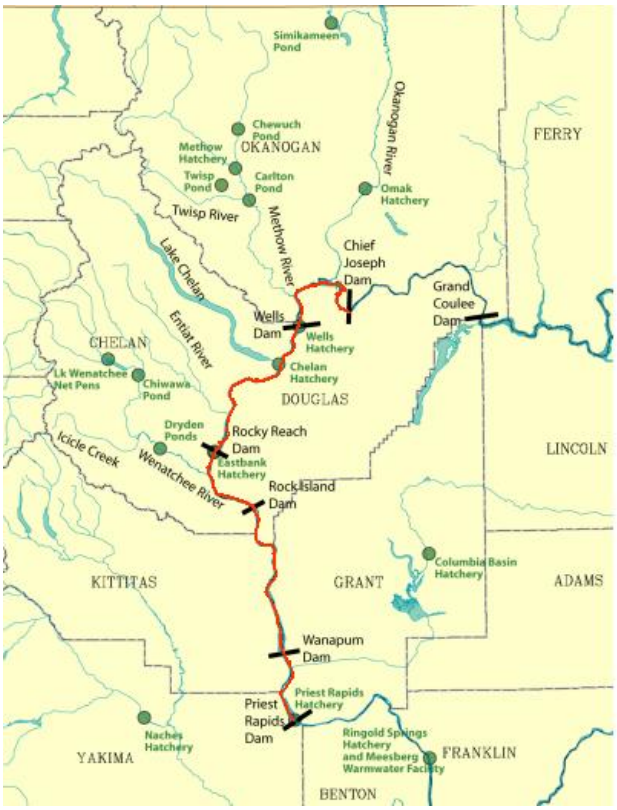

Figure 1. Summer chinook recreational fishery area.

[2] Based upon current production programs.
[3] Based upon future production programs.

Table 2. Non-treaty Harvest Framework for Upper Columbia Summer Chinook PRD = Priest Rapids Dam

River mouth run size[4]	Percentage of allowable catch above PRD[5]	Harvest regime below PRD	Description of expected fisheries above PRD
0 – 29,000	> 90%	No directed harvest	C&S for Colville and Wanapum, potential selective recreational
29,001 – 50,000	90%	Recreational and/or commercial[6]	C&S for Colville and Wanapum, limited recreational
50,001 – 60,000	90% -70%[7]	Recreational and/or commercial[8]	C&S for Wanapum and Colville, recreational
60,001 – 75,000	70 - 65%	Recreational and/or commercial[9]	C&S for Wanapum and Colville, recreational
75,001+	65% - 60%	Recreational and/or commercial[10]	C&S Wanapum and Colville, recreational

Table 2a. Example of actual number of fish available for harvest based upon percentages in Table 2.

River mouth run size	*Total Fish available for harvest*	*Harvest rate*	*Harvest above PRD*	*Harvest below PRD*
0 – 29,000	*<1,450*	*<5%*	*<1,450*	*Incidental only*
29,001 – 50,000	*1,500 – 10,500*	*5 – 21%*	*1,350 – 9,450*	*150 – 1,050*
50,001 – 60,000	*10,500 – 14,250*	*21 – 23%*	*9,450 – 9,975*	*1,050 – 4,275*
60,001 – 75,000	*14,250 – 19,875*	*23 – 27%*	*9,975 – 12,919*	*4,275 – 6,956*
75,001 – 100,000	*19,875 – 29,250*	*27 – 29%*	*12,919 – 17,550*	*6,956 – 11,700*
> 100,000	*>29,250*	*>29%*	*>17,550*	*>11,700*

Current *U.S. v. Oregon* agreements provide that the non-treaty share is calculated as 50% of the harvestable run, which is the amount of the river mouth run size in excess of the 29,000-management goal at Bonneville Dam. The effect of the proposed framework is to limit all non-treaty fishing to minimal levels when the run size is below escapement. At levels of low allowable harvest, up to a 50,000 run size, harvest opportunity should be allocated almost exclusively to upstream areas, to meet Colville and Wanapum needs as well as provide recreational fishing in the upstream areas which typically have limited salmon angling

[4] Increases in spawning escapement, reflected in Table 1 (footnote 2) will require a corresponding increase in river mouth run size.
[5] Changes in percent of harvest do not diminish existing fisheries in total fish available for harvest, rather it provides for additional harvest opportunities in other areas, consistent with the increase in run size.
[6] A harvest allocation framework will need Fish and Wildlife Commission consideration.
[7] Range is reflective of harvest holding steady or increasing slightly above PRD as harvest rates increase below PRD. Total number harvest available for harvest is ≥ than previous break point in run size at mouth. See Table 2a.
[8] A harvest allocation framework will need Fish and Wildlife Commission consideration.
[9] A harvest allocation framework will need Fish and Wildlife Commission consideration.
[10] A harvest allocation framework will need Fish and Wildlife Commission consideration.

opportunities. Below Bonneville fisheries would be promulgated when run sizes are large enough that abundances will support meaningful fisheries.

Additional work is needed to determine appropriate marking and selective fishery frameworks. It is likely that the varying productivities of the individual components of the upper Columbia summer chinook run, the mixed stock nature of the river fisheries, and the integrated production strategy of the tributary artificial production programs will provide justification for a marking/harvest framework that relies on some level of selective fishing. In particular, it is likely that the Colville Tribes through development of live-capture, selective fishing gears, and WDFW, through selective recreational fisheries, will be able to exert higher harvest rates on some of the hatchery origin fish returning to the Upper Columbia.

The WDFW will base its decisions on whether to promulgate mark selective fisheries on several factors including mark rates in each fishery, availability and feasibility of appropriate selective gear, and broodstock management needs. The HGMP processes, and development of fishery management agreements will support those framework decisions.

Upper Columbia Spring Chinook

Background –
The numbers of spring chinook that entered the Columbia River in the years immediately following the construction of Bonneville Dam (1938) averaged less than 102,000 (Chapman et al. 1995a). Numbers of spring chinook passing Rock Island Dam in the late 1930s and 1940s were likely depressed from years of over fishing. Runs increased in the 1950s, partly in response to reduced harvest rates. However, reduced harvest rates occurred concomitant with the hydropower development era, essentially reducing overall natural production of spring chinook from the Upper Columbia. Spring chinook counting at Rock Island Dam (1933) began in 1935, and the numbers for the period 1935 – 1938 were less than 3,000 fish per year. Adult counts of spring chinook passing dams upstream of Priest Rapids Dam fluctuated extensively in the years following, but reached a peak of about 27,000 fish in the mid-1980s, a period of high ocean productivity. Escapements dropped precipitously in the six years following the peak, rose again in 1992 and 1993, but dropped to less than a few hundred in 1995 when ocean productivity dropped. Although abundance varied considerably through the early 1990s, long-term declines were not apparent (Chapman et al. 1995a). However, hatchery fish were likely contributing a larger part to the overall escapement numbers which masked the poor overall productivity of wild spring Chinook. Poor ocean productivity, coupled with low instream flows in the tributaries and mainstem hydro-system management during low water years revealed the abysmal productivity of the wild fish in the late 1990s.

The long-term relative stability of returns of spring chinook to the upper Columbia River has been supported by drastic reductions in harvest in zones 1 – 6. Prior to the 1960s, harvest rates on upriver spring chinook ranged from 40-85%. During the 1960s and into the early 1970s harvest rates trended downward, and subsequent to 1974 averaged less than 10%. Through the 1990s, non-treaty harvest was directed at more abundant lower river populations, thus upriver spring chinook were caught only incidental to these fisheries, generally at rates less than 2%. Beginning in 2000, selective recreational and commercial non-treaty fisheries have been

implemented in the lower river, targeting marked hatchery production from lower river populations as well as some hatchery production from the upper Columbia and Snake drainages. Harvest rates on marked fish in these non-treaty selective fisheries have ranged as high as 15-20%, while impact rates on natural production and unmarked hatchery production from the upper Columbia are capped at 2% or lower under Endangered Species Act (ESA) limits.

The first hatchery that released spring chinook into the upper Columbia River region began operation in 1899, with the goal of replenishing the severely depleted runs (McDonald 1895 and Gilbert and Evermann 1895). The biggest challenges to these early programs were lack of broodstock and in some cases severe winter conditions. Artificial production of spring chinook prior to the completion of Grand Coulee Dam (1941) was sporadic in time and place, and inconsistent to stock or focus. Therefore the programs were probably not successful at creating adult returns. With the completion of Grand Coulee Dam, the United States Fish and Wildlife Service (USFWS) began a more comprehensive artificial production program for spring chinook in the regions tributaries. However, their efforts were also not without challenges e.g. adult returns. Since the federal programs were intended to provide fish for harvest and offset the impacts of hydropower development on potential harvest, stock source was less important to meeting smolt release goals. Therefore, the spring chinook used in the USFWS facilities, excluding the Winthrop National Fish Hatchery (WNFH) in recent years, has had a large degree of influence by spring chinook stocks from outside the ESU. In contrast to the federal programs, the State programs began comprehensive operation in the late 1980s and early 1990s. The focus of the State programs was to increase the number of adult spring chinook spawning naturally by utilizing locally adapted spring chinook i.e. supplementation.

ESA listing status –
Spring chinook from the upper Columbia River region was listed as *endangered* under the ESA in March 1999. Three populations of spring chinook are recognized within the ESA listing; Methow, Entiat and Wenatchee. All three have established recovery levels, and collectively will need to meet or exceed these levels for the ESU to achieve recovery. In addition to the ESA listing of the natural origin spring chinook, hatchery origin spring chinook derived from local populations were included within the listing since they were deemed necessary to achieve recovery. Carson NFH-origin spring chinook continue to be reared at the Leavenworth and Entiat federal facilities. These fish are not included in the listing, and are therefore not subject to ESA management constraints. Harvest objectives identified within this Plan are designed to target the Carson-origin spring chinook, as well as more abundant upper Columbia River hatchery origin spring chinook. The management and harvest strategies outlined for spring Chinook are similar to those used for the steelhead. However, implementation of harvest strategies remains in part dependent upon authorization for the fishery action from NOAA Fisheries.

Management Strategy –
At present, non-treaty harvest opportunities through mixed stock fisheries are limited to selective recreational and commercial fisheries below McNary Dam and a non-selective harvest by the Wanapum tribal band near Priest Rapids Dam. A non-treaty selective recreational fishery targeting Carson origin spring chinook (not ESA listed) also occurs in Icicle River, a tributary to the Wenatchee River.

The WDFW operates several hatcheries and/or their satellite facilities above Priest Rapids Dam to produce spring chinook smolts for release into the Chiwawa, Chewuch, Methow and Twisp rivers. Commensurate with hydropower dam relicense requirements through the Federal Energy Regulatory Commission (FERC), the Wenatchee basin spring chinook smolt release number total is expected to increase, as well as expand to other tributaries, namely Nason Creek and the White River.

Current programs, as well as anticipated programs are reflective of the origin of adults used for brood fish to produce the subsequent progeny. A supplementation strategy, using wild fish in the broodstock, is used with the goal of increasing the number of adults successful at spawning naturally. Embedded objectives include conservation and recovery of the ESA listed upper Columbia River spring chinook, as well as selective harvest. To afford protection to the hatchery populations in fisheries, past management did not 100% adipose fin clip hatchery spring chinook smolts. However, for the Wenatchee River population, juvenile spring chinook are 100% adipose fin clipped to meet research objectives for evaluating the effectiveness of hatchery fish spawning naturally. By 2010, consistent with current smolt to adult survival rates and agreement by parties in *U.S. v. Oregon*, both the Wenatchee basin and Methow basin spring chinook releases will be proportionately adipose fin clipped for ready identification of returning adult hatchery fish and maximum protection back to the natural spawning areas. This management will allow WDFW to balance hatchery and natural spawners in the Columbia River tributaries through implementation of selective fisheries.

The USFWS also produces spring chinook from three hatchery facilities within the region. The goal for all of the federal facilities is to provide harvest. Two of the three facilities use Carson origin spring chinook (genetically similar to Carson National Fish Hatchery stock) for their programs (Leavenworth and Entiat), while the Winthrop facility produces spring chinook genetically similar to the ESA listed populations in the Methow basin.

Escapement Objective –
Spring chinook natural spawning escapement objectives for the principle tributaries to the upper Columbia River region include about 4,100 for the Wenatchee, 500 for the Entiat, and 2,000 for the Methow. These numbers, although not formally agreed to within *U.S. v. Oregon,* are also consistent with carrying capacity or recovery requirements. In addition to the natural spawning escapement, artificial production requirements total almost 2,600 adults, including the federal facilities. Minimum run size necessary at Priest Rapids Dam to achieve the 9,200 fish natural escapement and brood stock goals is 16,000 spring chinook. Since the population is listed as endangered under the ESA, it's conceivable that at least 2,400 fish (15%) of the 16,000 fish total must be wild to warrant non-treaty recreational fisheries in the tributaries, excluding the Icicle River fishery[11]. All other hatchery fish in excess of the spawning escapement and broodstock collection objectives are available for harvest, most likely within the tributary areas, provided the ESA take limits on the naturally produced component are not exceeded. The Icicle River fishery is dependent upon Leavenworth National Fish Hatchery meeting its broodstock requirement of 1,000 adults. Any fish in excess of the 1,000 are available for harvest.

[11] Assumes interdam survival of 96% plus survival to spawn of 66%, and at least a natural escapement of 2,400 within the total run size.

Harvest Management –
Few upper Columbia River origin spring chinook are harvested in marine fisheries (TAC 1991). Harvest of unmarked upper Columbia spring chinook is limited to incidental catches in main-stem Columbia River recreational and commercial fisheries. Impacts in tribal fisheries are based on an abundance driven framework, keyed to the aggregate status of middle and upper Columbia River as well as Snake River spring chinook. The non-treaty harvests below McNary Dam and by the Wanapum tribal band are limited by natural stock impacts through an abundance-based framework, contained in the recent *U.S. v. Oregon* harvest agreement. As noted above, non-treaty harvest in Icicle River is managed to meet hatchery broodstock needs. Non-treaty harvest above Priest Rapids Dam is essentially zero, but as artificial production increases through development of the Chief Joseph Dam Hatchery spring chinook Program and/or the number of ESA listed hatchery spring chinook returning to the tributaries exceeds broodstock collection goals and natural spawning escapement objectives, the following harvest framework is proposed (Tables 3, 7, and 8). However, it is important to note that additional harvest constraints could be imposed by the mortality limits on ESA listed population(s). A change in the listing status from endangered to threatened will increase the recreational opportunities within the terminal area for all tributary streams.

Wenatchee Basin

The number of naturally produced fish expected to return to the Wenatchee River will be derived from smolt production estimates and the most recent smolt to adult return (SAR) data available for naturally produced fish. The number of hatchery fish expected to return to the Wenatchee River will be estimated from the number of fish released and the most recent SAR data available for hatchery fish. When combined with the estimated number of naturally produced fish, the number of hatchery fish in excess of 4,100 total spawners (hatchery and wild combined, equitable to a run size of 5,500 fish) will be deemed surplus and managed consistent with Table 3. The harvest plan as described ensures carrying capacity for adult spawners is achieved at a minimum. But, because the hatchery spring Chinook programs use an integrated broodstock management strategy[12], managing the proportion of hatchery fish on the spawning grounds is important to the overall success of the hatchery program. That is, hatchery fish need to contribute to natural spawning, but as the carrying capacity is exceeded, they should not represent more as a proportion than the wild fish used in the broodstock. In-season estimates of the number of returning adults (hatchery and naturally produced) will be estimated from passive integrated transponder (PIT) tag recaptures at hydroelectric projects (i.e., Bonneville Dam, Priest Rapids Dam, and Rock Island Dam). In season estimates should be made in adequate time to adjust fisheries or other management strategies.

In years when the number of excess ESA listed hatchery fish destined for waters upstream of Tumwater Dam is estimated to be greater than the number required for re-introduction efforts in Peshastin Creek, a selective fishery may occur on the Wenatchee River. The area open would be commensurate with the number of spring chinook available for harvest (Table 3). The limited area open would consist of that portion of the Wenatchee River from the Hwy 2 Bridge in Leavenworth upstream to mouth of Icicle River (Icicle River would be open consistent with

[12] HSRG/WDFW/NWIFC Technical Discussion Paper #1: Integrated Hatchery Programs June 21, 2004

separate requirements identified above). When the number of excess ESA listed hatchery fish is estimated to exceed 1,351, then the Wenatchee River from the confluence with Icicle River downstream to the 285 Bridge crossing on the Wenatchee River at the town of Wenatchee would be open.

The season would be from May 15 – July 15, although the fishery will be limited to proportional mortality as outlined in Table 4. The fishery will be monitored intensely and the season closed when the proportional mortality approaches (Table 4) of the wild chinook component. A 10% hooking mortality rate when using bait will be applied to determine proportional impact to wild spring chinook caught and released. Daily limit will be up to two adipose fin clipped chinook, inclusive of adults and jacks.

Table 3. Tiered approach for management of excess Wenatchee River hatchery spring Chinook as measured at Tumwater Dam.

	Number of excess hatchery fish	Release of adults into Peshastin Creek	Wenatchee River selective fishery
Tier 1	0-350	Yes	No
Tier 2	351-1,351	Yes	Limited
Tier 3	>1,351	Yes	Yes

Table 4. Sliding scale of allowable recreational angling impact mortality on ESA listed adult upper Columbia River spring chinook.

Status indicator	Predicted Spawning Stock Size of listed Natural Adult fish	Maximum Mortality (%)	Range of Potential Lethal Take
Critical Threshold	≤ 800	0	0
20 – 40% of Viable	800 –1,600	2	16 - 32
40 – 60% of Viable	1,600 – 2,400	4	64 - 96
60 – 80% of Viable	2,400 – 3,200	6	144 - 192
80 – 100% of Viable	3,200 – 4,000	8	256 – 320
> 100% Viable Threshold	≥ 4,000	10	≥ 400

Management decisions are dependent upon reliable forecast abilities for annual upper Columbia River spring chinook run size and composition (hatchery and wild). Bonneville Dam spring chinook adult passage information will be the first indicator used to assist in forecasting annual run size to the upper Columbia River. Annual PIT tagging programs, of both hatchery and naturally produced fish will provide a more precise method of estimating the number of fish returning to each of the basins in the upper Columbia River.

For the foreseeable future, all non-treaty harvest opportunity on ESA listed upper Columbia spring chinook will be abundance-based using mark selective fishing techniques.
Harvest allocation of the non-treaty share of Columbia spring chinook originating above Bonneville Dam, which includes the upper Columbia (above Priest Rapids Dam origin chinook)

for the 2004 and 2005 fisheries below McNary Dam was established by Commission decision. The Commission will establish future allocations in the fall of 2005.

Entiat Basin

Spring chinook (Carson stock) released from the Entiat NFH are produced exclusively for treaty and non-treaty fisheries. At present, the stock is not included in the ESA listing of spring chinook in the Upper Columbia River ESU. The target of this fishery is non-listed Carson stock spring chinook. Recent spring chinook adult escapements (1998-2004) reveal average escapements exceeding 1,000 fish, and have been dominated by Carson origin spring chinook (Table 5). The purpose of the fishery is to minimize the number of Carson origin spring chinook contributing to natural production within the Entiat River basin through harvest opportunity; thereby reducing the potential hybridization with naturally spawning population.

In-season run abundance of both hatchery and natural origin fish determines if and when harvest of hatchery fish will be allowed. Analysis of run size and potential impacts to listed fish will be determined in April. Maintenance of work focused on current smolt production estimates and PIT tagging is crucial to determination of run composition and estimated total return. A minimum escapement of 100 natural and 800 Carson origin hatchery fish are required to initiate a fishery. One hundred natural origin spawning adults represents an estimated critical threshold escapement level for the basin and is 20% of the viable threshold level (500 fish) for the Entiat River (Interior Columbia River Technical Recovery Team) (Table 6). A minimum 800 Carson origin chinook necessary to initiate a fishery provides a 400 fish escapement required for broodstock collection at Entiat NFH, with adequate fish available to provide harvest opportunity and meet federal requirements for provision of fish.

An Entiat River spring chinook fishery constitutes a "new" fishery, not previously authorized under ESA Section 10 Permit #1248, which expired December 31, 2004. However, the new permit (#1554) has identified a spring Chinook fishery. The Entiat River spring chinook fishery will be regulated as a selective fishery requiring the use of barbless hooks, non-buoyant lure restriction, night closure and mandatory release of adipose present chinook, coho and steelhead.

Table 5. Estimated spring chinook spawning and run escapements to the Entiat River basin.

Return	Run Escapement		Hatchery Broodstock		Spawn Escapement		Total
Year	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	
1998	216	58	216	0	0	58	274
1999	724	65	724	0	0	65	789
2000	2,020	74	1,919	0	101	74	2,094
2001	2,858	260	2,666	0	192	260	3,118
2002	2,024	182	1,834	2	190	180	2,206
2003	967	176	883	1	84	175	1,143
2004[13]	880	181	759		121	181	1,061
Mean	1,065	123	998	1	130	122	1,209

[13] Spawn escapement origin determination is preliminary, pending scale analysis.

Table 6. Sliding scale of allowable recreational angling produced mortality of ESA listed adult upper Columbia River spring chinook in the Entiat River basin.

Status Indicator Critical Threshold	Predicted Natural origin escapement	Maximum percent mortality	Range of potential lethal take
0 - 20% of viable	≤ 100	0	0
20 – 40% of viable	101 – 200	2	2 – 4
40 – 60% of viable	201 – 300	4	4 – 8
60 – 80% of viable	301 – 400	6	18 – 26
80 – 100% of viable	401 – 500	8	32 – 40
> 100% viable threshold	≥ 501	10	≥ 50

Run escapement estimates (hatchery and natural origin) will be calculated through April, using smolt production estimates and PIT tag data. Should escapement estimates predict a fishery is warranted, limits and gear restrictions will be announced in late April. The season would occur from May 15 – July 15, although the fishery will be limited to proportional mortality as outlined in Table 6. The fishery will be monitored intensely and the season closed when the proportional mortality approaches (Table 6) of the wild chinook component. A 10% hooking mortality rate when using bait for wild spring chinook caught and released to determine cumulative hooking mortality will be applied to determine proportional impact to wild fish.

Angling will be allowed from the Alternate Highway 97 Bridge (rkm 0.3) near the mouth of the Entiat River, upstream approximately 11 rkm, to about 150m downstream of the Entiat NFH Rack (rkm 11.2).

This is a new fishery proposal, so no empirical data for effort or harvest exists; however, inferences may be made with the Icicle River fishery. Effort in the Icicle River fishery was estimated between 13,000 and 30,000 angler hours in 2000-2003. A smaller return to the Entiat NFH (approximately one third of the Icicle), coupled with limited public access, suggest lower effort can be anticipated. Therefore, the WDFW projects angler effort to range between 6,000-15,000 angler hours for this fishery.

Methow Basin

The number of naturally produced fish expected to return to the Methow River will be derived from smolt production estimates and the most recent smolt to adult return (SAR) data available for naturally produced fish. When smolt production estimates are not available, SAR data derived from the Wenatchee population and adjusted for additional interdam mortalities from Rocky Reach and Wells will provide a surrogate. The number of hatchery fish expected to return to the Methow River will be estimated from the number of fish released and the most recent SAR data available for hatchery fish. When combined with the estimated number of naturally produced fish, the number of hatchery fish in excess of 2,000 total spawners (hatchery and wild combined, equitable to a run size of 3,500 fish) will be deemed surplus and managed consistent with Table 7. In-season estimates of the number of returning adults (hatchery and naturally produced) will be estimated from passive integrated transponder (PIT) tag recaptures at hydroelectric projects (i.e., Bonneville Dam, Priest Rapids Dam, and Rock Island Dam). In

season estimates should be made in adequate time to adjust fisheries or other management strategies.

In years when the numbers of excess ESA listed hatchery fish destined for tributaries of the Methow Basin are estimated to be greater than the number required to meet natural spawning goals, a selective fishery would occur on the mainstem Methow River. The area open would be commensurate with the number of spring chinook available for harvest (Table 7). The limited area open would consist of that portion of the Methow River from the KOA Campground in Winthrop upstream to the Foghorn Diversion Dam (immediately upstream of Methow Hatchery). When the number of excess ESA listed hatchery fish is estimated to exceed 1,500, then the Methow River from the Hwy 20 bridge crossing in Twisp upstream to the Foghorn Diversion Dam would be open.

The season would be from May 15 – July 15, although the fishery will be limited to proportional mortality as outlined in Table 8. The fishery will be monitored intensely and the season closed when the proportional mortality approaches (Table 8) of the wild chinook component. A 10% hooking mortality rate when using bait for wild spring chinook caught and released to determine cumulative hooking mortality will be applied to determine proportional impact to wild fish. Daily limit will be up to two adipose fin clipped chinook, inclusive of adults and jacks.

Table 7. Tiered approach for management of excess hatchery spring chinook in the Methow River.

Number of excess hatchery fish		Methow River selective fishery
Tier 1	0-600	No
Tier 2	601-1,200	Limited
Tier 3	>1,200	Yes

Table 8. Sliding scale of allowable recreational angling impact mortality on ESA listed adult upper Columbia River spring chinook.

Status indicator	Predicted Spawning Stock Size of listed Natural Adult fish	Maximum Mortality (%)	Range of Potential Lethal Take
Critical Threshold	≤ 400	0	0
20 – 40% of Viable	400 – 800	2	8 - 16
40 – 60% of Viable	801 – 1,200	4	32 - 48
60 – 80% of Viable	1,201 – 1,600	6	72 - 96
80 – 100% of Viable	1,601 – 2,000	8	128 - 160
> 100% Viable Threshold	≥ 2,001	10	≥ 200

Management decisions are dependent upon reliable forecast abilities for annual upper Columbia River spring chinook run size and composition (hatchery and wild). Bonneville Dam spring chinook adult passage information will be the first indicator used to assist in forecasting annual run size to the upper Columbia River. Annual PIT tagging programs, of both hatchery and

naturally produced fish will provide a more precise method of estimating the number of fish returning to each of the basins in the upper Columbia River.

For the foreseeable future, all non-treaty harvest opportunity on ESA listed upper Columbia spring chinook will be abundance-based using mark selective fishing techniques.

Harvest allocation of the non-treaty share of Columbia spring chinook originating above Bonneville Dam, which includes the upper Columbia (above Priest Rapids Dam origin chinook) for the 2004 and 2005 fisheries below McNary Dam was established by Commission decision. The Commission will establish future allocations in the fall of 2005.

Okanogan Basin

The Colville Tribes have initiated an interim spring chinook program on the Okanogan River to restore an important ceremonial and subsistence fishery. Initial releases have been Carson-origin spring chinook, but the long-term objective is to use ESA listed spring chinook from the nearby Methow basin. Use of Methow basin spring chinook in the Okanogan basin will be dependent upon total abundance of ESA listed spring chinook in the Methow basin, as well as National Marine Fisheries Service (NMFS) approval to use the releases in the Okanogan basin as an experimental population. An experimental population designation by NMFS removes "take" limits imposed through the ESA on the portion of the population associated with the Okanogan.

Tables 9 and 10 outline harvest percentages for Okanogan origin spring Chinook only, which will represent some portion of the total spring Chinook passage at Wells Dam. Priority for harvest will be for the Colville Confederated Tribes, and as the total number of Okanogan origin spring Chinook increases to above 2,000 fish within the Wells Dam spring Chinook count total, recreational harvest directed at the Okanogan origin Chinook can be initiated.

Table 9. Tribal & Recreational Selective Harvest of Okanogan Origin Spring Chinook Above Wells Dam prior to Chief Joseph Dam spring Chinook production returns.

Wells Dam Okanogan River origin Ad-Clip Chinook Count April 1 – June 30	Maximum CCT Ad-Clip Chinook Harvest (%)	Maximum Recreational Ad-Clip Chinook Harvest (%)
< 1,500	100	0
1,501 – 2,000	100	0
2,001 – 6,000	80	20
6,001 – 10,000	70	30

Table 10. Tribal and Recreational Selective Harvest of Okanogan Origin Spring Chinook Above Wells Dam with Chief Joseph Dam spring Chinook production returns.

Wells Dam Okanogan River origin Ad-Clip Chinook Count April 1 – June 30	Maximum CCT Ad-Clip Chinook Harvest (%)	Maximum Recreational Ad-Clip Chinook Harvest (%)	Escapement/broodstock
< 1,000	20	0	80%
1,001 – 1,500	30	0	70%
1,501 – 2,000	50	0	50%
2,001 – 4,000	50	20	30%
4,001 – 6,000	60	20	20%
6,001 – 10,000	70	20	10%

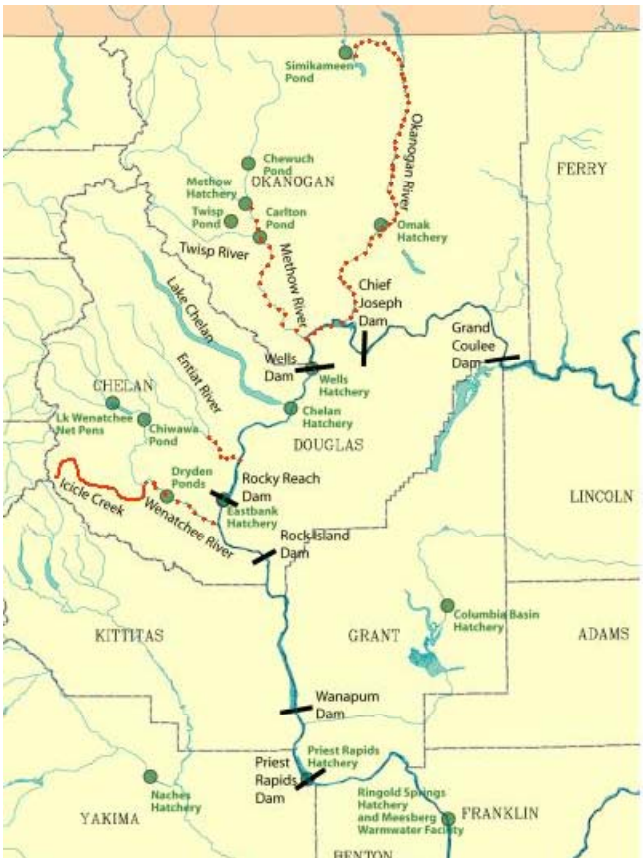

Figure 2. Spring chinook recreational fishery areas.

Upper Columbia Sockeye

Background -

Sockeye in the Columbia River upstream from the confluence of the Snake River historically inhabited the lakes of the Yakima Basin, Lake Wenatchee, lakes upstream and including Lake Osoyoos in the Okanogan Basin, and the Arrow Lakes in British Columbia (headwaters to Columbia River). Construction of impassable dams, irrigation removals and hydropower

operations, coupled with over fishing significantly altered the historic distribution of sockeye upstream of the Snake River, such that Lake Wenatchee and Lake Osoyoos retain the only current populations.

Since 1938, the percentage of sockeye destined for waters upstream of Rock Island Dam has been reported to vary from less than 1% (1941) to greater than 95% (1979) of the total that entered the Columbia River (Chapman et al. 1995b). Although there has been years the escapement has been significantly altered by harvest in the lower Columbia River i.e. mid-1980s, the percentage as a total of the run to the mouth of the Columbia River has grown steadily to generally exceed 90%. The percentage of adults returning to Lake Wenatchee and Lake Osoyoos has varied considerably from the total at Rock Island Dam. Historically, the Lake Wenatchee population outnumbered the Lake Osoyoos population. However, since the early 1960s and with the exception of 2002, the percentage of sockeye destined for Lake Osoyoos has been greater than the percentage destined for Lake Wenatchee. More recent counts have shown the Lake Osoyoos population to generally represent 60 – 75% of the count at Rock Island Dam. However, the percentage of adults observed on the spawning grounds has not comported well with the number of fish counted at different dams. Spawning ground surveys in both basins has often only been able to account for 50 – 70% of the dam counts. A variety of reasons could contribute to this disparity including: 1) inflated dam counts due to a high rate of fallback, 2) inefficiencies of the spawning ground surveys as it relates to the ability to accurately account for total escapement, and 3) high pre-spawning mortality which is conceivably a factor for the Lake Osoyoos population.

Historical artificial production programs were supported by the USFWS, but sockeye were not a dominant species cultured, and by the 1960s no artificial production of sockeye was occurring within the region. In 1990, the WDFW began operation of a small artificial production program (200,000 smolts) for sockeye from Lake Wenatchee as part of the Rock Island Settlement Agreement and now the new Mid-Columbia River Habitat Conservation Plan (HCP). Although the Confederated Tribes of the Colville Reservation operated sporadically another small artificial production program for Lake Osoyoos sockeye in the 1990s, the program was discontinued in the late 1990s. For all intents and purposes, the Lake Osoyoos population is viewed as one of the only populations of salmon in the Columbia River system to have had limited, if any, influence from artificial production programs.

ESA Listing Status –
Upper Columbia River sockeye are not currently listed under the federal ESA. However, WDFW SaSI (2002) identifies both the Okanogan and Wenatchee populations of sockeye as depressed.

Stock status for the Okanogan population was rated as depressed in 2002 because of chronically low escapements. A minimum escapement objective of 58,730 adults at Wells Dam is supported by data from the Department of Fisheries and Oceans, Canada. Observed returns, averaging 18,148 adult sockeye per year in the most recent decade, were the lowest for any decade within the 45-year period for which counts have been made.

The stock status for the Wenatchee population was also rated as depressed in 2002 because of short-term severe declines of escapements in 1998 and 1999. The spawning escapement goal for this stock is 23,000 fish. Despite a significant improvement in the 2000 and 2001 returns, the stock has been at less than one-half the goal from 1994 to 1999.

Management Strategy and Escapement Objectives –
The natural and hatchery populations of sockeye originating from the Wenatchee and Okanogan basins are managed for natural spawning escapement goals of 23,000 fish over Tumwater Dam in the Wenatchee basin and 34,000 over Wells Dam, although downstream treaty and non-treaty fisheries are managed to meet a combined goal of 65,000 over Priest Rapids Dam. The 65,000 fish escapement objective translates to about 75,000 fish at Bonneville Dam, accounting for hydrosystem passage losses in the mainstem Columbia. An increase in the escapement objective for Priest Rapids Dam, as it correlates to the Okanogan Basin population will be sought should estimates of increased carrying capacity be agreed to consistent with habitat improvement actions with Canada.

Recreational fisheries will be implemented when the run size exceeds (or is expected to exceed) 25,000 sockeye at Tumwater Dam. The Lake Wenatchee population is the only one of the two that has an artificial production program associated with it. The current artificial production program of 200,000 smolts annually is support by Chelan Public Utility District as part of the Mid-Columbia River HCP (formerly part of the Rock Island Settlement Agreement). This program is slated to change, and likely increase, consistent with the recently signed Mid-Columbia River HCP, which replaces the Rock Island Settlement Agreement.

Harvest Management -
WDFW fishery objectives for Upper Columbia sockeye are to support:

- Recreational fisheries in Lake Wenatchee (Figure 3);
- Wanapum and Colville ceremonial and subsistence harvest, accounted as part of the non-treaty share; and
- Commercial and recreational fisheries below Bonneville Dam; when the combined abundance supports harvest and when Snake River sockeye constraints can be accommodated. Recreational fisheries in the mainstem Columbia River are very minor for sockeye when retention is allowed, averaging less than 300 per year.

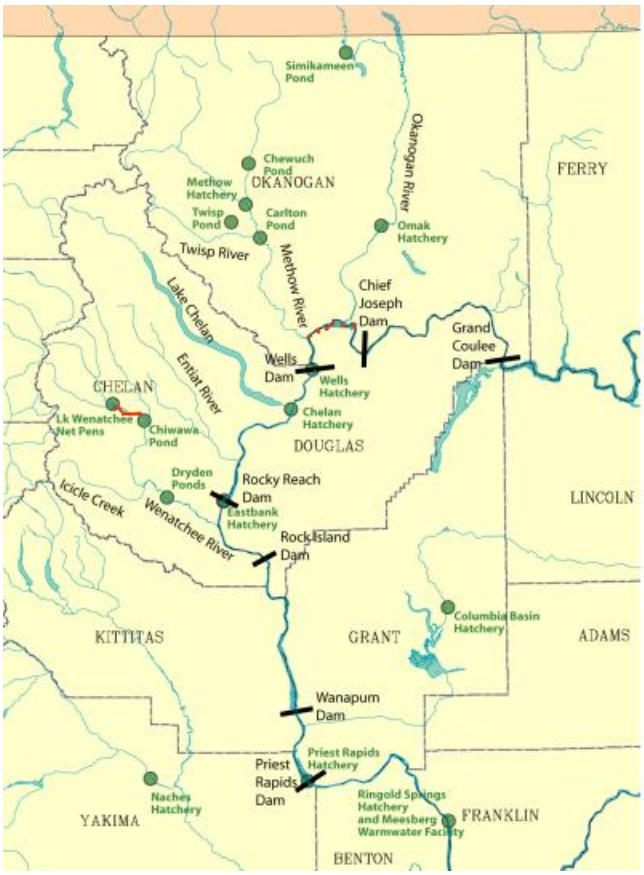

Figure 3. Sockeye recreational fishery areas.

The first priority will be meeting ceremonial and subsistence needs for the Colville Tribes and Wanapum Band, before allocating other non-treaty harvest (other than minor incidental mortalities) to any mainstem recreational or commercial fisheries.

For sockeye runs entering the Columbia River that are larger than needed to achieve the 65,000 management target at Priest Rapids Dam, the Colville Tribes and upper Columbia River recreational fisheries (including the Wanapum Band) would be allocated the majority of the non-treaty share. For sockeye runs greater than 100,000 entering the Columbia River, the non-treaty share of the harvestable fish in excess of 100,000 would be allocated approximately 75/25 between upper Columbia River region and lower river recreational and commercial fisheries.

Upper Columbia coho

Background –
Prior to the 1940s, runs of coho salmon originating from the tributary streams of the upper Columbia River (Wenatchee, Entiat, Methow and Okanogan rivers) were essentially destroyed as a result of over harvest, early hatchery practices, and impassable dams. With completion of Grand Coulee Dam, the USFWS made a strong effort to re-establish self-perpetuating populations within the region, but much of the failure was related to reliance upon stocks lacking genetic suitability (Mullan et al. 1992). Long run coho, like those found in the region through

the early 1900s, were unique among a species that usually migrates very short distances to spawn in freshwater. Historic pictures of the native upper Columbia River region coho indicate the fish were equal in size to spring chinook (Mullan et al. 1992).

Since the 1990s the Yakama Nation has renewed the region's focus on the reintroduction of coho into mid-and upper Columbia River tributaries. In 1996, the Northwest Power and Conservation Council recommended the mid/upper-Columbia Coho Reintroduction Project for funding by the Bonneville Power Administration. Feasibility research associated with the reintroduction effort has been conducted by the Yakama Nation since 1999. Project participants include co-managers Yakama Nation and Washington Department of Fish and Wildlife; NOAA Fisheries; USFWS; U.S. Forest Service and Confederated Tribes of the Colville Indian Reservation. The feasibility work focused on increasing the knowledge about coho and their interactions with the environment to sufficient detail to make informed decisions regarding full-scale reintroduction of coho to the region. The Coho Reintroduction Program (Program) will protect species of fish listed or proposed for listing under the Endangered Species Act.

ESA Listing Status –
Upper Columbia River native coho were extirpated several decades ago. Coho currently produced within the region were developed from out of basin populations, and therefore are not ESA listed.

Management strategy –
The long-term vision for this program is to reestablish naturally reproducing coho salmon populations in mid/upper-Columbia river tributaries, with numbers at or near carrying capacity to provide opportunities for harvest by tribal and non-tribal fishers. The Program's long-term vision remains optimistic, although it is expected to take many years to achieve. Short-term goals, coupled with regular review and coordination between agencies will provide information to enable decision-makers to assess whether the vision is achievable.

The conceptual long-term plan for coho reintroduction into the region's tributaries comprises four distinct phases.

- Broodstock Development Phase 1 (BDP1) is designed to develop a local broodstock from reprogrammed lower Columbia River coho, which become increasingly adapted to the longer migration to mid-Columbia tributaries. BDP1 focuses on eliminating reliance on lower Columbia stocks and transitioning to a local broodstock.
- Broodstock Development Phase 2 (BDP2) is designed to "fine-tune" the broodstock development process by moving broodstock capture sites further upstream, where stamina and run-timing constraints of lower Columbia brood coho may be reaching their limits (Murdoch et al. 2004).
- The third phase (Natural Production Implementation Phase) focuses on initiating natural production on a broad scale: determining which tributaries within each basin are the most productive for coho salmon and the level of supplementation required to maintain a naturally producing population of coho in mid-Columbia tributaries.
- Phase 4, the Natural Production Supplementation Phase, would continue releases at lower levels than initially used to establish natural production. Supplementation would be used only in tributaries, which have demonstrated the potential for natural production; releases

would be discontinued in tributaries with levels of productivity that will not support natural production.

The length of each phase will be determined by the actual return strength as compared to the criteria for transition into the subsequent phase.

Escapement Objectives –

Tributaries in the upper Columbia River region historically occupied by coho include the Wenatchee, Methow, Entiat, and Okanogan rivers. Mullan (1984) estimated historical upper-Columbia River adult coho populations as follows:

- Wenatchee-6,000 - 7,000
- Methow-23,000 - 31,000
- Entiat-9,000-13,000

Okanogan numbers were not identified; however, their presence was documented. Although the long term goal remains to achieve coho populations that approach historical numbers, varying degrees of habitat degradation in the tributaries and mainstem Columbia River will likely preclude this goal from being achieved.

Preliminary spawning escapement goals for tributaries to the Upper Columbia River region are based upon Ecosystem Diagnosis and Treatment (EDT) data and Zillges (1977). When spawning estimates differed markedly between the two methods, a median value was used. Spawning escapement goals will be adjusted as appropriate based upon empirical data. As the Program ramps up from feasibility study to natural production implementation phase, the natural spawning goals are as follows:

- Wenatchee- 4,970
- Methow – 6,200

Broodstock collection goals for the associated artificial production programs are about 1,300 and 1,200, respectively. Refinement to the broodstock collection numbers will occur as the stock continues to adapt to the local conditions.

Harvest Management –

It is difficult to development a harvest management framework for a species that remains in the reintroduction phase. Harvest, both tribal and non-tribal remains a primary objective of the Program. Tributaries to the Upper Columbia River region will be the most probable locations to implement recreational fisheries (Figure 4). As the coho are a late summer and early fall returning species, recreational fisheries would occur commensurate with chinook fisheries in the area.

Empirical data will help refine the current natural escapement goals, and as consistent escapement goals are established, it is conceivable coho in excess of the broodstock collection and escapement goals will be available for harvest.

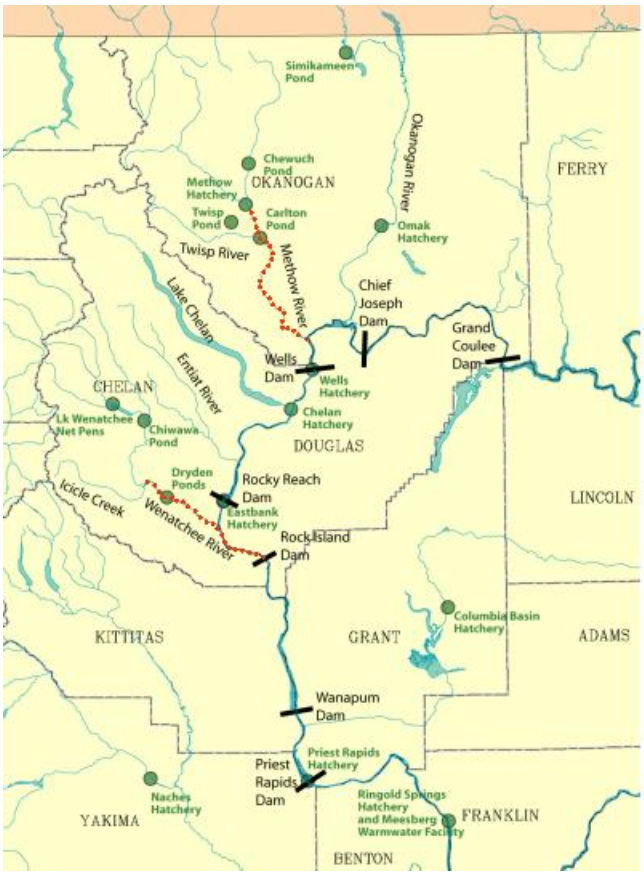

Figure 4. Coho recreational fishery areas.

Upper Columbia steelhead

Background -
Upper Columbia River tributaries were once productive wild summer steelhead systems, but the populations have declined significantly since the early 1900s. The intensive commercial fisheries in the late 1800s and industrial development of the Columbia River were largely responsible for the decline of the wild steelhead run (Mullan et al. 1992; Chapman et al. 1994b). Unlike chinook and sockeye salmon catches, steelhead harvest remained fairly constant from the early 1900s through 1940 at about 300,000 fish. Between 1938 and 1942, lower river commercial fisheries, including tribal fisheries within zone 6 took about 70% of the run. Curtailing the commercial fisheries resulted in a resurgence of wild steelhead productivity in the upper Columbia River region, where the run size tripled (5,000 fish to 15,000 fish) from 1941-1954 (Mullan et al. 1992). Sale of steelhead by non-Indians was prohibited beginning in 1975. Subsequent to the dramatic increase, escapement has fluctuated widely. When the wild productivity declined again with completion of the Columbia River hydropower system, hatchery steelhead had replaced natural production in the run counts masking the gravity of the change in wild fish production. Wild fish were subjected to, and suffered as a result of, mixed stock fisheries in the lower Columbia River directed at their abundant hatchery cohort. And, while the hatchery steelhead could sustain the relatively high harvest rates, their wild counterparts could not.

Hatchery fish made up an increasing fraction of the steelhead run after the 1960s, as wild runs were already depleted (Chapman et al. 1994b). Mullan et al. (1992) spawner-recruit analysis calculated the maximum sustainable yield (MSY) run size and escapement for steelhead at Rock Island Dam to be 16,000 - 19,000 and 4,000 – 7,000, respectively. When hatchery produced steelhead are combined with the naturally produced steelhead, no long-term trend in decline is evident. However, naturally produced steelhead exists only at threshold levels currently.

ESA Listing Status –
Upper Columbia River summer steelhead were listed as *endangered* in August 1997 because the naturally spawning population was not replacing itself. Hatchery fish in the region, derived from local populations, were included in the listing because they are necessary to achieve recovery. Subsequent to the *endangered* listing, all summer steelhead fisheries occurring within the region were closed, as well as the trout fisheries that occurred in the anadromous zones of the rivers within the region. The latter fisheries were closed in an effort to reduce the fishery impacts on juvenile steelhead caught during the course of the resident trout fisheries. However, NMFS has recently down listed the summer steelhead population to *threatened*, which may allow for additional recreational opportunity within the tributary areas. Efforts are currently underway to develop fishery options consistent with the change in listing status.

Management Strategy –
The current management strategy is reflective of the original federal listing status of *endangered*. However, the population was recently down listed to *threatened*, which may allow for additional opportunity. At present, non-treaty harvest opportunities are limited to selective recreational fisheries below McNary Dam, Wanapum band tribal harvest near Priest Rapids Dam, incidental take in Colville Tribal fisheries (Table 12) and recreational fisheries with conservation implications above Priest Rapids Dam when abundances allow (Table 11).

Artificial production programs, using locally adapted summer steelhead were fully implemented by the late 1960s. External marking of all hatchery steelhead was implemented in 1987, allowing fishery managers to increase harvest rates on the component of the run that could sustain it, while providing more protection to the beleaguered wild component. Current artificial production programs focus releases into the Wenatchee, Methow and Okanogan systems, although the Entiat River received a portion of the hatchery steelhead up through 1998. Since the success of supplementation through artificial propagation remains equivocal, NMFS requested at least one stream in the region be treated as a reference stream, essentially eliminating all hatchery released steelhead. The Entiat River was chosen as the reference stream for the region because of the relatively small number of steelhead released annually (<50,000 fish), the limited public access in comparison to the other rivers, and the greater potential to account for changes in productivity based upon a more refined natural production area in the other systems.

Wild steelhead returning to the upper Columbia River region sustain themselves only at threshold population size today. The high hatchery return rate, genetic homogeneity of hatchery and wild steelhead (Chapman et al. 1994b), and maintenance of near MSY levels in most years suggest a truly wild fish does not exist. Rather, natural production sustains them, and without hatchery supplementation the steelhead would suffer dire consequences.

All of the artificial production programs operating in the region are intended to contribute to recovery of the naturally produced component as well as provide selective harvest opportunities.

Escapement Objectives -
The run size needed at Priest Rapids Dam to meet minimum escapement objectives for the tributary streams of the region totals 9,550 adults. The 9,550 fish run size is intended to provide a minimum of 2,500 natural spawners in the Wenatchee River, 500 natural spawners in the Entiat River, 2,500 natural spawners for the Methow River and 600 natural spawners for the Okanogan River. Although the total run size is managed as a composite of hatchery and wild fish, conservation and recovery of the Evolutionarily Significant Unit (ESU) is critical, so embedded within the total run size is the requirement to achieve at least 1,300 wild (naturally produced) summer steelhead before any type of fishery is considered.

Harvest Management -
At present, non-treaty harvest opportunities outside the Upper Columbia region are limited to mark selective recreational fisheries below McNary Dam on mixed stocks. Within the region, non-treaty harvest opportunities include the Wanapum band tribal harvest near Priest Rapids Dam, and incidental take in Colville Tribal fisheries (Table 12) as well as recreational fisheries (Figure 5). In addition, as abundances allow, a non-treaty selective recreational fishery is authorized with conservation implications above Priest Rapids Dam (NOAA Fisheries Federal Permit #1395).

The WDFW manages artificially propagated steelhead returning to the Wenatchee River, Methow River, and Okanogan River basin tributary spawning areas in a manner

consistent with recovery goals to enhance natural-origin populations (see Escapement Objectives above). To reduce the number of artificially propagated UCR steelhead in the spawning areas in excess of full habitat seeding levels and to increase the proportion of the natural-origin steelhead in the tributary spawning populations, the WDFW uses recreational fisheries to reduce the number of adipose fin-clipped hatchery-reared steelhead (Table 11). No harvest will be allowed when the steelhead run size at Priest Rapids Dam is below 9,550. Furthermore, the harvest management strategy is reflective of two principles; wild fish impacts are acceptable within the scope of reducing hatchery fish influence on the spawning grounds, and recreational harvest is managed to ensure tributary escapement objectives are achieved. Since the fishery is directed at an ESA listed population and has conservation implications, the following conditions must be met for the fishery to be allowed:

- Tier 1: When the natural-origin UCR steelhead run is predicted to exceed 1,300 fish at Priest Rapids Dam and the total UCR steelhead run is predicted to exceed 9,550 steelhead, then a harvest fishery may be considered as an option to remove excess adipose fin clipped hatchery reared steelhead. In addition, for a fishery to be authorized in the tributary areas, the tributary escapements must be predicted to meet the minimum targets listed in Table 11, Tier 1. The mortality impact on natural-origin UCR steelhead, including catch and release mortality and illegal harvest, must not exceed the limits specified for Tier 1 in each tributary area.
- Tier 2: When the natural-origin UCR steelhead run is predicted to exceed 2,500 fish at Priest Rapids Dam, the total UCR steelhead run is predicted to exceed 10,035 steelhead, and the tributary escapements meet the minimum targets listed in Table 11, Tier 2, then the natural-origin UCR steelhead mortality impacts, including catch and release mortality and illegal harvest, must not exceed the limits specified for Tier 2 for each tributary area.
- Tier 3: When the natural-origin UCR steelhead run is predicted to exceed 3,500 fish at Priest Rapids Dam, and the total UCR steelhead run is predicted to exceed 20,000 steelhead, and the tributary escapements meet the minimum targets listed in Table 11, Tier 3, then the natural-origin UCR steelhead mortality impacts, including catch and release mortality and illegal harvest, must not exceed the limits specified for Tier 3 in each tributary area.

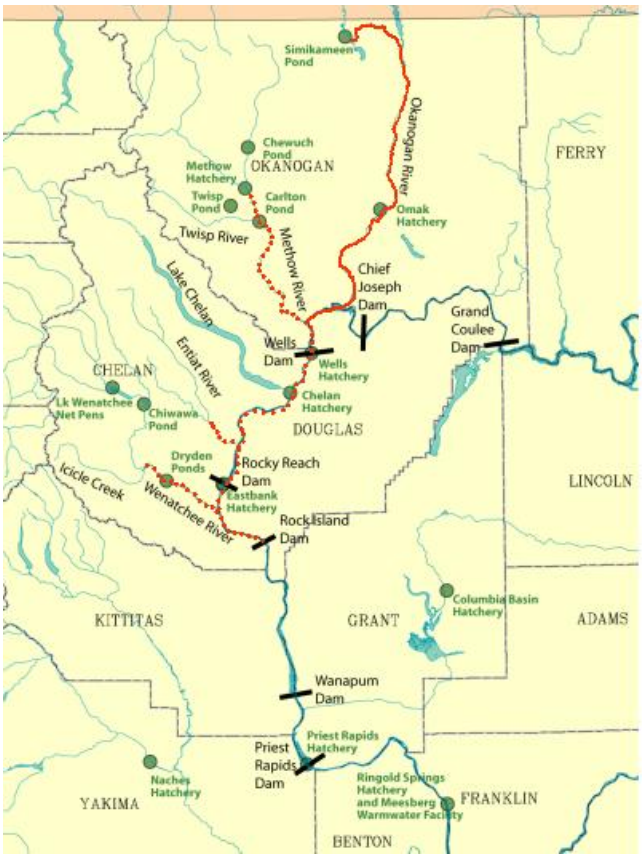

Figure 5. Summer steelhead recreational fishery areas.

Table 11. Natural-origin UCR steelhead run-size criteria for recreational harvest of excess hatchery steelhead in the Wenatchee River, Methow River, and Okanogan River basin tributary spawning areas and mortality take limit of natural-origin UCR steelhead. Catch and release mortality is assumed at five percent.

Tributary Area	Priest Rapids Dam Count	Estimated Escapement to Tributary Area	Maximum Allowable Mortality Impact
Wenatchee River and Columbia River above Rock Island Dam to below Rocky Reach Dam			
	<837	<599	0%
Tier 1	838	600	2%
Tier 2	2,146	1,700	4%
Tier 3	3,098	2,500	6%
Methow River and Columbia River above Wells Dam			
	<908	<499	0%
Tier 1	804	500	2%
Tier 2	2,224	1,600	4%
Tier 3	3,386	2,500	6%
Okanogan River Basin upstream of the Highway 97 Bridge			
	<175	<119	0%
Tier 1	176	120	5%
Tier 2	180	120	7%
Tier 3	795	600	10%

Table 12. Colville Tribal Incidental Take Thresholds for ESA-Listed Upper Columbia River Steelhead (from BiOp).

Steelhead Count Wells Dam	Maximum Colville Take Hatchery- origin	Maximum Colville Take Natural-origin
<1,000	3%	1%
1,001 – 2,000	5%	1%
2,001 – 3,000	7%	2%
3,001 – 5,000	15%	3%
5,001 – 10,000	30%	5%
10,001 -	50%	10%

The above noted take percentages apply to hatchery and natural origin steelhead passing Wells Dam that are either returning to the Okanogan River or available to Tribal fisheries in the mainstem Columbia. They do not apply to the total Wells Dam count, which serves as an index of annual stock productivity.

Resident Trout

Background –
Rainbow trout are native, although at varying levels to all the basins within the upper Columbia River, and it is likely the resident form of *O. mykiss* has helped sustain the summer steelhead population (Mullan et al. 1992). Anadromy is not obligatory in *O. mykiss* (Rounsefell 1958; Mullan et al. 1992). Progeny of anadromous steelhead can spend their entire life in freshwater, while progeny of rainbow trout can migrate seaward. Anadromy, although genetically linked (Thorpe 1987), runs under environmental instruction (Shapovalov and Taft 1954; Thorpe 1987; Mullan et al. 1992). It is difficult to summarize one life history strategy (anadromy) without due recognition of the other (resident). The two strategies co-mingle on some continuum with certain residency at one end, and certain anadromy on the other.

Cold-water temperatures limit upstream distribution of rainbow trout. Westslope cutthroat trout on the other hand reside in cold-water refugia where interactive threats from other species, like rainbow, are absent because many cutthroat populations are protected from invasion by barrier falls and most invaders are competitively debilitated by cold temperature. Hybridization with steelhead/rainbow trout results from the natural spawning interaction of cutthroat and steelhead/rainbow at their distributional point of contact where water temperature favors neither species (Mullan et al. 1992; Williams 1998). These hybridization zones are short, limiting the negative impact to either species. The interactions have long ago been resolved and the distributions stabilized with no further threat unless thermal conditions change. Movement downstream into the mainstem rivers can be beneficial for a portion of the population because of the warmer water temperatures and subsequent growth rate. However, competition among species than also increases, and different systems have different productivities of resident trout.

ESA Listing Status –
Currently, bull trout are the only trout or char population within the upper Columbia River region that are federally listed as *threatened* under the ESA. State fishery regulations require the release of bull trout unharmed.

Management strategy –
Non-anadromous salmonids are seldom planted in Washington streams today. Stocking in alpine lakes is ongoing and intra-agency safeguards to filter out ill-advised plants include the Wild Salmonid Policy, the State Environmental Policy Act, and disease prevention stocking policies. Interagency agreements, Memorandum Of Understanding (MOUs), and mandates with National Parks and the U.S. Forest Service also play discriminating roles.

Although current numbers of fluvial fish may be lower than pre-Anglo abundance due to over harvest, their preservation is assured through regulatory protection, annual stocking, and egress from a host of resident populations. The resident stream populations attract few anglers because of remote locations and small fish sizes. The oldest westslope cutthroat trout ever reported in the literature (Mullan et al. 1992) grew for 13 years amidst summer parades of visitors to the Gardner Meadow campsite at the head of Wolf Creek in the Methow River drainage because there was little demand for this 6.3-inch trout. In addition, the state regulation minimum size of 8 inches, precluded retention.

Harvest Management -

Wenatchee Basin

Prior to 1915 only steelhead, salmon and bull trout inhabited the Wenatchee River, very few if any rainbow or cutthroat trout were found. Similar to the Entiat River the Wenatchee River was stocked heavily with trout to provide recreation trout fishing opportunity from 1915 to the late 1980s. Resident trout stocking of streams was discontinued to reduce angler impacts on naturally produced juvenile steelhead that were extensively caught and released during the course of the trout fishery. Hooking mortality on juvenile fish when bait is used can be substantial and thus significantly impact the steelhead population and its productivity.

Subsequent to the endangered ESA listing for both steelhead and spring chinook, the Wenatchee River was closed to all trout, salmon and steelhead fishing within the anadromous areas. While an endangered listing remains in place for steelhead, resident trout fishing opportunities within the anadromous areas will remain closed. Should the steelhead be down listed under the ESA from endangered to threatened, it may be possible to provide limited recreational fishing opportunity that targets any resident trout present as well as residualized hatchery steelhead.

Many hatchery reared juvenile steelhead are released annually in to the Wenatchee River. Smolt collection data indicates several thousand juvenile hatchery steelhead fail to migrate from the river after release. A portion will attempt to overwinter another year before migrating seaward, while another portion will “residualize” and remain in freshwater. Similar occurrences have been documented throughout Washington, Oregon and Idaho (Seelbach 1987, Everson and Ewing 1992, Viola and Schuck 1995, Cannamella, IDFG personal communications).

WDFW may have the opportunity to reduce the number of hatchery-residualized steelhead in the Wenatchee River through implementation of a fishery that specifically targets these fish. Currently 50% of the hatchery steelhead smolts released are adipose fin clipped. While the

steelhead remain ESA listed, the external mark rate/adipose fin clip rate will not deviate significantly from 50% to optimize protection and return of adults to meet recovery goals. However, the change in listing status from endangered to threatened may prompt a reevaluation of the mark rates necessary for protection from fisheries that occur outside the upper Columbia River region, balanced against the need to remove residualized steelhead and excess adults upon return.

Prior to establishing a "trout" season on the Wenatchee River, the WDFW must conduct sufficient sampling with selective fishing gear to examine the proportion of residual hatchery steelhead compared to naturally produce juvenile steelhead and salmon that recreational anglers would likely catch. The WDFW hatchery evaluation team has some preliminary information of this type. Nevertheless, more sampling is needed to determine if certain sections of the river may contain higher proportions of residual hatchery steelhead than naturally produced salmonids. Ordinarily residual hatchery steelhead are found at higher densities in low gradient sections of the river, particularly in close proximity to the release site. It would be in these sections that a trout fishery may be of benefit to recovery efforts. It is important that the benefits of removing residual hatchery steelhead from the river outweigh the effects of incidental hooking mortality of naturally produced salmonids. A trout fishery would only be justified if sampling suggests that trout sport fishing would assist in recovery efforts for steelhead and spring chinook. If WDFW does open a trout sport fishery intensive monitoring would be needed to ensure that the benefits to listed salmonids outweighs any negative effects of the fishery.

This is not a new management strategy for Washington as examples can be found on many Washington Rivers. One of the benefits gained by the "trout" fisheries in the Tucannon, Touchet, Grand Ronde and Walla Walla rivers is the reduction of residual steelhead. Idaho Fish and Game uses this management strategy to reduce hatchery residual steelhead in the Salmon River. A trout fishery that targets residualized hatchery juvenile steelhead would both support upper Columbia River steelhead recovery and provide trout fishing opportunity on the Wenatchee River.

Entiat Basin

Like the Wenatchee Basin, prior to 1915 only steelhead, salmon and bull trout inhabited the Entiat River from Entiat Falls (a barrier to anadromous fishes) downstream, as very few if any rainbow or cutthroat trout were found. Long ago steelhead and salmon out competed the resident *O. mykiss* presumably because of the warmer temperatures downstream of the falls, which in the case of the *O. mykiss* species elicited smoltification and seaward migration. Bull trout on the other hand presumably thrived in river below Entiat Falls. Currently bull trout do not exit upstream of Entiat Falls. It is uncertain whether these fish historically existed in the river and tributaries upstream of Entiat Falls.

Because the river contained few if any trout, biologists began stocking trout into the Entiat River beginning in the early 1900's to provide recreational fishing opportunity. The earliest record of trout stocking occurred in the mainstem Entiat River in 1915. State hatcheries stocked a mix of rainbow, cutthroat and brook trout into the Entiat River in most years from 1915 until 1933, and

annually thereafter until 1968. From 1968 - 1994 the Chelan Public Utility District (PUD) provided funding to rear rainbow trout for annual release into the Entiat River.

Subsequent to 1994 all trout stocking ceased statewide for rivers and streams containing anadromous fish, namely steelhead because of concerns over hooking mortality to juvenile steelhead and the desire to manage for wild trout in rivers. Essentially, the Entiat River has reverted to pre-1915 status, with few trout present below Entiat Falls.

The river downstream of Entiat Falls remains closed to trout fishing because acceptable incidental impacts to ESA listed juvenile summer steelhead and spring chinook cannot be attained since they represent the dominant species present. However, any future down listing for these ESA endangered fishes to a threatened status could provide some trout fishing opportunity.

The river area upstream of Entiat Falls is currently managed under the statewide standard for trout fishing. Trout fishing is open June 1 – October 31, with a limit of two trout greater than 8", except no size limit is required for brook trout and up to 5 brook trout may be kept. Only 5 fish in total may be kept, and no more than two can be other trout species. Future regulations will be designed to increase the removal of brook trout that negatively interact with bull trout through competition and interbreeding; to increase the size and abundance of larger rainbow and cutthroat trout; and to provide enhanced fishing opportunity**.**

We have proposed in the 2005 – 2006 regulation cycle to allow trout fishing from June 1 – October 31 selective gear rules, with the daily limit increased to 15 fish; no minimum size; no more than 10 brook trout and no more than one fish over 12 inches.

Methow Basin

The Methow basin appears to have the highest density of rainbow and cutthroat trout as compared with the Entiat and Wenatchee basins. This is presumably because of the numerous cold, headwater streams and contiguous alpine lakes that feed into the mainstem Methow River. The comparatively higher productivity for resident rainbow and cutthroat trout provides catch and release fishing opportunities in select areas of the mainstem river and two principle tributaries (Figure 6). The catch and release fishery targets these relatively abundant, non-ESA listed species. Impacts to listed species, namely juvenile summer steelhead occurs incidental (previously covered under Biological Opinion permit #1248, and new permit #1554) to the trout fishery as the steelhead represent less than 50% of the target population.

The resident trout fishery occurs,

- June 1 through September 30 in the mainstem Methow River, from Burma Bridge near the town of Methow upstream to the confluence with the Chewuch River.
- June 1 through August 15 in the Methow River from the Chewuch River confluence upstream to the Weeman Bridge (six miles northwest of Winthrop).
- June 1 through August 15 in the mainstem Chewuch River from its confluence with the Methow River upstream to Eightmile Creek
- and, June 1 through August 15 in the Twisp River from its confluence upstream to War Creek.

The regulations for this fishery are catch-and-release of trout only, using unscented artificial flies and lures with single, barbless hooks. The use of bait is prohibited. Waters outside areas with anadromous fish, including most tributaries above impassable barriers open June 1 through October 31 under statewide rules.

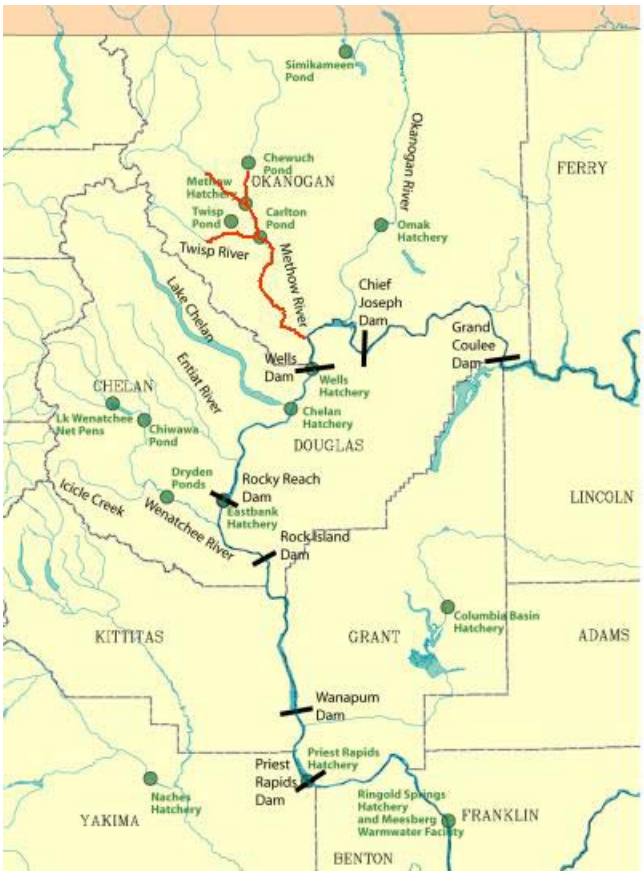

Figure 6. Resident trout fishery areas.

References

Chapman D. W. 1986. Salmon and steelhead abundance in the Columbia River in the Nineteenth Century. Transactions of the American Fisheries Society 115:662-670.

Chapman D., A. Giorgi, T. Hillman, D. Deppert, M. Erho, S. Hays, C. Peven, B. Suzumoto, R. Klinge. 1994a. Status of summer/fall chinook salmon in the mid-Columbia region. Don Chapman Consultants, Inc. Boise, ID.

Chapman, D., C. Peven, T. Hillman, A. Giorgi, F. Utter. 1994b. Status of summer steelhead in the mid-Columbia River. Don Chapman Consultants, Inc. Boise, ID.

Chapman, D., C. Peven, A. Giorgi, T. Hillman, F. Utter. 1995a. Status of spring chinook salmon in the mid-Columbia River region. Don Chapman Consultants, Inc. Boise, ID.

Chapman, D.W., C. Peven, A. Giorgi, T. Hillman, F. Utter, M. Hill, J. Stevenson, M. Miller. 1995b. Status of sockeye salmon in the mid-Columbia region. Don Chapman, Consultants, Inc. Boise, ID.

Evenson, M.D., and R.D. Ewing. 1982. Migrations characteristics and hatchery returns of winter steelhead volitionally released from Cole River Hatchery, Oregon. North American Journal of Fishery Management 12:736 – 743.

Gilbert, C.H., and B.W. Evermann. 1895. A report upon the investigations in the Columbia River basin, with description of four new species of fishes. Bull. U.S. Fish. Comm., Vol. 14 for 1894. p. 169-207.

Mid-Columbia River Habitat Conservation Plan. Chelan Public Utility District. 2002. Anadromous fish agreement and habitat conservation plan: Rock Island Hydroelectric Project, FERC license No. 943. Chelan PUD. Wenatchee, Washington and Douglas Public Utility District (Public Utility District No. 1 of Douglas County). 2002. Anadromous fish agreement and habitat conservation plan: Wells Hydroelectric Project, FERC license No. 2149. Douglas PUD. East Wenatchee, Washington.

McDonald, M. 1895. Bulletin of the United States Fish Commission. Vol. XIV.

Mullan, J.W. 1984. Overview of artificial and natural propagation of coho salmon (O. kisutch) in the mid-Columbia River. Re. No. FRI/FAO-84-4, USFWS, Leavenworth, WA.

Mullan, J.W. 1986. Determinants of sockeye salmon abundance in the Columbia River, 1880s-1982: A review and synthesis. USFWS Biol. Rep. 86(12).

Mullan, J.W., K.R. Williams, G. Rhodus, T.W. Hillman, and J.D. McIntyre. 1992. Production and habitat of salmonids in mid-Columbia River tributary streams. U.S. Fish and Wildlife Serv. Monograph I. 489pp.

Murdoch, K.G, C.M. Kamphaus, and S.A. Prevatte. 2004. Mid-Columbia Coho Reintroduction Feasibility Study: 2002 Annual Monitoring and Evaluation Report. *Prepared For:* Bonneville Power Administration. Project Number 1996-040-00. Portland, OR

National Marine Fisheries Service (NMFS). 2002. Endangered Species Act-Section 7 Consultation Biological Opinion on the issuance of three Section 10 permits for takes of threatened and endangered species associated with upper Columbia River ESU steelhead hatchery supplementation programs. U.S. Dept.of Commer., NOAA. NMFS. ESA Section 7 Consultation Number 2002/000981

Seelbach, P. W. 1987. Smolting success of hatchery raised steelhead planted in a Michigan tributary of Lake Michigan. North American Journal of Fishery Management 7:223-231.

Technical Advisory Committee 1991 (TAC). 1991 all species review Columbia River Fish Management Plan.

Thompson, W. F. 1951. An outline for salmon research in Alaska. University of Washington, Fisheries Research Institute Circular 18, Seattle.

Viola A.E. and M. G. Schuck. 1995. A method to Reduce the Abundance of Residual Hatchery Steelhead in River. North American Journal of Fishery Management 15:488-493

WDF/ODFW (Washington Department of Fisheries and Oregon Department of Fish and Wildlife). 1992. Columbia River runs and fisheries. Status Report, Oregon Department of Fish and Wildlife, Portland, OR., and Washington Department of Fisheries, Olympia, WA.

Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes. 2002. Washington State Salmonid Stock Inventory. Appendix 3: Columbia River stocks. Washington Department of Fish and Wildlife, Olympia, WA.