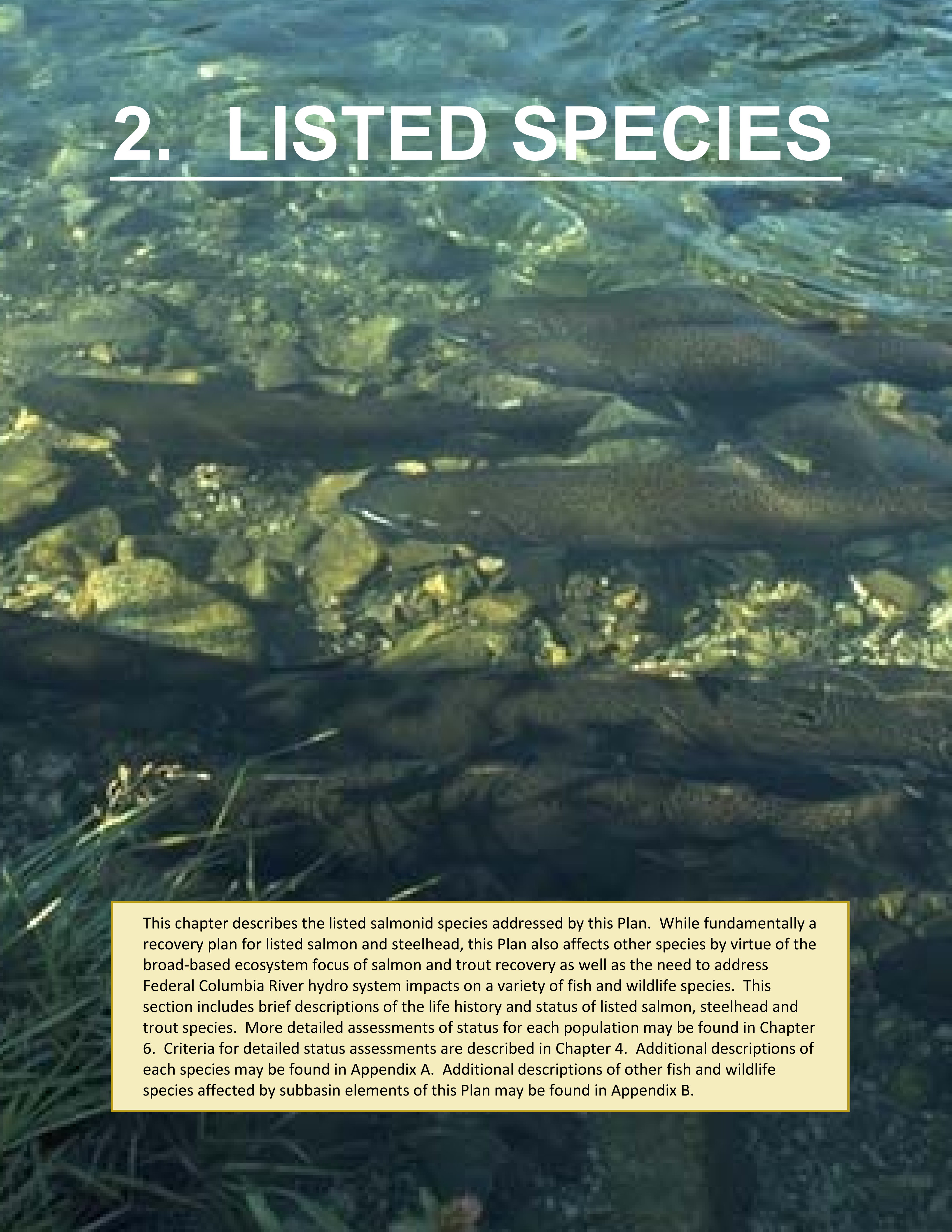

2. LISTED SPECIES

This chapter describes the listed salmonid species addressed by this Plan. While fundamentally a recovery plan for listed salmon and steelhead, this Plan also affects other species by virtue of the broad-based ecosystem focus of salmon and trout recovery as well as the need to address Federal Columbia River hydro system impacts on a variety of fish and wildlife species. This section includes brief descriptions of the life history and status of listed salmon, steelhead and trout species. More detailed assessments of status for each population may be found in Chapter 6. Criteria for detailed status assessments are described in Chapter 4. Additional descriptions of each species may be found in Appendix A. Additional descriptions of other fish and wildlife species affected by subbasin elements of this Plan may be found in Appendix B.

2. LISTED SPECIES

Tables

Figures

2.1. Overview

Washington's lower Columbia River and tributary streams were once among the most productive salmon and steelhead systems found anywhere. These systems supported tremendous biological diversity including five salmonid species that filled practically every accessible niche and habitat (Box 2-1). These fish runs sustained abundant fisheries that were intricately woven over millennia into the economy and fabric of life of the the people of the region.

Now, the pervasive, compounding impacts of a variety of factors threaten these fish with extinction. Historical wild runs numbering a million or more in Washington lower Columbia streams have been reduced to averages of only about 30,000 per year. Virtually every population of these keystone salmonid species is currently estimated to be at high or very high risk of extinction (Figure 2-1). Chinook salmon, chum salmon, coho salmon, steelhead, and bull trout of the lower Columbia River region, including parts of Washington and Oregon, were all listed as Threatened under the U.S. Endangered Species Act between 1998 and 2005 (Table 2-1).

This Plan addresses listed salmon, steelhead, and trout species in the Washington lower Columbia region. Most species include a variety of life history types (Table 2-2). It is this irreplaceable raw material, shaped and honed by natural processes over thousands of years that the ESA listing, the NPCC Fish and Wildlife Program, and this Recovery Plan seek to preserve and restore.

Box 2-1. Listed lower Columbia River salmon, steelhead, and trout species.

***Chinook salmon* (Oncorhynchus tshawytscha) are the largest and most diverse of the listed species. Over a quarter million Chinook salmon historically returned to lower Columbia systems. Spring, fall, and late fall runs spawn in river mainstems from the Columbia to the headwaters of the larger tributaries and juvenile Chinook are rearing or migrating through the lower Columbia River in practically every month of the year. Chinook salmon range north to Alaska, typically on a multi-year journey before returning home again.**

***Coho salmon* (Oncorhynchus kisutch) historically numbered in the hundreds of thousands. Early and late coho runs return with each fall's rains to spawn in the smaller, lower gradient streams and tributaries throughout the lower Columbia from low elevation valley bottoms to the mountainous headwaters. Coho inhabit the nearshore ocean of the Oregon and Washington coasts where weather-related upwelling patterns and the short 3-year life cycle of this species cause highly variable population cycles.**

***Chum salmon* (Oncorhynchus keta) return to spawn in the lowermost reaches of streams and rivers. Almost a million chum historically returned to lower Columbia River streams. Young chum spend the briefest time of any of the species in freshwater, migrating seaward soon after emerging from the clean spring-fed gravel upon which they depend. They migrate to the far north Pacific and the Bering sea.**

***Steelhead,* (Oncorhynchus mykiss) including summer and winter runs, return to freshwater during most any month of the year and typically spawn and rear in the steeper boulder-strewn upper reaches of lower Columbia River tributary rivers and streams. Freshwater life history of steelhead is very diverse, with juveniles rearing 1-3 years before riding the spring freshets to the sea. Steelhead range far out into the ocean almost to the shores of Japan. Unlike salmon, not all steelhead die after spawning and some return to spawn again.**

***Bull trout* (Salvelinus confluentus) are creatures of the clear, cold headwater forest streams, of which few remain. Current distribution in the lower Columbia is limited to the upper Lewis River, and several Columbia River gorge streams. This species is a fish predator from an early age and historically depended on the large salmon runs for sustenance. Bull trout rarely leave freshwater but life histories often involve extensive upstream and downstream migration between streams, rivers, and lakes.**

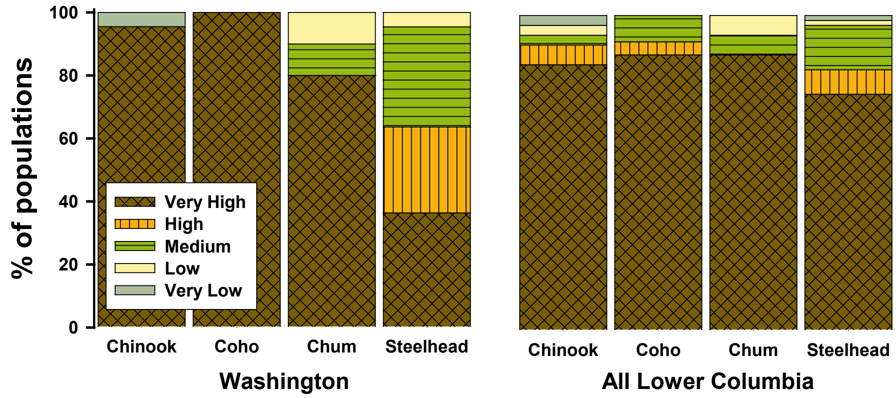

Figure 2-1. Estimated extinction risks of populations of listed lower Columbia River salmon and steelhead in Washington and throughout the region (including both Washington and Oregon). Risks are defined based on extinction probability within the next 100 years (Very high: >60%, high: 26-60%, medium: 6-25%, low: 1-5%, and very low: <1%)

NMFS has explicitly identified listing units for each species and defined a hierarchy of units and subunits including evolutionarily significant units (salmon) or distinct population segments (steelhead), major population groups or strata, and demographically-independent populations (Box 2-2). Listing units of west coast salmon and steelhead were identified by NMFS during a coastwide status review that was initiated in 1995.

Geographical boundaries identified for lower Columbia River salmon ESUs and steelhead DPSs generally include the Columbia River and its tributaries, from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, and upstream in the Willamette River to Willamette Falls, Oregon. Exceptions include steelhead populations downstream from the Cowlitz River in Washington and the Willamette River in Oregon (these populations are part of the unlisted Southwest Washington DPS), steelhead in the White Salmon basin (which are part of the threatened Middle Columbia DPS and are addressed in a separate recovery plan), and spring Chinook in the Clackamas River basin in Oregon (which are part of the threatened Upper Willamette ESU). Designated critical habitats for listed salmonid species within this area include accessible reaches of all rivers (including estuarine areas and tributaries), as well as waterways, substrate, and adjacent riparian zones below longstanding naturally impassable barriers.

Table 2-1. Chronology of listing decisions for lower Columbia River salmon, steelhead and trout.

Species	Action	Reference[1]
Lower Columbia River Chinook	• Listed as Threatened on 3/24/1999 (effective 5/24/1999) • Listing reaffirmed on 6/28/2005 • Current critical habitat designated on 9/2/2005 (effective 1/2/2006)	64FR14308 70FR37160 70FR52630
Lower Columbia River Coho	• Identified as a candidate species on 7/25/1995 • Listed as Threatened on 6/28/2005 • Critical habitat designation under development	60FR38011 70FR37160 --
Columbia River Chum	• Listed as Threatened on 3/25/1999 (effective 5/24/1999) • Listing reaffirmed on 6/28/2005 • Current critical habitat designated on 9/2/2005 (effective 1/2/2006)	64FR14507 70FR37160 70FR52630
Lower Columbia Steelhead	• Listed as Threatened on 3/19/1998 (effective 5/18/1998) • Listing reaffirmed on 6/28/2005 • Current critical habitat designated on 9/2/2005 (effective 1/2/2006)	63FR13347 70FR37160 70FR52630
Bull trout	• Listed as Threatened on 6/10/1998 (effective 7/10/1998) • Critical habitat designated on 9/26/2005 (effective 10/26/2005)	63FR31647 70FR56212

[1] Federal register number

Table 2-2. Life history and population characteristics of salmon and steelhead originating in Washington portions of the lower Columbia.

Characteristic	Chinook			Coho		Chum	Steelhead	
	Spring	Fall (tule)	Late fall (bright)	Early – Type S	Late – Type N		Summer	Winter
Life history type	Stream	Ocean	Ocean	Stream	Stream	Ocean	Stream	Stream
Freshwater return timing	March – June	August – September	August – October	August – September	September – December	October – December	May – November	November – April
Spawn timing	August – September	September – November	November – January	October – November	November – January	November – December	January – June	March – early June
Spawning habitat	Headwaters of large tributaries	Mainstem, large tributaries	Mainstem large tributaries	Higher tributaries	Lower tributaries	Mainstem, tributaries, or side channels	Upper watersheds streams	Rivers and tributaries
Emergence timing	December – January	January – April	March – May	January – April	January – April	February – April	March – July	March – July
Freshwater rearing	Usually 12-14 months	Usually 1-4 months	Usually 1-4 months	12-15 months	12-15 months	About 1 month	1-3 years (mostly 2)	1-3 years (mostly 2)
Rearing habitat	Tributaries and mainstem	Mainstem, tributaries, sloughs, estuary	Mainstem, tributaries, sloughs, estuary	Smaller tributaries, river edges, sloughs, off-channel ponds	Smaller tributaries, river edges, sloughs, off-channel ponds	Tributaries, mainstem, estuary	River and tributary main channels	River and tributary main channels
Estuary use	A few days to weeks	Several weeks to several months	Several weeks to several months	A few days to weeks	A few days to weeks	Up to 4 months	Briefly in the spring, peak abundance in May	Briefly in the spring, peak abundance in May
Ocean migration	As far north as Alaska	As far north as Alaska	As far north as Alaska	South migrating (Coastal WA, OR, & Northern CA)	North migrating (Coastal BC, WA, OR)	North Pacific and Bering Sea	North to Canada and Alaska, and into the N Pacific	N to Canada and Alaska, into the N Pacific
Age at return	3-6 years	2-5 years	2-5 years	3 years, some 2-year jacks	3 years, some 2-year jacks	3-4 years, a few 5 years	3 – 5, occasionally 6 years	3 – 5, occasionally 6 years
Historical numbers	120,000	140,000	20,000	400,000		900,000	30,000	100,000
Recent natural spawners	800	6,500	9,000	6,000 – mostly of hatchery origin		6,000	1,500	3,500
Recent hatchery returns	13,000	37,000	n/a	5,000 - 90,000	12,000 - 180,000	300 (in 2002)	2,000	9,000

Box 2-2. Definitions and application of listing units under the Endangered Species Act.

The ESA, as amended in 1978, allows listing of named species, subspecies, and distinct population segments of vertebrates (Good et al. 2005). This choice of language established that the ESA intended to preserve the genetic variability within taxonomic species and extended protection to include smaller biological units (Waples 1991). The ESA defines a "species" to include any distinct population segment of any species of vertebrate fish or wildlife. NMFS policy considers a salmon population or group of populations to be "distinct" if it is 1) substantially reproductively isolated fromconspecific populations, and 2) an important component in the evolutionary legacy of the species (Waples 1991, 1995). Reproductive isolation is based on the incidence of straying, rates of recolonization, degree of differentiation, and the existence of barriers to migration (Good et al. 2005). Evolutionary significance is based on genetics, life history, habitat differences, and the effects of stock transfers or supplementation efforts.

For Pacific salmon, NMFS considers an evolutionarily significant unit, or "ESU," a "species" under the ESA. For Pacific steelhead, NMFS has delineated distinct population segments (DPSs) for consideration as "species" under the ESA. When NMFS originally listed LCR steelhead as threatened, it was classified as an ESU and included both the anadromous and resident forms of O. mykiss. In 2006, NMFS revised its determinations for West Coast steelhead under the ESA, delineating anadromous, steelhead-only DPSs. The ESUs emphasized reproductive isolation and ecological or genetic distinctiveness and subdivided salmon species geographically. The DPSs focused on ecological distinctiveness and divided the O. mykiss species into anadromous (steelhead) and resident (trout) life histories, then subdivided the steelhead geographically. Steelhead and trout within a common geographic area are not necessarily reproductively isolated or genetically distinct (Kostow 2003). However, only the steelhead life history of O. mykiss is listed under the ESA and is addressed in this Recovery Plan.

ESUs and DPSs may include one or more strata or Major Populations Groups (MPGs) which represent different life history types, geographical regions, or ecological zones. For instance, the Lower Columbia River Chinook salmon ESU includes spring, fall, and late fall life history types variously occurring in coast, cascade, and gorge ecoregions. The TRT calls these groups "strata". They are analogous to the "Major Population Groups" (MPGs) that were defined by the Interior Columbia TRT, and to the "geographic regions" that were described by the Puget Sound TRT. Strata of listed lower Columbia River and Willamette River salmon and steelhead were identified by the TRT based on an extensive review of historical and current information (Myers et al. 2006).

ESU's and strata may contain multiple "demographically independent" populations (DIPS) (McElhany et al. 2000). DIPs are defined as "one or more spawning aggregations that are linked sufficiently by an exchange of spawners such that they share a common demographic fate" (McElhany et al. 2000). Populations include groups of fish of the same species that spawn in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season. Populations are isolated to such an extent that exchanges of individuals with other populations do not substantially affect the population dynamics or extinction risk (McElhany et al. 2000). DIPs were identified by the TRT based on an extensive review of information on geography, migration fidelity, genetic attributes, life history patterns, morphological characteristics, population dynamics, and environmental/habitat characteristics (Myers et al. 2006).

Example hierarchy of units and subunits of salmon and steelhead species addressed by this Plan:

Unit	*Number*	*Example*
Domain	*1*	*Willamette-Lower Columbia*
Subdomain	*2*	*Lower Columbia*
Management Unit	*3*	*Washington*
Species	*5*	*Chinook Salmon*
Evolutionarily Significant Unit/Distinct Population Segment	*4*	*L. Col. River Chinook Salmon*
Stratum/Major Population Group	*16[a]*	*Cascade Spring Chinook*
Population	*72[a]*	*Lewis River*

[a]Number occuring in the Washington Management Unit of the lower Columbia River.

Although NMFS has determined that the Southwest Washington DPS is currently not warranted for listing, the three coast stratum populations in that DPS were included in this Plan to recognize the benefits to these populations of the ecosystem approach to recovery of listed salmon originating in the same area.

Some hatchery stocks were included in all four Lower Columbia River ESUs/DPS and are listed along with naturally produced fish (Table 2-3). Hatchery stocks determined to be part of an ESU or DPS may be considered in determining whether the ESU or DPS is threatened or endangered under the ESA, and may be included in any listing of the ESU or DPS (FR 70 37204). According to NMFS's Hatchery Policy: "Hatchery stocks with a level of genetic divergence relative to the local natural population(s) that is no more than what occurs within the ESU: (a) are considered part of the ESU; (b) will be considered in determining whether an ESU should be listed under the ESA; and (c) will be included in any listing of the ESU." The Hatchery Policy further recognized that the role of hatchery fish in status assessment and recovery would be determined "… in the context of their contributions to conserving natural self sustaining populations." Hatchery fish were recognized to potentially have either positive or negative effects on the status of natural populations. Finally hatchery fish were not given full protection under Section 4(d) of the ESA; instead "For ESUs listed as threatened, NMFS will, where appropriate, exercise its authority under section 4(d) of the ESA to allow the harvest of listed hatchery fish that are surplus to the conservation and recovery needs of the ESU, in accordance with approved harvest plans." Thus the three salmon ESUs and the steelhead DPS addressed in this Recovery Plan include hatchery stocks, but recovery focuses on the conservation of self-sustaining naturally-produced populations.

The inclusion of hatchery stocks in ESUs or DPSs was based on a review and analysis by NMFS of hatchery broodstock origins, broodstock age, management history, and life history and genetic information conducted by NMFS (2003). The specific hatchery stocks included in each ESU/DPS are provided in the final listing notices (70 FR 37160 and 71 FR 834). These hatchery stocks could be considered for use in recovery actions for these ESUs and DPS. Most hatchery fish released into the lower Columbia are currently marked with an adipose fin clip and are available for use in harvest (70 FR 37204). While the hatchery fish may be used as a resource in some recovery actions, their status is not the focus of recovery.

Table 2-3. Artificial production programs included in listing units of lower Columbia River salmon and steelhead.

Run type	WA Programs	OR Programs
Fall Chinook	Elochoman River, Cowlitz, North Fork Toutle, Kalama, Washougal, Spring Creek	Sea Resources, Big Creek, Astoria High School, Warrenton High School
Spring Chinook	Upper Cowlitz and Cispus rivers, Friends of the Cowlitz, Kalama, Lewis River, Fish First	Sandy River
Chum	Chinook River (Sea Resources Hatchery), Grays River, and Washougal River/Duncan Creek chum hatchery programs	
Coho	Grays River, Sea Resources, Peterson Project, Elochoman, Cathlamet High School FFA, Cowlitz Type-N, Cowlitz Game and Anglers Program, Friends of the Cowlitz Program, North Fork Toutle River, Kalama River, Lewis River, Fish First, Syverson Project	Big Creek, Astoria High School, Warrenton High School, Eagle Creek, Sandy, and the Bonneville/Cascade/Oxbow complex
Summer steelhead	Kalama River Wild	Hood River
Winter steelhead	Cowlitz Trout Hatchery (in the Cispus, Upper Cowlitz, Lower Cowlitz, and Tilton Rivers), Kalama River Wild	Clackamas Hatchery, Sandy Hatchery, Hood River

2.2. Chinook Salmon

ESA listing: Threatened	**3/24/1999 (effective 5/24/1999)**	**64FR14308**
Status affirmed:	**6/28/2005**	**70FR37160**
Critical Habitat Designation:	**9/2/2005 (effective 1/2/2006)**	**70FR52630**

The listed lower Columbia River ESU includes all naturally spawned populations of spring and fall Chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River. Celilo Falls, which historically may have presented a migrational barrier to Chinook salmon under certain flow conditions, is the eastern boundary of the ESU (Myers et al. 1998, 2003). Also included is the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River.[1] Willamette Falls historically limited upstream movement of Chinook during low fall stream flows.

Lower Columbia River Chinook are classified as spring, fall, or late fall runs based on when adults return to fresh water. These types of Chinook salmon have different life history traits, geographic distribution, and genetic characteristics. Fall Chinook predominate in the lower Columbia River tributaries, though several tributaries also support spring Chinook.

Chinook life history varies among the run types in behavior and timing of spawning, incubation, and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to fresh water. Within this life history cycle, there may be a high degree of variability in response to freshwater environmental conditions and genetic imprinting. Chinook spawn in streams as small as 10 ft wide to rivers as large as the mainstem Columbia. Life history patterns, including run timing, have evolved over thousands of years to match stream flow, water temperatures, and habitat in a particular stream. Critical freshwater habitat requirements include clean gravels for spawning as well as pool and side channel habitat for rearing. Chinook rear for a few months to a year or more in freshwater streams, rivers, or the estuary before migrating to the ocean in spring, summer, or fall depending on run type. All runs migrate far into the north Pacific on a multi-year journey along the continental shelf to Alaska before circling back to their river of origin.

Lower Columbia River Chinook salmon populations began declining by the early 1900s because of habitat alterations and unsustainable high harvest rates given the changing habitat conditions. Long- and short-term trends in abundance of individual populations are mostly negative, some severely so. About half of the populations comprising this ESU are very small, increasing genetic and demographic risks. Today, the once abundant natural runs of spring and fall Chinook have been largely replaced by hatchery production. Apart from the relatively large and highly viable fall-run population in the Lewis River, production in the ESU appears to be predominantly hatchery-driven with few identifiable native, naturally reproducing populations.

[1] Clackamas spring Chinook are in the ESA threatened Upper Willamette Chinook ESU.

Spring Chinook

Lower Columbia spring Chinook historically spawned in upstream portions of large subbasins including the Cowlitz, Lewis, Kalama, and Big White Salmon rivers. Adults enter the lower Columbia River from March through June, well in advance of spawning in August and September (Figure 2-3). Historically, fish migrations were synchronized with periods of high rainfall or snowmelt to provide access to upper reaches of most tributaries where fish would hold until spawning. Since spring Chinook enter freshwater well before the time of spawning, survival until the spawning period is primarily a function of body fat reserves at the time of freshwater entry.

Spring Chinook are “stream type” salmon that generally rear in the river for a full year. This extended freshwater residency is characteristic of Chinook that inhabit more productive watersheds where temperature and flow conditions are relatively consistent. Most juveniles emigrate from freshwater as yearlings, typically in the spring of their second year. However, some juveniles migrate downstream from their natal tributaries in the fall and early winter into larger rivers, including the mainstem Columbia River, where they are believed to over-winter before outmigration the next spring as yearling smolts.

Once stream-type Chinook salmon leave freshwater, they usually move quickly through the estuary, into coastal waters, and ultimately to the open ocean. Thus, they are often more dependent on freshwater, rather than estuarine, ecosystems. Adults migrate as far north as the Aleutian Islands and are widely distributed in the open ocean far from coastal waters. Most Chinook salmon remain at sea from 1 to 5 years (more commonly 2 to 4 years) and return to spawn at 3 to 6 years of age.

Figure 2-2. Photo of an adult spring Chinook salmon captured shortly after return from the ocean to freshwater.

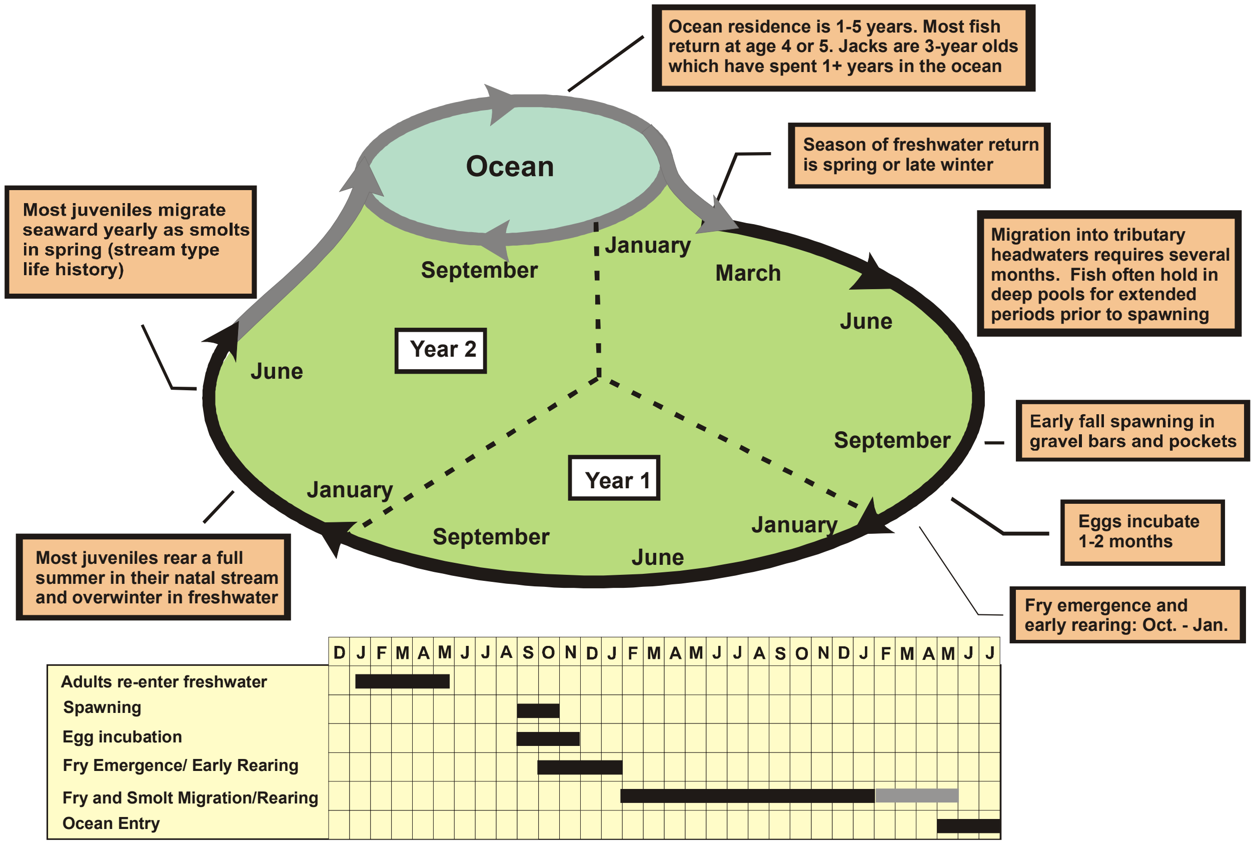

Figure 2-3. Life cycle of lower Columbia River spring Chinook salmon.

Extinction risks were estimated to be very high in all seven Washington populations of spring Chinook, and eight of nine Washington and Oregon populations that comprise the ESU (Figure 2-4). It is possible that some native spring Chinook runs are now extinct, but that this loss is masked by the presence of naturally spawning hatchery fish. Only one population is currently not at very high risk of extinction – Oregon's Sandy River spring Chinook is at moderate risk.

The distribution of spring Chinook populations has been severely reduced by loss of access into core headwater production areas in the Cowlitz, Cispus, Lewis, and White Salmon rivers. The upper Cowlitz and Lewis systems historically accounted for the majority of the Washington lower Columbia spring Chinook production. While most historical habitats in the Kalama and Toutle remain accessible, these populations were historically much smaller and current distribution has been further reduced by habitat degradation in these systems.

Numbers of naturally-spawning spring Chinook salmon in Washington are currently very low. Wild abundance is uncertain due to large numbers of naturally-spawning hatchery spring Chinook. Habitat assessments suggest that current natural production capacity is under 3,000 fish. Historical abundance was estimated to be approximately 50,000 to 100,000 fish based on historical records and habitat conditions. Total abundance of the combined natural and hatchery run has fluctuated widely over the last 35 years, reaching dangerous low levels of just 3,000 to 5,000 fish during 1996-1999 (Figure 2-5).

Diversity of spring Chinook has been greatly reduced due to pervasive hatchery effects and small population bottlenecks within the natural populations during recent low run size years. Remaining natural production areas for spring Chinook in Washington are very limited and hatchery-origin fish typically comprise a large fraction of the spawners in natural production areas.

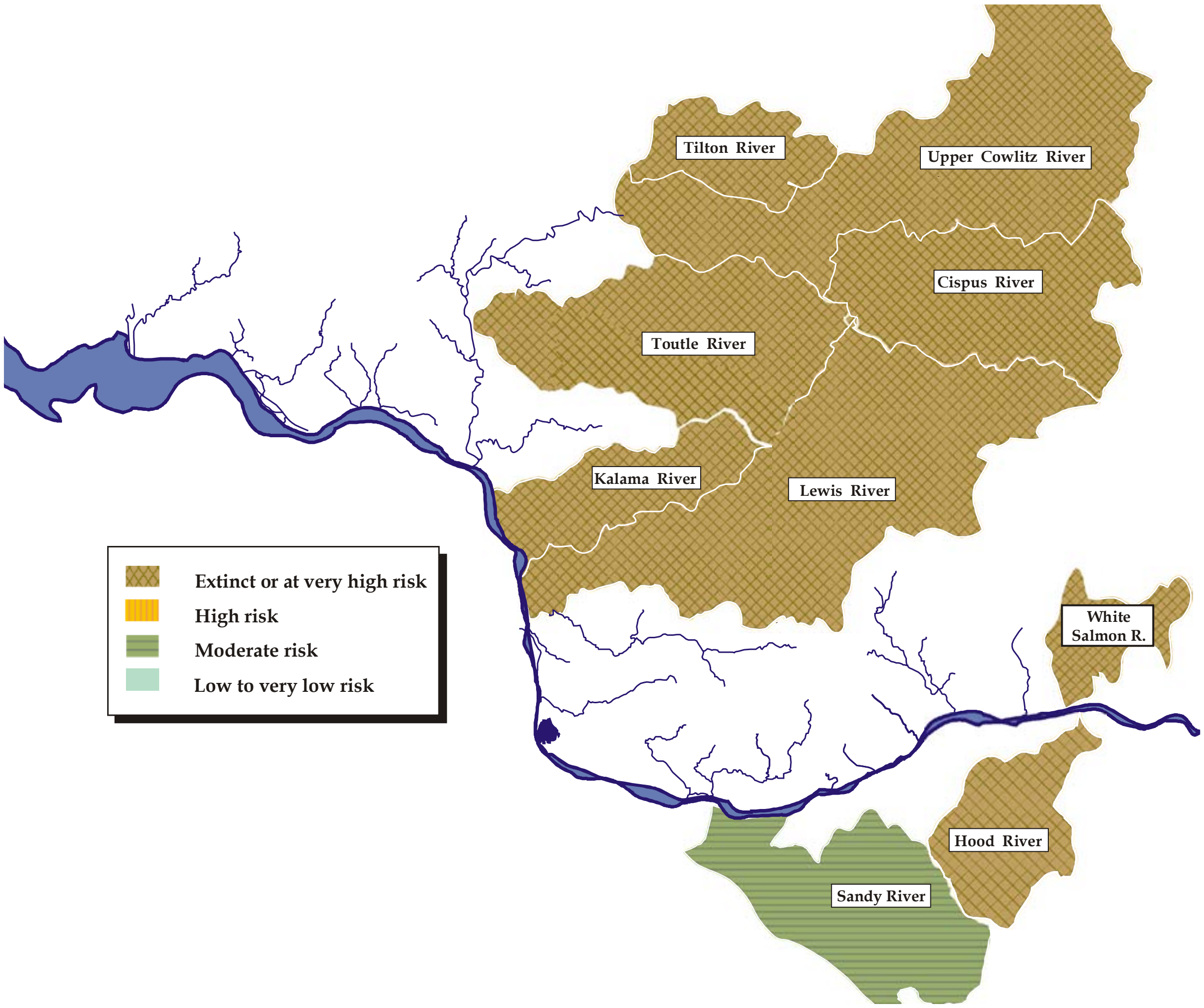

Figure 2-4. Distribution of historical spring Chinook populations among lower Columbia River subbasins.

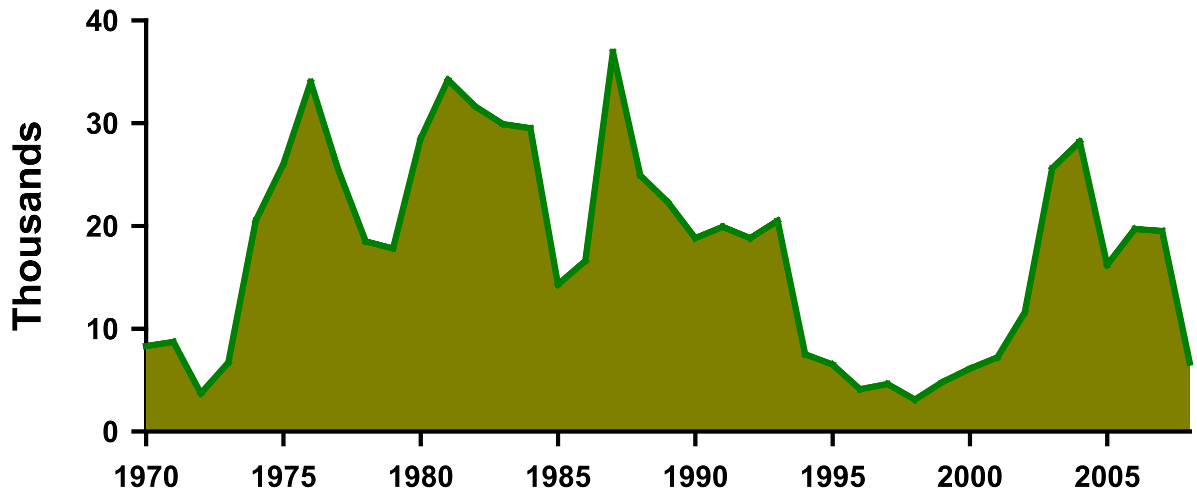

Figure 2-5. Total Columbia River run size of Cowlitz, Kalama and Lewis river spring Chinook (hatchery and wild adults combined).

Fall Chinook

Fall Chinook spawn in large river mainstems including most tributaries of the lower Columbia River. Most lower Columbia fall Chinook enter freshwater from August to September and spawn from late September to November, with peak spawning activity in mid-October (Figure 2-7). These fish, typically referred to as "tule" stock, are distinguished by their dark skin coloration and advanced state of maturation at the time of freshwater entry. Tule fall Chinook salmon populations historically spawned from the mouth of the Columbia River to the Klickitat River.

A late fall stock (commonly referred to as lower river brights or lower river wild), returns later, are less mature when they enter the Columbia, and spawn later than tule fall Chinook. Late fall Chinook enter the Columbia River from August to October and spawn from November to January, with peak spawning in mid-November. Late fall Chinook return to the Lewis River and several gorge tributaries in Oregon and the Sandy River in Washington. Natural populations of bright fall Chinook, originating from out of ESU hatchery fish, also spawn in the Columbia mainstem immediately downstream of Bonneville Dam and in the Wind River basin.

Fall Chinook life history is an "ocean type" that typically emigrates from freshwater as subyearlings at 1 to 4 months of age. Juveniles typically emigrate from freshwater in late summer or autumn and make extensive use of the estuary. In the Columbia River estuary, subyearling Chinook salmon may be found in every month of the year and rivers with well-developed estuaries, such as the Columbia, are able to sustain large ocean-type populations. Lower Columbia fall Chinook adults migrate northward into ocean waters off of Washington, British Columbia and Southeast Alaska. Bright fall Chinook appear to migrate farther north than tule fall Chinook as reflected in their harvest in ocean salmon fisheries. Most fall Chinook salmon remain at sea from 1 to 5 years (more commonly 3 to 5 years) and return to spawn at 2 to 6 years of age.

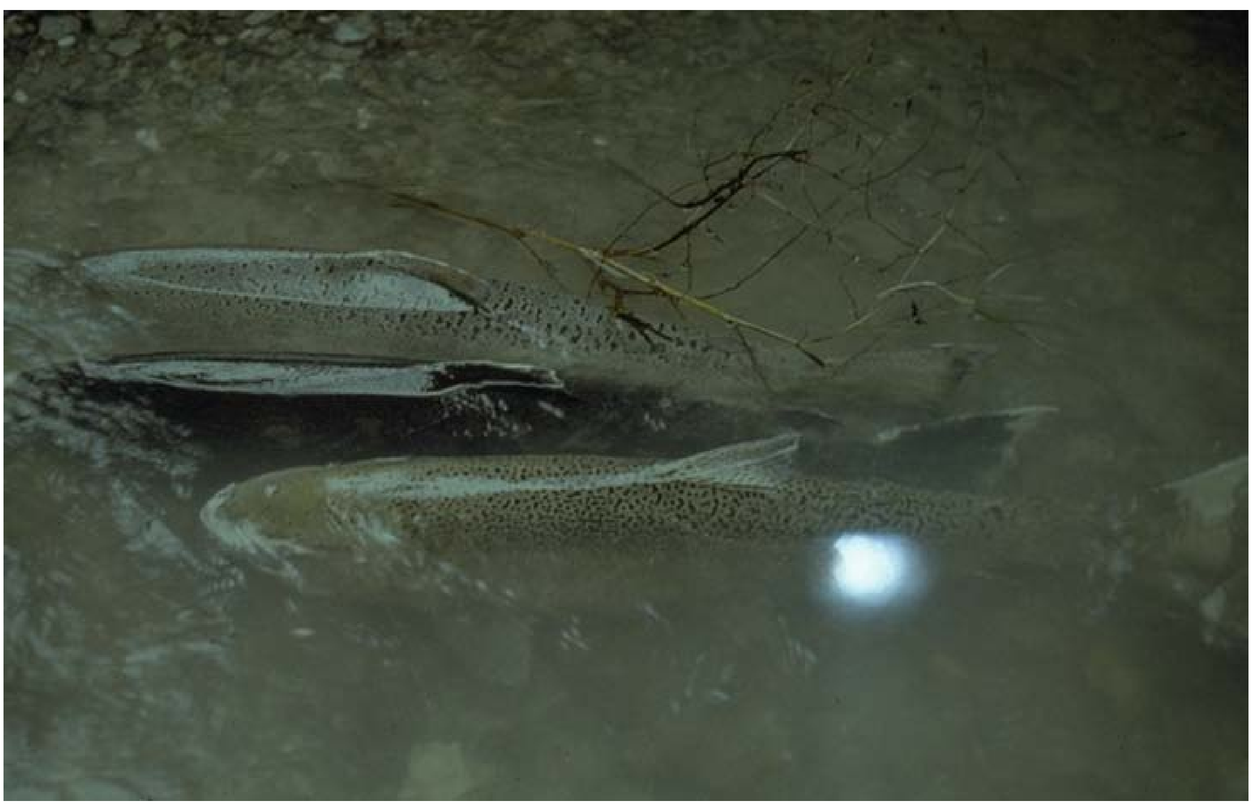

Figure 2-6. Photo of spawning fall Chinook salmon.

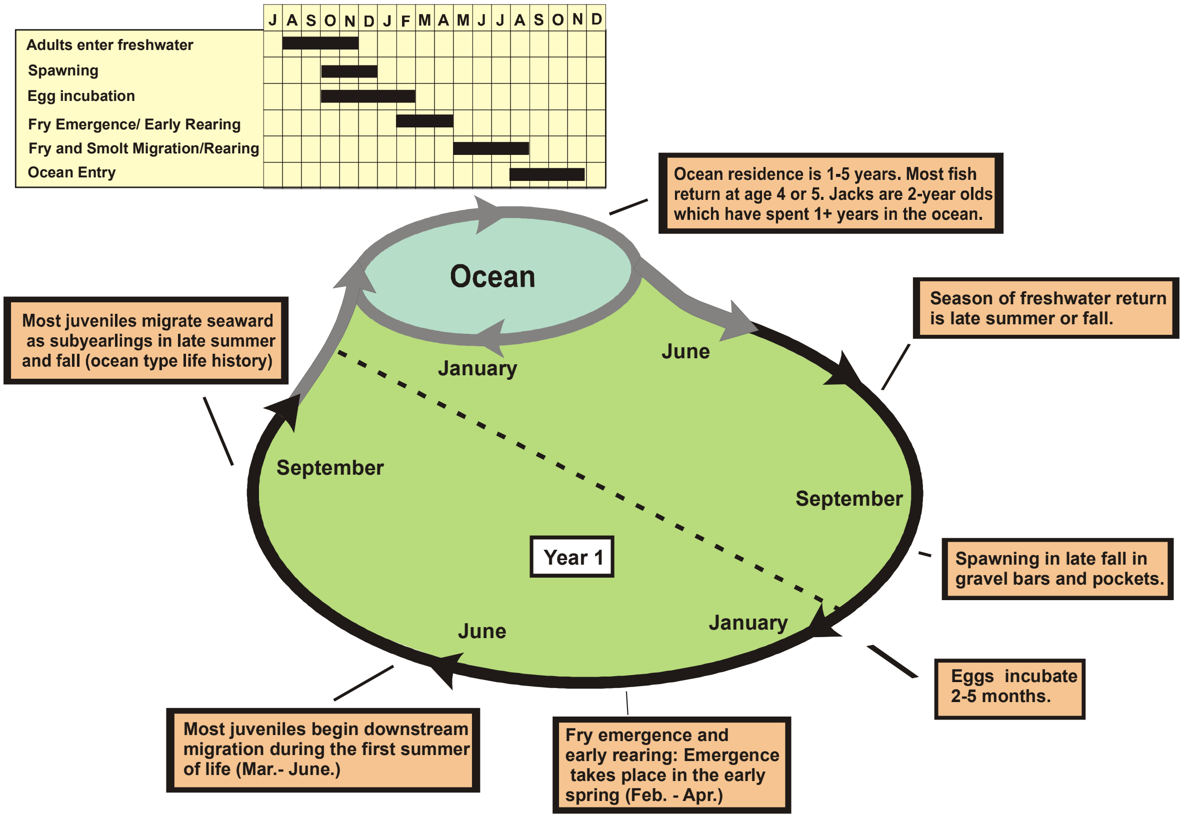

Figure 2-7. Life cycle of lower Columbia River Fall Chinook salmon.

Extinction risks were estimated to be very high in 14 of 15 Washington populations of fall Chinook (93%), and 19 of 23 Washington and Oregon populations (83%) that comprise the ESU (Figure 2-8, Figure 2-10). Only one population is currently at low or very low risk of extinction – Washington's Lewis River late fall (bright) Chinook. No tule fall Chinook population is currently at low or very low risk.

Fall Chinook remain widely distributed throughout the region as fish continue to have access to most areas of historical spawning habitat (except in upper Cowlitz and White Salmon rivers where dams block access). However, current numbers of wild fish are very low. Recent abundance of wild tule fall Chinook is uncertain due to large numbers of naturally-spawning hatchery fall Chinook but spawning ground surveys and habitat assessments suggest that current natural production capacity is under 5,000 fish. Historical abundance was estimated to be approximately 100,000 fish based on historical records and habitat conditions. Spawner numbers vary widely from year to year. For instance, spawner numbers in the Coweeman and East Fork Lewis Rivers, where hatchery influence is relatively low, have ranged from a few hundred to a few thousand fish per year, but have regularly fallen to dangerous low levels of just 200 to 300 fish spawners per year (Figure 2-9). In contrast, spawner numbers of the highly viable Lewis River bright fall Chinook population have never fallen below 3,000 and spawning escapement has averaged approximately 10,000 fish per year (Figure 2-11).

Diversity of tule fall Chinook is estimated to have been greatly reduced due to pervasive hatchery effects and small population bottlenecks within the natural populations during recent low run size years. Hatchery-origin fish typically comprise a large fraction of the spawners in natural production areas. Large numbers of fall Chinook have been produced in lower Columbia River hatcheries for decades and included a long history of inter-population transfers and also significant influence of from out-of-basin stocks. In contrast, the single late fall Chinook population has been largely uninfluenced by hatchery production and has avoided small population bottlenecks.

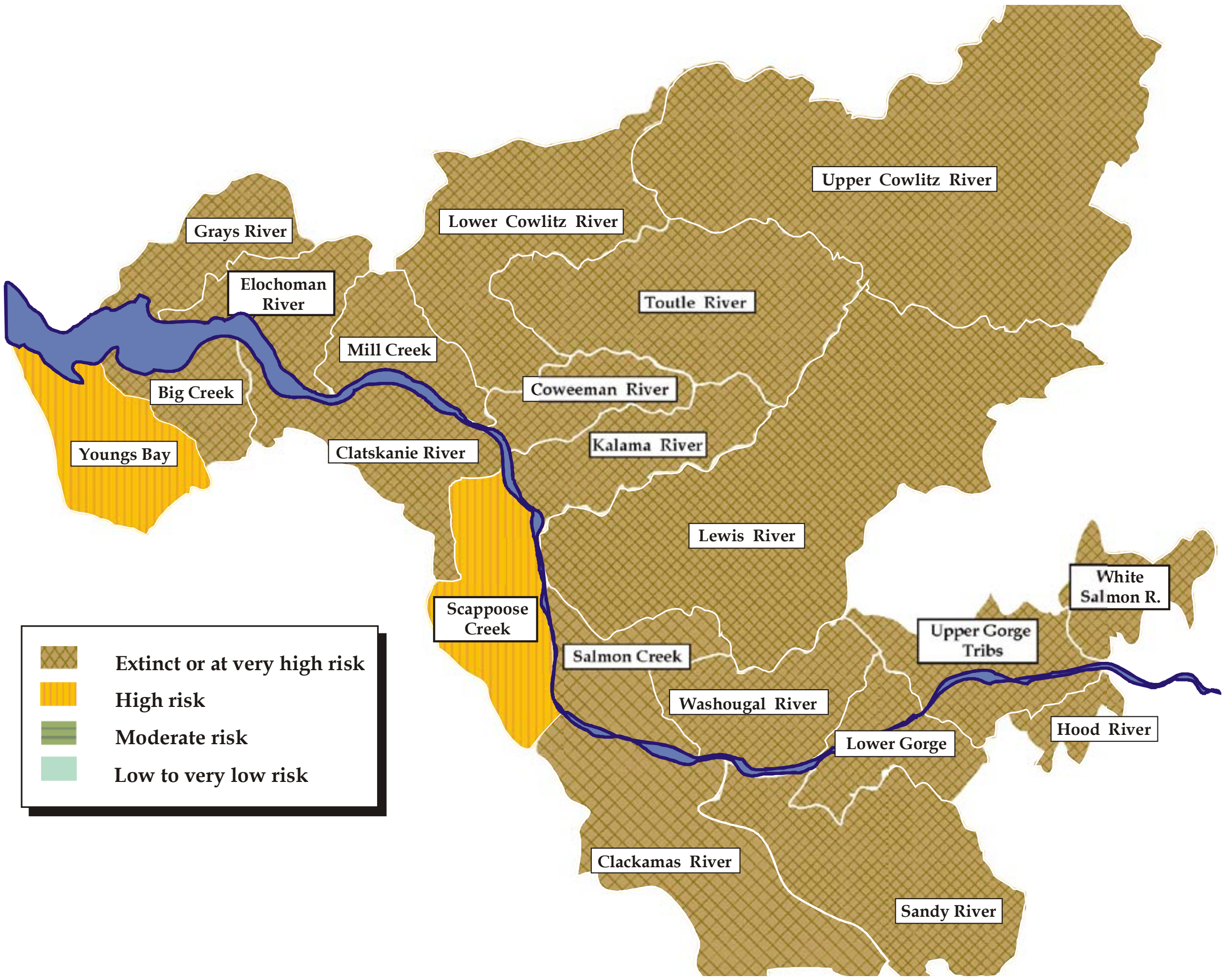

Figure 2-8. Current status of historical demographically-independent lower Columbia fall (tule) Chinook populations.

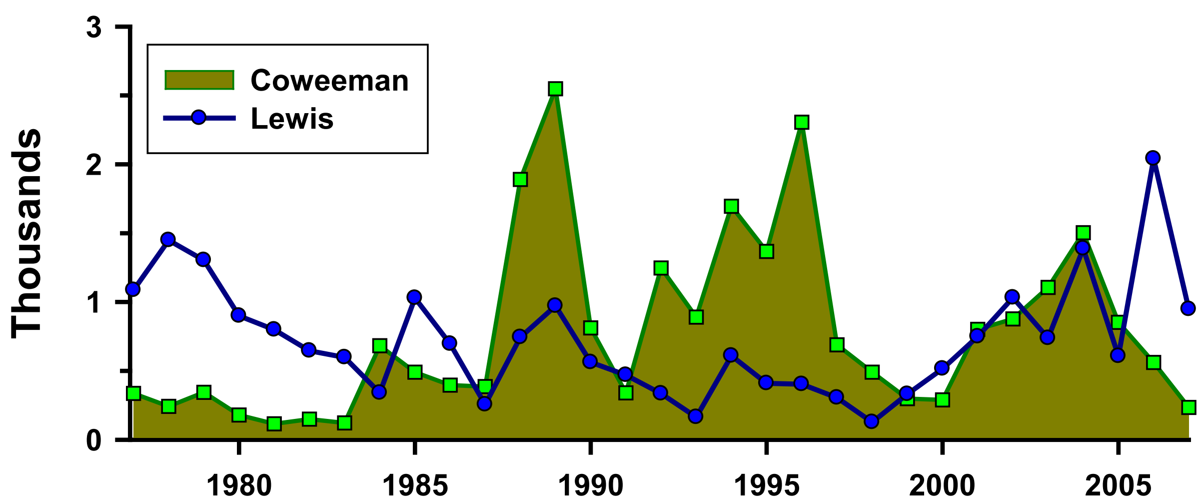

Figure 2-9. Natural fall Chinook spawner abundance estimates for the Coweeman and EF Lewis rivers.

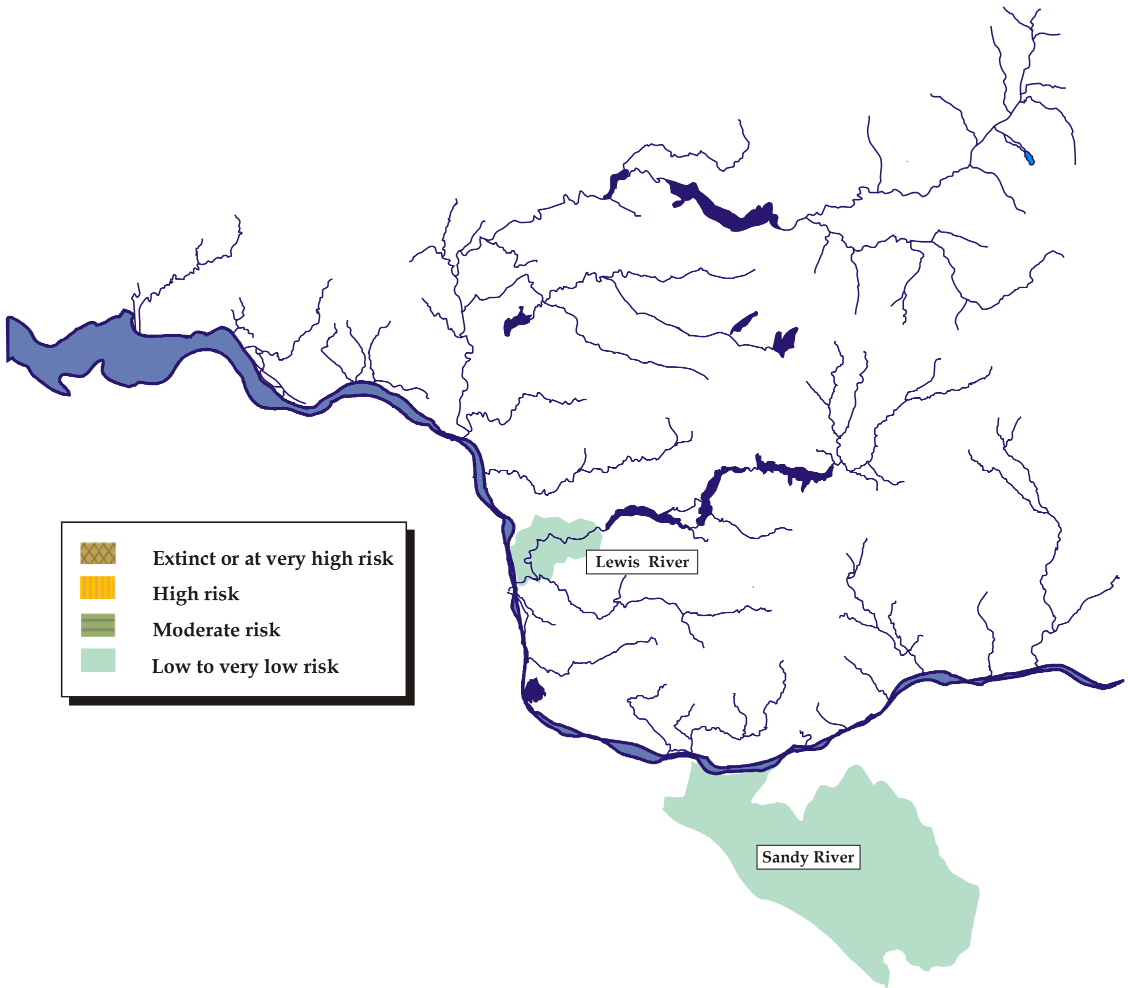

Figure 2-10. Current status of historical demographically-independent lower Columbia late fall (bright) Chinook populations.

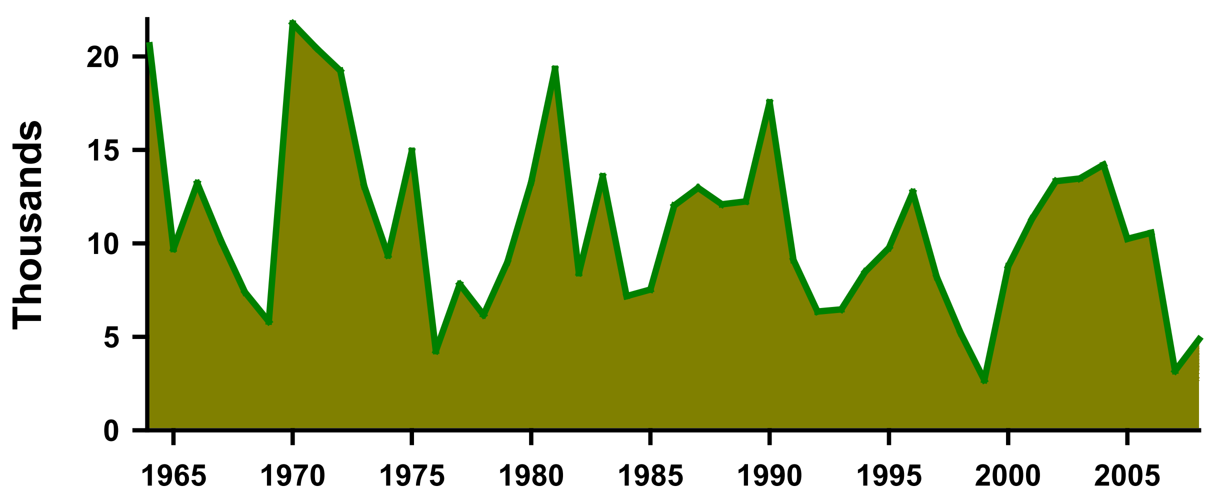

Figure 2-11. Late fall (bright) Chinook abundance estimates for the North Fork Lewis River (primarily natural-origin spawners).

2.3. Chum Salmon

ESA listing: Threatened	**3/25/1999 (effective 5/24/1999)**	**64FR14507**
Status affirmed:	**6/28/2005**	**70FR37160**
Critical Habitat Designation:	**9/2/2005 (effective 1/2/2006)**	**70FR52630**

The ESU includes all naturally-spawning populations in the Columbia River and its tributaries in Washington and Oregon as well as three artificial propagation programs: the Chinook River (Sea Resources Hatchery), Grays River, and Washougal River/Duncan Creek chum hatchery programs.

Chum were once widely distributed throughout the lower Columbia River basin and historically spawned in the lower reaches of most lower Columbia River tributary rivers and streams as well as in the mainstem Columbia. Spawning previously occurred as far upstream as the Umatilla and Walla Walla rivers, but is now largely restricted to areas downstream from Bonneville Dam. Adult chum salmon primarily return to the Columbia River in late fall from mid-October through November and spawn from early November to late December (Figure 2-13). A summer run population or subpopulation of chum salmon was also historically documented returning to the Cowlitz River.

Spawning occurs in clean gravels in low gradient, low elevation reaches. Many Columbia River chum have been found to select spawning sites in areas of upwelling groundwater. New spawning grounds for chum were recently discovered along the Washington shoreline near the I-205 Glen Jackson Bridge where groundwater upwelling occurs. A significant proportion of chum returning to Hamilton Creek spawn in a spring-fed channel, and portions of the Grays River and Hardy Creek populations spawn in the area of springs.

Chum fry emigrate downstream soon after emergence which typically occurs from March through May. Chum salmon do not typically have substantial freshwater rearing time. Chum are capable of adapting to seawater soon after emerging from gravel. Juveniles use the Columbia River estuary to feed from February through June before beginning long-distance oceanic migrations. Significant estuary rearing habitats for small juvenile salmonids such as chum salmon include shallow, protected habitats such as salt marshes, tidal creeks, and intertidal flats. The period of estuarine residence appears to be a critical phase in the life history of chum salmon and may play a major role in determining the size of the subsequent adult run back to fresh water. Because chum salmon spend more time in the estuary, they are also more susceptible to changes in the productivity of that environment than stream-type salmonids. Because chum fry generally emigrate shortly after emergence, predation mortality during downstream emigration can also be significant.

Figure 2-12. Chum salmon in spawning coloration.

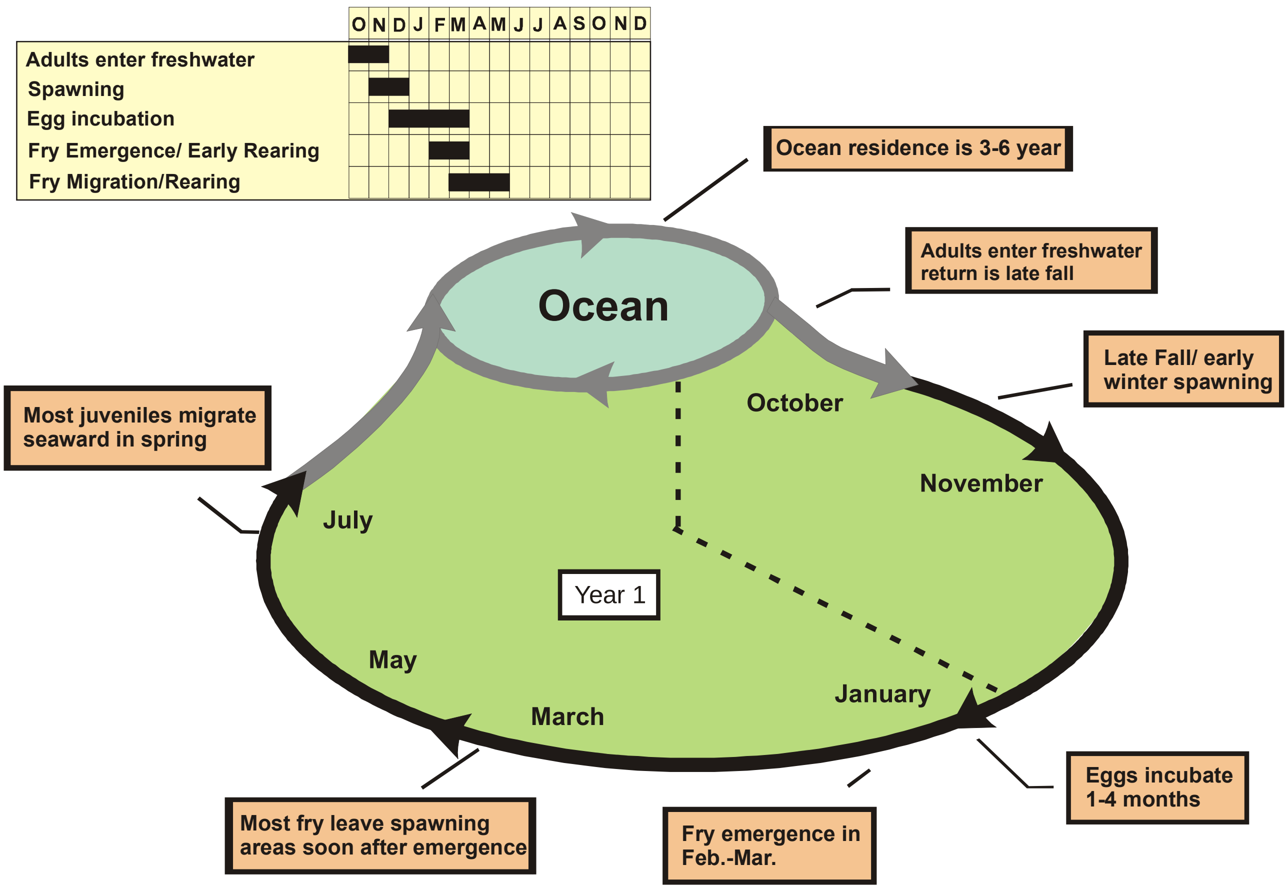

Figure 2-13. Life cycle of Columbia River chum salmon.

Chum salmon spend more of their life history in marine waters than other Pacific salmonids. During their first year at sea, juvenile chum migrate northward along the coastline. In southeast Alaska, they move offshore in a generally southwestern direction into the high seas where they remain until returning to spawn at 3 to five years of age. Tagging and scale studies by the International North Pacific Fisheries Commission (INPFC) show that chum salmon from North America are distributed throughout the North Pacific Ocean and Bering Sea as far west as long, 175°E. On their return migration, maturing chum salmon in the North Pacific begin to move coastward in May and June and enter coastal waters from June to November.

While chum salmon continue to have access to most historical spawning areas in the lower Columbia River, distribution has been severely reduced by degradation of spawning habitats in the lower mainstems of tributaries throughout the region. Spatial structure of inland populations has been lost due to the loss of habitat or habitat access upstream from Bonneville Dam. Chum previously returned to tributaries as far upriver as the Walla Walla River but only a handful are now counted at Bonneville Dam. Extinction risks were estimated to be very high in nine of eleven populations of chum salmon occurring in whole or in part in Washington. All six of the Oregon-only populations are believed to be functionally extirpated (Figure 2-14). The Columbia River historically produced hundreds of thousands of chum salmon (Figure 2-15) but only a few thousand remain. Current abundance is estimated to be perhaps only 1% of historical levels.

The majority of the current chum production occurs in two populations. Washington's Grays River and the Columbia River mainstem and small tributaries in the lower Gorge each generally contain 1,000 or more spawners per year. Abundance of the remaining populations is typically fewer than 100 spawners per year. Index counts of chum salmon in significant Washington production areas have remained at consistently low levels since 1950 with the exception of a spike in returns in 2001-2002 due to better-than-average freshwater and ocean production patterns around 2000 (Figure 2-16). Diversity has been substantially reduced by the loss of many populations and by genetic bottlenecks due to low abundance within the remaining populations. However, hatchery production of chum salmon has been limited and effects on diversity are thought to have been relatively small.

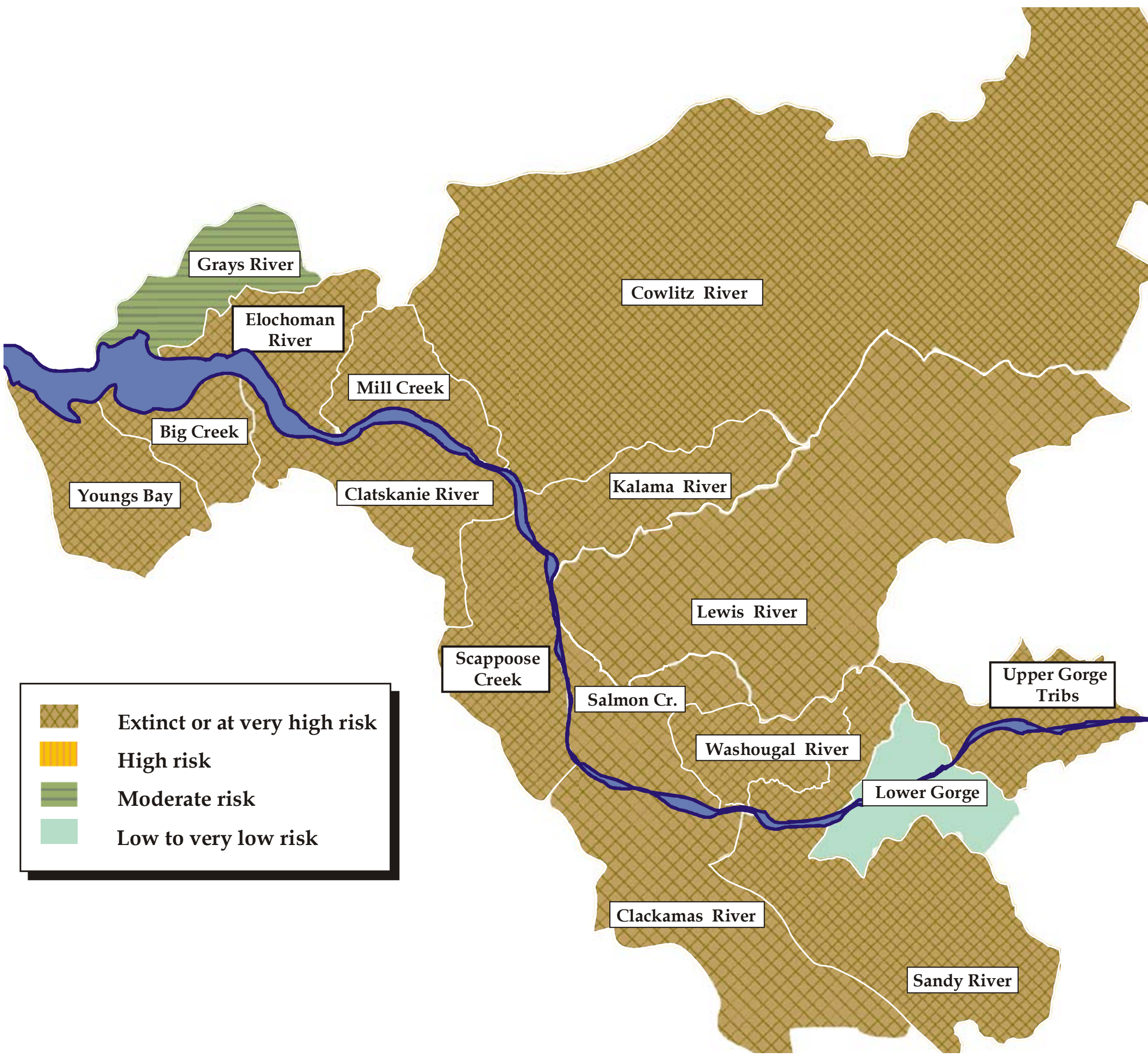

Figure 2-14. Current status of historical demographically-independent lower Columbia chum populations.

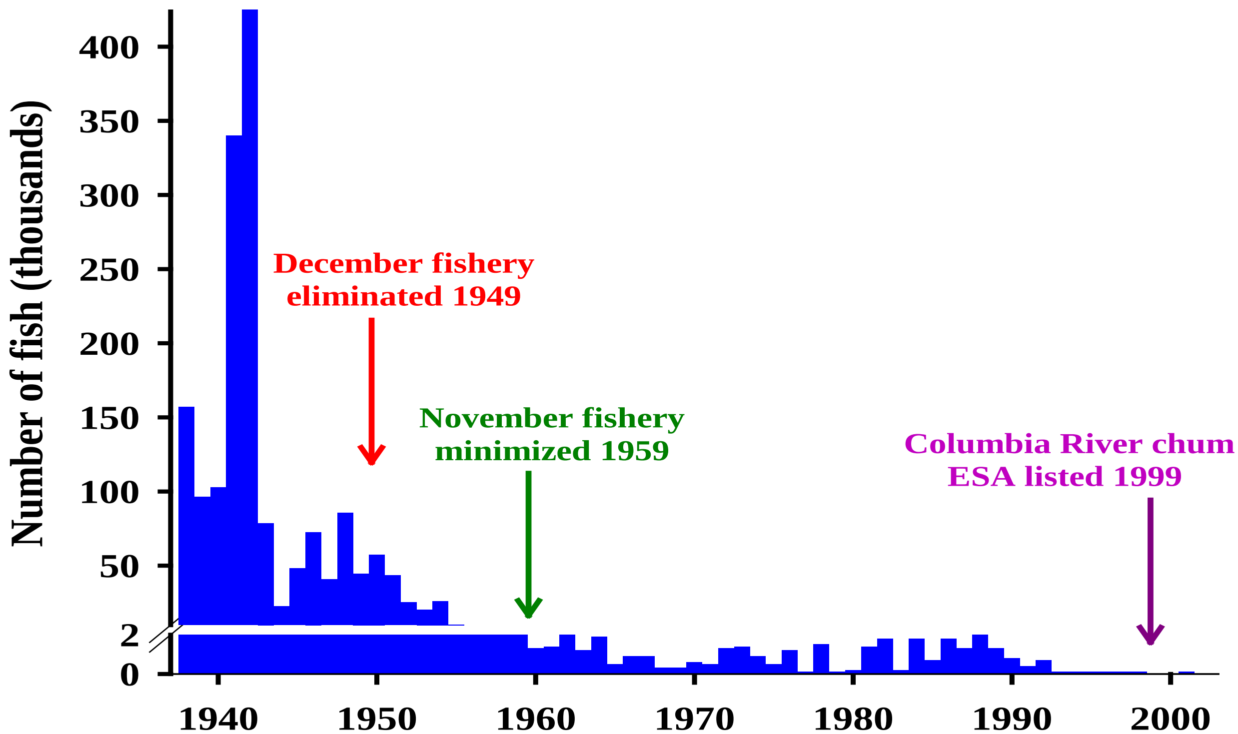

Figure 2-15. Commercial landings of chum salmon in the Columbia River from 1938–2002.

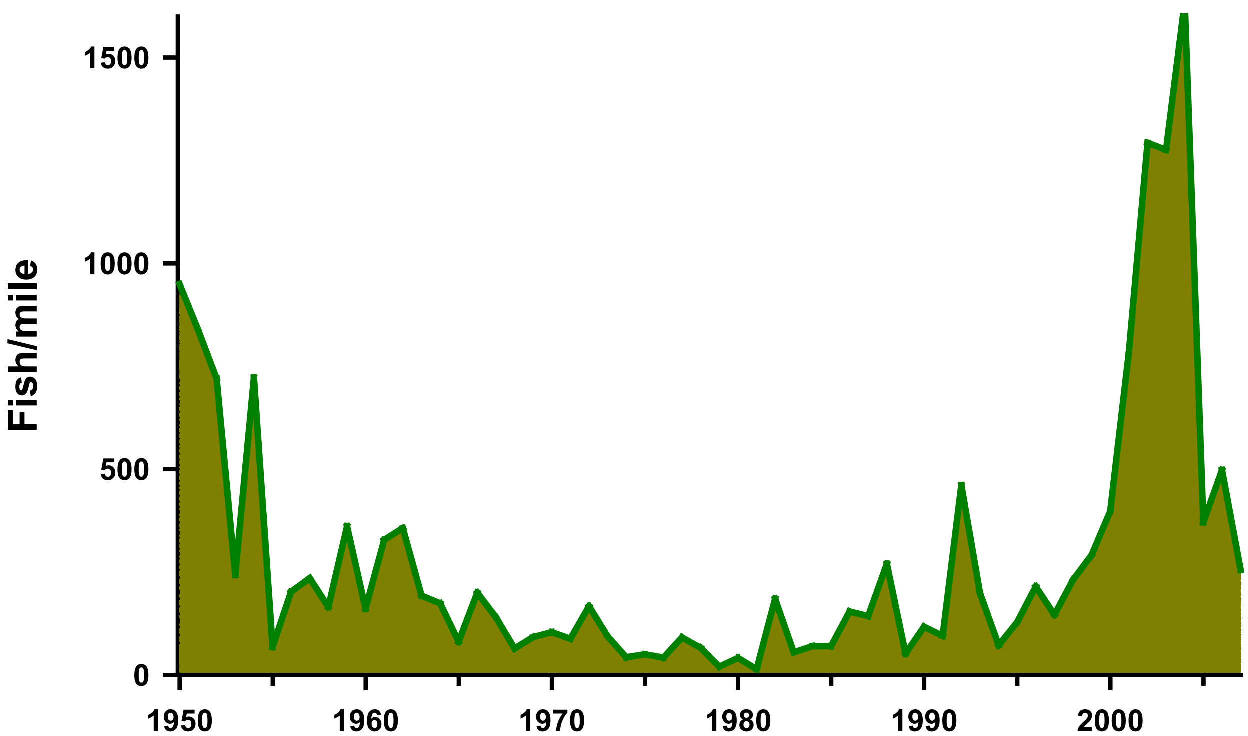

Figure 2-16. Chum escapement index values based on fish/mile peak counts for combined Washington index tributaries (almost entirely natural-origin spawners).

2.4. Coho Salmon

ESA designation: Candidate	**7/25/1995**	**60FR38011**
ESA listing: Threatened	**6/28/2005**	**70FR37160**
Critical Habitat Designation:	**Under development**	**--**

The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers, and including the Willamette River to Willamette Falls, Oregon. Twenty-five artificial propagation programs are included in the ESU.

Lower Columbia River coho are typically categorized into early and late returning stocks. Early-returning (Type S) coho enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning (Type N) coho pass through the lower Columbia from late September through December and enter tributaries from October through January. Most spawning occurs from November to January, but some spawning ranges to February and as late as March.

Coho historically utilized almost every accessible stream tributary in the lower Columbia River. Coho particularly favor small, rain-driven, lower elevation streams characterized by relatively low flows during late summer and early fall, and increased river flows and decreased water temperatures. Coho salmon spawning in warmer tributaries spawned later than those spawning in colder tributaries. Early run fish generally spawn farther upstream within a basin than late run fish. Returning fish often mill near the river mouths or in lower river pools until the first fall freshets occur.

Figure 2-17. Photo of male (top) and female (bottom) in late stages of spawning coloration.

Eggs incubate over late fall and winter and juveniles typically rear in freshwater for more than a year (Figure 2-18). Hatching success depends on stable gravel that is not choked with sediment. Thus, river channel stability is vital at this life history stage and flood impacts can be significant. After emergence, coho fry move to shallow, low velocity rearing areas, primarily along the stream edges and in side channels. Juvenile coho favor pool habitat and often congregate in quiet backwaters, side channels, and small creeks with riparian cover and woody debris. Side channel rearing areas are particularly critical for overwinter survival of coho which is also a key regulator of freshwater productivity.

Most juvenile coho migrate seaward as smolts in April – June, typically during their second year. Salmon with stream-type life histories including coho typically do not linger for extended periods in the estuary but the estuary is a critical habitat used for interim feeding during the physiological adjustment period to salt water. Juvenile coho salmon are present in the Columbia River estuary from March to August.

Coho salmon typically spend 18 months in the ocean before returning to fresh water at age 3. A small proportion of male coho (jacks) return at age 2 after only 5 to 7 months in the ocean. Columbia River coho typically range throughout the nearshore ocean over the continental shelf off of the Oregon and Washington coasts. Early stock (Type S) coho are typically found in ocean waters south of the Columbia River mouth. Late stock (Type N) coho are typically found in ocean waters north of the Columbia River mouth.

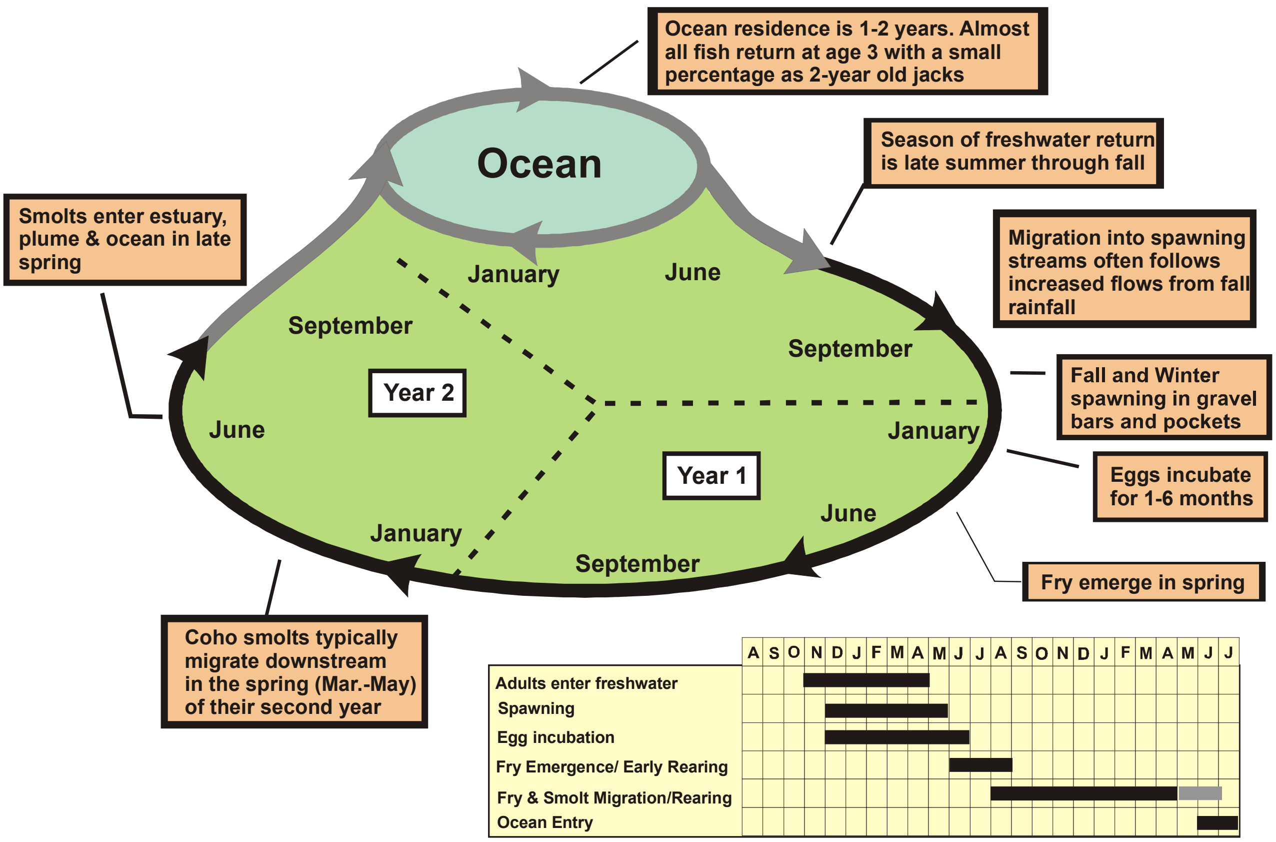

Figure 2-18. Life cycle of lower Columbia River coho salmon.

Coho historically spawned in all accessible lower Columbia River tributaries but the run now consists of very few wild fish. Until recently, Columbia River coho salmon were managed primarily as a hatchery stock. Present coho populations have been heavily influenced by extensive hatchery releases. In a 1995 status review of coho salmon, NMFS found that, if an evolutionarily significant unit of coho salmon still exists in the lower Columbia River, it is not presently in danger of extinction, but is likely to become so. NMFS was subsequently petitioned to list lower Columbia coho salmon on an emergency basis and to designate critical habitat. They determined that the petition presented substantial scientific information that a listing may be warranted, but there was insufficient evidence to support an emergency listing. Lower Columbia coho were again proposed for listing on May 28, 2004 and listed as threatened on June 28, 2005.

Every one of the 17 Washington lower Columbia River coho populations is estimated to be at a very high risk of extinction. Twenty-one of the 24 populations in the ESU, including Oregon, are at a very high risk (Figure 2-19). It is possible that some native coho populations are now extinct, but that this loss is masked by the presence of naturally spawning hatchery fish. The strongest remaining populations occur in Oregon and include the Clackamas River and Scappoose Creek (both of moderate risk of extinction).

While many populations continue to have access to most of their historical range, the area of productive habitat has been significantly reduced by habitat degradation in many systems, particularly in the smaller, rain-driven, lower elevation tributaries. Access has been lost to upstream areas of the Cowlitz and Lewis rivers which historically supported very large, diverse, and productive runs of early and late coho.

Abundance and productivity of naturally-spawning coho is very low in all Washington populations. Current wild abundance is uncertain due to large numbers of naturally-spawning hatchery coho but habitat assessments suggest that current natural production capacity is under 2,000 fish. Historical abundance was estimated to be on the order of several hundred thousand coho. Annual escapement data is lacking for naturally-produced Washington coho but hatchery return data shows high annual variability and a declining trend in productivity (Figure 2-20). Since 1970, the population of Columbia hatchery-origin adult coho ocean abundance has ranged from over 3 million in 1971 to a low of 97,000 in 1996. Returns to the Columbia River mouth (after ocean harvest) have declined from over 1.5 million in 1986 to 75,000 in 1995. Recent numbers have rebounded somewhat from very low levels during the early 1990s but the Columbia River coho run continues to be dominated by fish released from hatcheries and naturally-produced fish from hatchery-origin parents.

Diversity of coho is estimated to have been greatly reduced due to pervasive hatchery effects and small population bottlenecks within the natural populations. Hatchery-origin fish typically comprise a large fraction of the spawners in natural production areas. Widespread inter-basin (but within ESU) stock transfers have homogenized many populations. While historical population structure likely included significant genetic differences among populations in each watershed, unique natural populations of coho salmon can no longer be genetically distinguished in the lower Columbia River (excluding the Clackamas and Sandy rivers in Oregon).

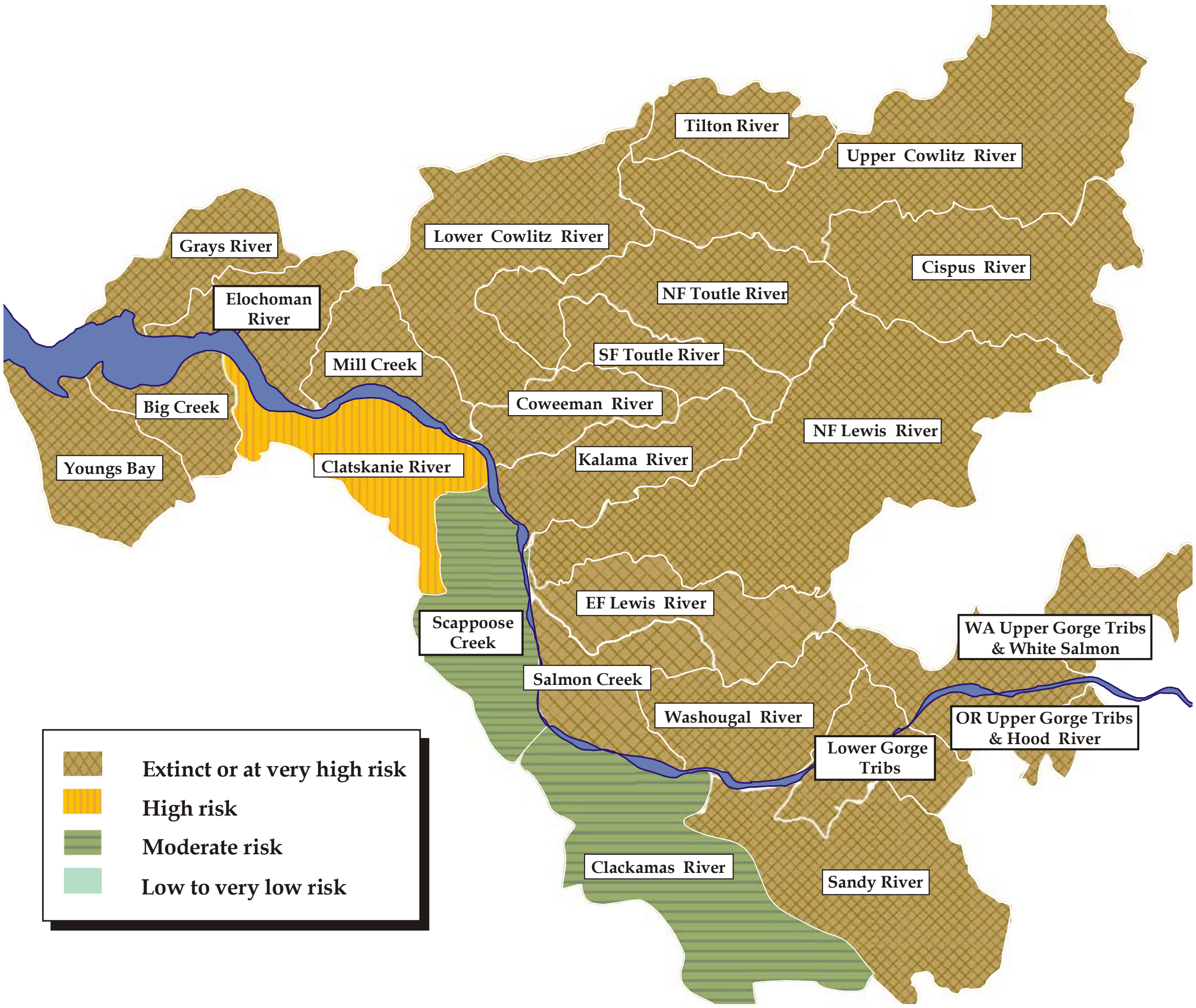

Figure 2-19. Current status of historical demographically-independent lower Columbia coho populations.

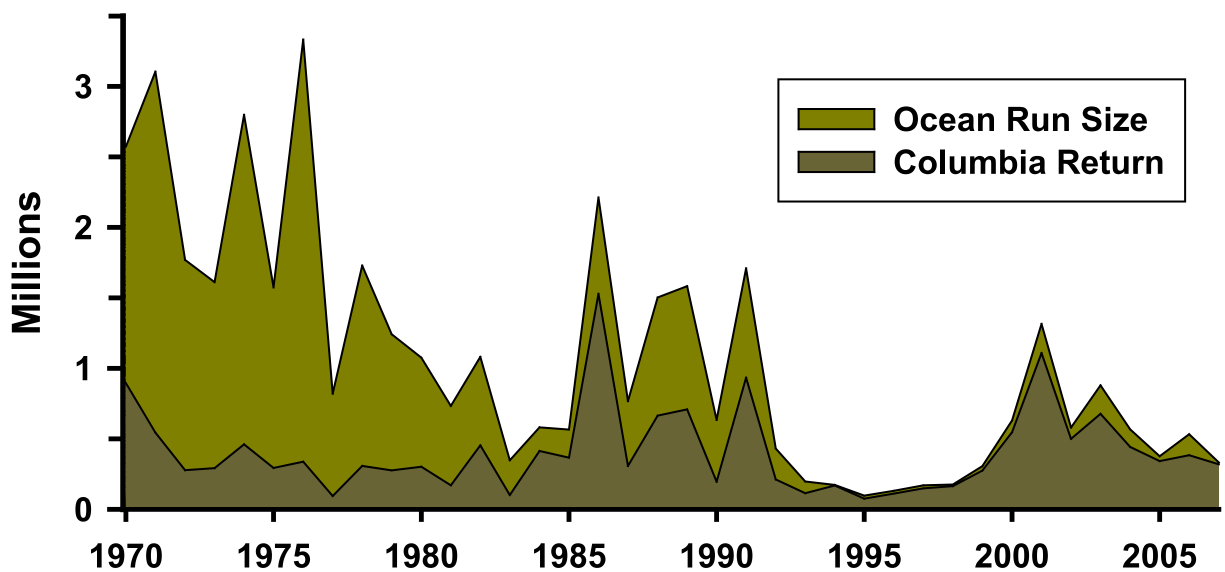

Figure 2-20. Columbia River coho ocean and freshwater run size (including natural and hatchery fish).

2.5. Steelhead

ESA listing: Threatened	**3/19/1998 (effective 5/18/1998)**	**63FR13347**
Status affirmed:	**6/28/2005**	**70FR37160**
Critical Habitat Designation:	**9/2/2005 (effective 1/2/2006)**	**70FR52630**

Summer and winter steelhead (*Oncorhynchus mykiss*) found in the lower Columbia River in Washington (as delineated by this Recovery Plan) fall into three separate ESUs defined by NMFS:

- The Southwest Washington ESU includes steelhead from the Grays and Elochoman Rivers, and Skamokawa, Mill, Abernathy, and Germany Creeks.
- The Lower Columbia ESU includes steelhead from the Cowlitz, Kalama, Lewis, Washougal, and Wind Rivers and Salmon and Hardy Creeks.
- The Middle Columbia ESU includes steelhead from the Little White Salmon and Big White Salmon Rivers.

The Lower Columbia ESU includes all naturally spawned populations of steelhead below natural and manmade impassable barriers (e.g., impassable waterfalls and dams) in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington, inclusive, and the Willamette and Hood Rivers, Oregon, inclusive. The ESU includes both Washington and Oregon populations, as well as ten artificial propagation programs. Excluded are steelhead in the upper Willamette River Basin above Willamette Falls, Oregon, and from the Little and Big White Salmon Rivers, Washington. These populations are considered in other recovery plans.

The Southwest Washington steelhead ESU is not thought to be in danger of extinction. Therefore, the Grays, Elochoman/Skamokawa, and Abernathy/Mill/Germany populations are not listed under the ESA. However, all of the Columbia River populations in the Southwest Washington ESU were categorized as depressed by WDFW in 2002 (except Mill Creek which was designated as unknown).

Steelhead are rainbow trout that migrate to and from the ocean. Resident and anadromous life history patterns are often represented in the same population. Anadromous parents can produce resident offspring and resident parents can produce anadromous offspring. Lower Columbia basin populations include summer and winter steelhead (Figure 2-22, Figure 2-23). Summer steelhead enter fresh water from May to October, enter freshwater in a sexually immature condition, and require several months in fresh water to reach sexual maturity and spawn. Winter steelhead enter fresh water from November to April as sexually mature individuals that spawn shortly thereafter.

Figure 2-21. Photo of summer steelhead after several months in freshwater. Note adipose fin clip that identifies this fish as hatchery-origin.

Winter steelhead favor lower elevation and coastal streams. Winter steelhead were historically present in all lower Columbia River subbasins and also return to other Columbia River tributaries as far upriver as Oregon's Fifteenmile Creek. In the lower Columbia, summer steelhead typically spawn in the upper portions of large forested watersheds in moderate to high elevations on the west slope of the Cascades. Summer steelhead also dominate inland populations upstream from Bonneville Dam. Most of the aggregate Columbia River steelhead run is comprised of summer fish destined for inland tributaries. Differences in run timing and distribution are related to seasonal stream flow and temperature patterns. The smaller, lower elevation streams do not support suitable migration and spawning conditions until rainfall increases in fall and winter.

Other than freshwater entry and migration timing, both races have similar life histories. All steelhead are late winter or spring spawners. Spawning occurs when temperatures are cold but increasing. Spawning timing optimizes competing risks from gravel-bed scour during periodic winter flood events and emergence when increasing temperatures support productive feeding conditions. Steelhead spawn in clear, cool, well-oxygenated streams with suitable gravel and water velocity. A wide range of stream sizes are utilized ranging from small tributary streams to moderate sized mainstem areas. Adult steelhead, unlike salmon, do not necessarily die after spawning but return to the ocean. However, repeat spawning is not common among steelhead migrating several hundred miles or more upstream from the ocean.

Steelhead eggs hatch in 35–50 days depending on water temperature. Following hatching, alevins remain in the gravel 2 to 3 weeks until the yolk-sac is absorbed (Barnhart 1986). Generally, emergence occurs from March into July, with peak emergence time generally in April and May. Following emergence, fry usually move into shallow and slow-moving margins of the stream, where they may aggregate in small schools of up to 10 individuals (Barnhart 1986) in waters 3-14 in (8 to 36 cm) deep (Bovee 1978). As they grow, they inhabit areas with deeper water, a wider range of velocities, and larger substrate. Also as they grow older, fry cease schooling behavior and defend individual territories. Juvenile steelhead typically favor riffle habitats and are often more abundant in steeper stream reaches than are juvenile Chinook or coho.

Steelhead typically spend 1-3 years in freshwater before migrating to the ocean for the first time. In the lower Columbia River, emigration of steelhead smolts generally occurs from March to June, with peak migration usually in April or May. Most steelhead in the lower Columbia smolt at age 2 with an average smolt size estimated at 6.3 in (160 mm). Once they begin their migration, steelhead smolts actively migrate through the lower Columbia River mainstem and estuary to reach the ocean. In the ocean, steelhead generally migrate north along the continental shelf. Steelhead migrational patterns are generally believed to extend further out in the ocean than other salmonids; however, steelhead are seldom caught in ocean fisheries and limited CWT recovery data is available to conclusively confirm this belief. Individuals grow rapidly in the ocean. Size and age of maturation are related to ocean growth rates.

Steelhead are widely distributed throughout lower Columbia River basins, most of which continue to support significant populations. Declining long term trends and habitat reductions have placed this ESU at significant risk of extinction. However, many lower Columbia River steelhead are substantially healthier than their salmon counterparts.

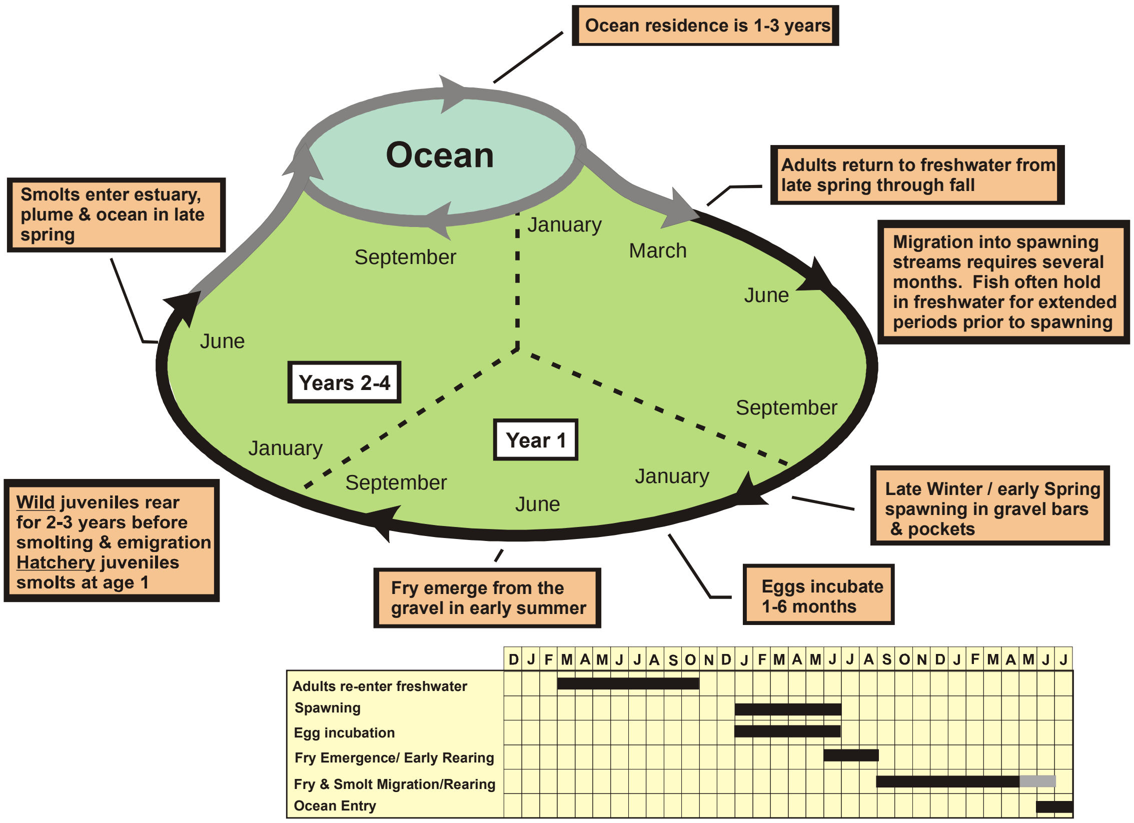

Figure 2-22. Summer steelhead life history.

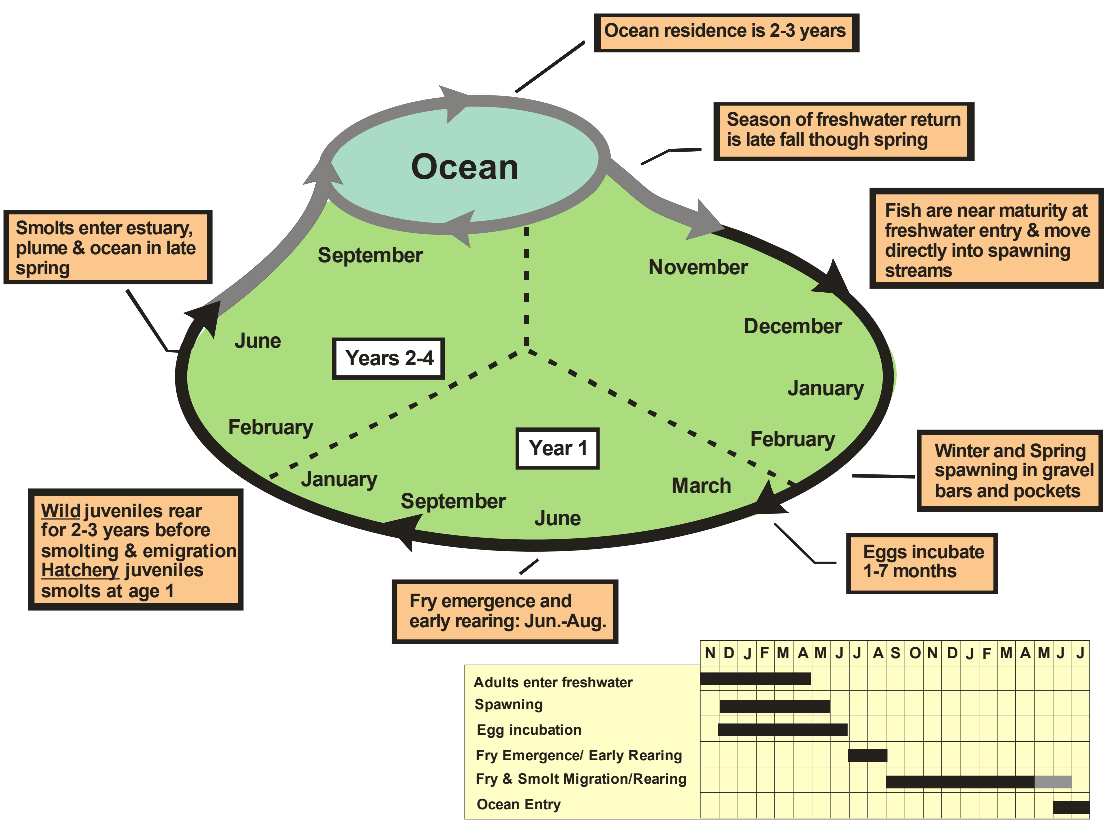

Figure 2-23. Winter steelhead life history.

Summer Steelhead

Five of six summer steelhead populations in the lower Columbia ESU occur in Washington. Of these, two are at very high risk of extinction, two are at moderate risk, and one is at low risk (Figure 2-24). The sole Oregon summer steelhead population in the ESU also has a very high risk of extinction. Wind River summer steelhead are a rare lower Columbia example of a population with a low current level of extinction risk.

Except in the North Fork Lewis where dams have blocked passage into the upper basin, most populations continue to have access throughout historical production areas and much of this forested, moderate to high elevation habitat, remains relatively intact. Abundance and productivity of naturally-spawning summer steelhead are very low for North Fork and East Fork Lewis population but high in the Kalama and very high in the Wind. However, aggregate abundance of lower Columbia summer steelhead is thought to have declined several fold from historical numbers. Total wild numbers currently average around 1,000-2,000 summer steelhead per year. Historical numbers were believed to be on the order of 10,000-30,000 per year. Numbers, as typified by Kalama weir counts, have generally declined over the last 20 years except for periodic spikes during favorable ocean survival conditions (Figure 2-25). Diversity of many summer steelhead populations has been reduced by historical hatchery effects, although not to the degree as has been seen in Chinook and coho salmon.

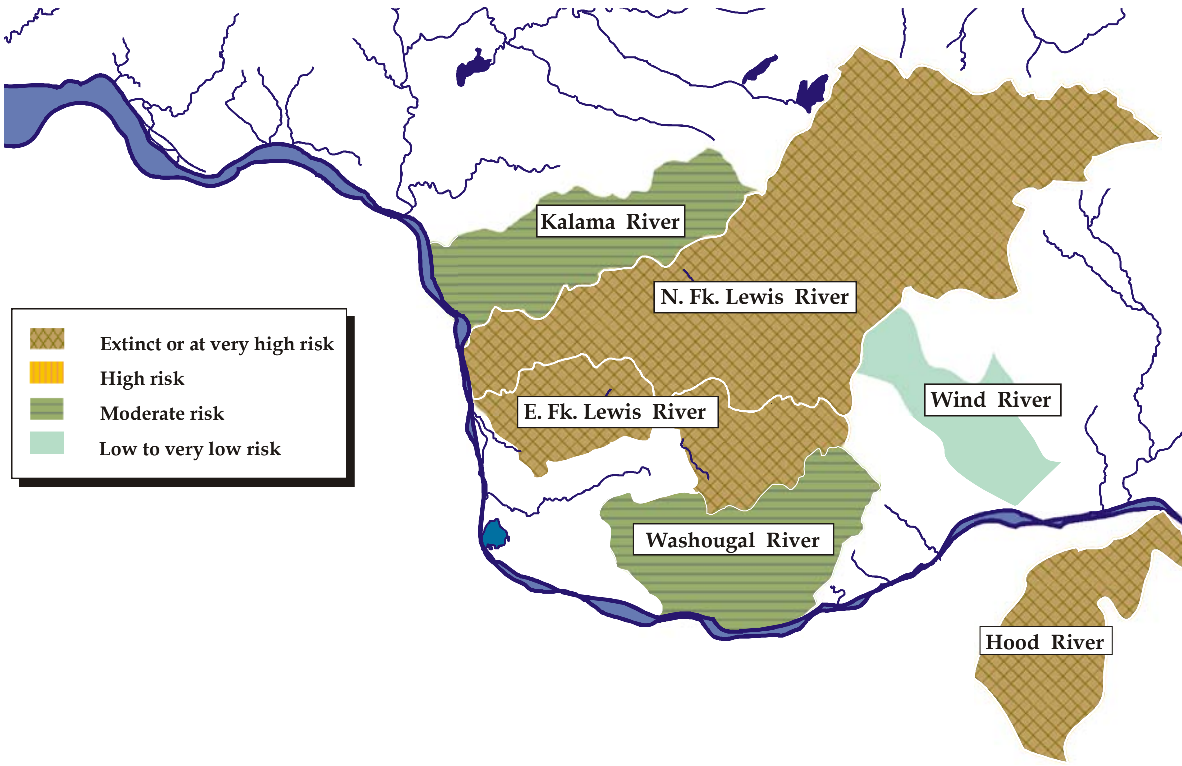

Figure 2-24. Current status of historical demographically-independent lower Columbia summer steelhead populations.

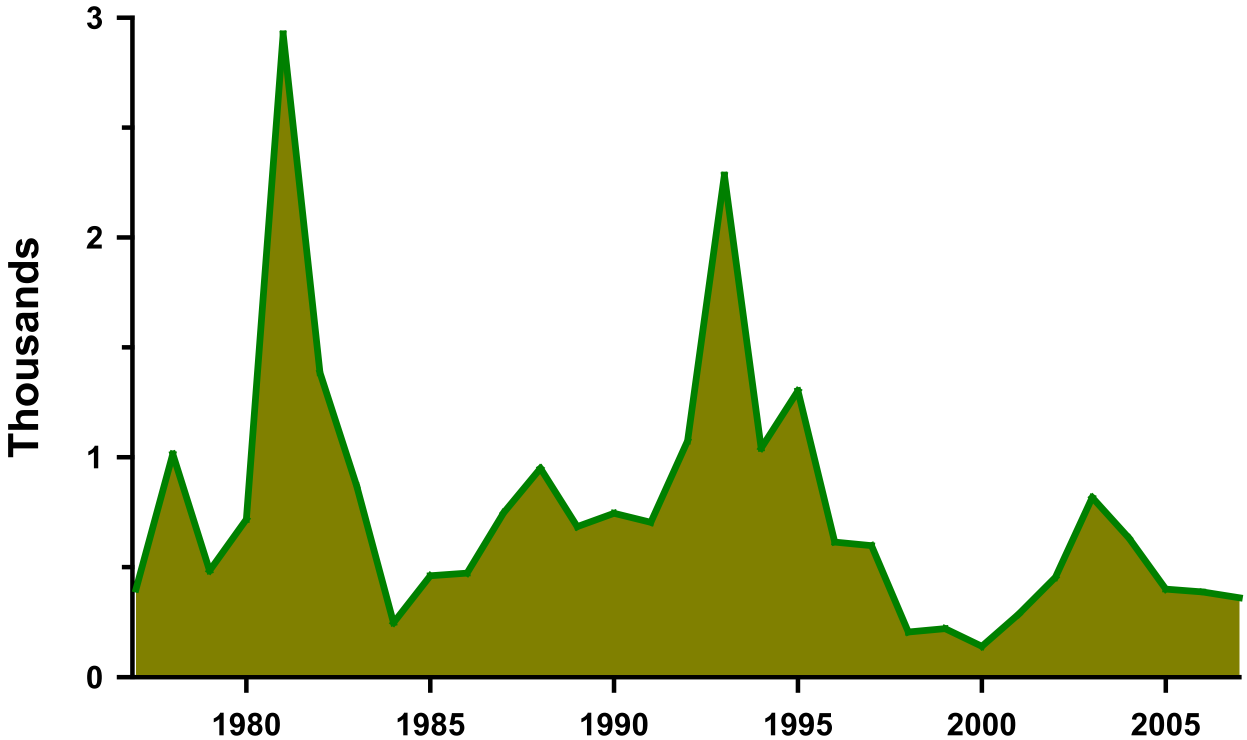

Figure 2-25. Counts of total wild and hatchery summer steelhead trapped at Kalama Falls Salmon Hatchery trap, 1976–2001. (Note that record returns of steelhead to the Kalama in 1980 and 1981 included large numbers of stray fish from the Cowlitz and Toutle rivers following the 1980 eruption of Mt. St. Helens.)

Winter Steelhead

Washington lower Columbia winter steelhead include six populations at very high risk of extinction, six at high risk, and five at moderate risk (Figure 2-26). No Washington populations are at low or very low risk of extinction. In contrast, of the seven additional populations occurring only in Oregon, six are at moderate, low, or very low risk.

Except in the upper Cowlitz and North Fork Lewis systems where dams have blocked passage into the upper basin, winter steelhead generally have access to most areas of significant historical habitat although many habitats no longer support significant production. Abundance and productivity of naturally-spawning winter steelhead are low or very low for most Cascade and Gorge populations. Total historical abundance of Columbia River winter steelhead was thought to number in the tens of thousands. Current returns of wild fish to Washington streams generally number less than 3,000 with a significant component of hatchery fish in many areas. Long-term escapement trend data is not available for most wild winter steelhead populations but recent escapement estimates in the subset of monitored streams has varied between 1,100 and 2,700 steelhead per year (Figure 2-27). Diversity of many winter steelhead populations has been somewhat reduced by historical hatchery effects, although not to the degree as has been seen in Chinook and coho salmon.

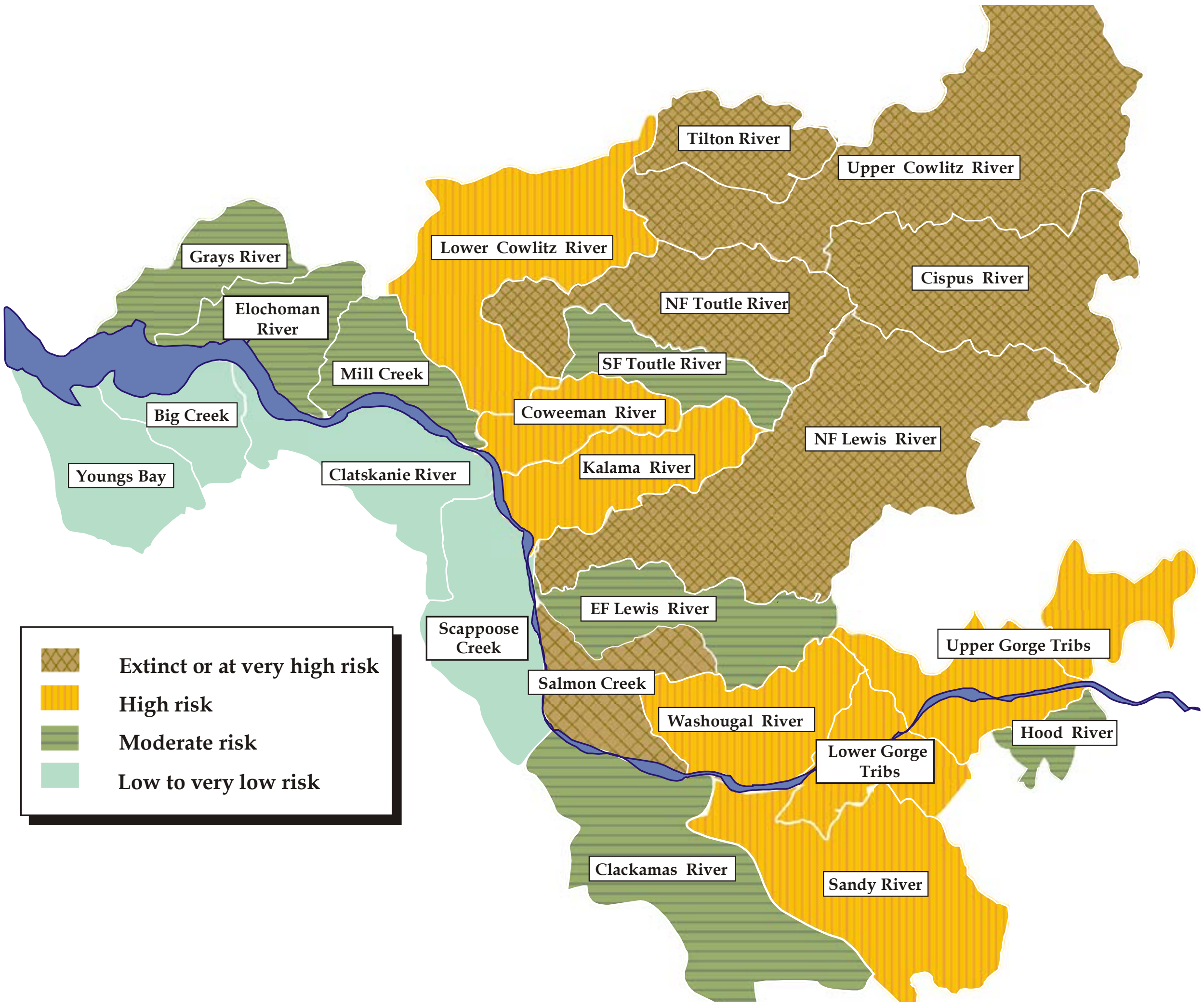

Figure 2-26. Current status of historical demographically-independent lower Columbia winter steelhead populations.

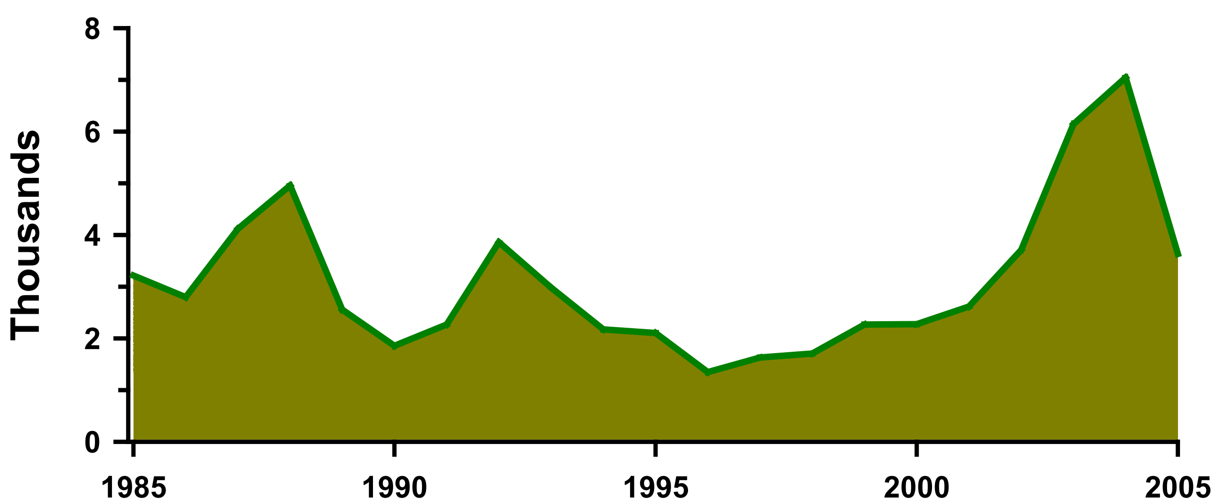

Figure 2-27. Winter steelhead aggregate escapement in eight Washington index streams (Coweeman, NF Toutle, SF Toutle River, Green, Kalama, East Fork Lewis, Cedar, and Washougal).

2.6. Bull Trout

ESA listing: Threatened	**6/10/1998 (effective 7/10/1998)**	**63FR31647**
Critical Habitat Designation:	**9/26/2005 (effective 10/26/2005)**	**70FR56212**

Bull trout (*Salvelinus confluentus*) are a distinct char species (Cavender 1978) previously considered to be the same species as Dolly Varden (*S. malma*) because of their overlapping ranges, similar appearance, and lack of sufficient analysis to discern the two species. Several genetic studies of the genus *Salvelinus* confirm the distinction between the bull trout and Dolly Varden (Phillips et al. 1989, Crane et al. 1994) and in fact show they are more closely related to other char species than to each other (Phillips et al. 1989, Phillips et al. 1991).

Bull trout were historically distributed as far south as the McCloud River in northern California, and Jarbidge River in northern Nevada, north to British Columbia, and east to Montana and Alberta. They were widely distributed throughout the Columbia Basin as far east as western Montana. Their current range in the lower 48 states is limited to Montana, Idaho, Oregon and Washington, with a small population in northern Nevada. They are now extinct in northern California.

Bull trout are listed as threatened under the ESA, are under the jurisdiction of the USFWS, and are the subject of a draft recovery plan. However, USFWS delayed completion of the plan in lieu of a 5-year review of the bull trout listing. The overarching goal of the draft plan is to ensure the long-term persistence of self-sustaining, complex interacting groups (or multiple local populations that may have overlapping spawning and rearing areas) of bull trout distributed across the species' native range. In the Washington portion of the lower Columbia, bull trout were believed to be historically distributed in the large subbasins including the Lewis River and Columbia River upper Gorge tributaries. In the USFWS bull trout recovery plan, the Lewis, White Salmon, and Klickitat rivers have been identified as core bull trout habitats for the Lower Columbia Recovery Unit. The Hood River Recovery Unit includes the Oregon bull trout populations within the Hood River and Sandy River subbasins which are discussed in greater detail in the Oregon plan. Of the subbasins addressed by this Plan, bull trout currently occur only in the upper Lewis River. Bull trout were reported in the White Salmon River as recently as 1989 but have not been observed since despite focused sampling efforts.

Figure 2-28. Photo of a Bull trout.

Bull trout exhibit resident, freshwater migratory, and anadromous life history patterns (Rieman and McIntyre 1993). In the lower Columbia River, bull trout may exhibit resident or freshwater migratory life history patterns but anadromous bull trout have not been documented. Resident and migratory forms are known to coexist in the same subbasin or even in the same stream. Resident forms live out their lives in the tributary where they were born and in nearby streams. Freshwater migratory forms include both fluvial and adfluvial strategies (Fraley and Shepard 1989). The fluvial form migrates between main rivers and tributaries while the adfluvial form migrates between lakes and streams.

Bull trout are found primarily in cold streams and tend to be nocturnal. Researchers consistently find that water temperature is a principal factor influencing distribution of bull trout in many streams (Rieman and McIntyre 1993, Baxter and McPhail 1996). Fraley and Shepard (1989) observed that water temperature above 59°F (15°C) may limit bull trout distribution. Studies in the John Day basin found bull trout present when maximum summer temperatures were 16°C or below, and maximum densities occurred where temperature maxima were 12°C or below (Buchanan et al. 1997).

Spawning migration patterns are complex and can vary within and across basins. In general, adult fish migrate into a stream during spring or early summer freshets and may reside in deep pools up to 2 months before spawning (Figure 2-29). This tendency makes adult bull trout particularly vulnerable to poaching or overfishing. Spawners migrate upriver slowly, mostly at night, and enter tributary streams from late July through September. Adults typically spawn from August to November during periods of decreasing water temperatures.

Bull trout tend to spawn higher in the watershed and have more specific habitat requirements than those of other salmonids. Preferred spawning habitats include stream reaches with groundwater infiltration, loose clean gravel and cobble substrates, and temperatures 41-48°F (5-9°C) in late summer and early fall (Fraley and Shepard 1989, Goetz 1989). Redd building and courtship behaviors occur mainly at night but have been observed during the day (McPhail and Baxter 1996). Redd site selection across years may be remarkably consistent, and superimposition of redds has been observed (Baxter and McPhail 1996).

Incubating and emergent bull trout require colder water than other salmonid species. Cool water during early life history results in higher egg survival and fry growth rates (Pratt 1992, McPhail and Murray 1979, Shepard et al. 1984). After hatching, juveniles remain in the substrate for up to 3 weeks before emerging from the gravel. Emergence normally occurs April-May, up to 200 days after eggs have been deposited. McPhail and Murray (1979) found that bull trout fry grew to larger sizes at lower temperatures, with maximum growth at about 4°C.

Juvenile bull trout typically rear in their natal streams for many years. Juvenile bull trout are associated with complex cover, including large wood, undercut banks, boulders, and pools (Fraley and Shepard 1989). In addition, they prefer shallow water depths with good cover, near faster-flowing water that delivers food particles (Baxter and McPhail 1996). Fry stay close to the streambed, perhaps as an adaptation to avoid being carried downstream before they are large enough to take up residence in a suitable feeding site. Migratory bull trout generally migrate out of their natal streams after 2 to 3 years at about 200 mm in length. Although juvenile migration can occur any time of the year, it typically peaks during May and June. Once migratory bull trout leave the streams in which they are born, they travel to larger rivers and lakes throughout their range. Bull trout normally reach sexual maturity from age 4–7, and may live longer than 12 years. Size and age at maturity vary depending if the fish is resident, freshwater migratory. At maturity, resident fish are generally smaller and less fecund than migratory fish (Fraley and Shepard 1989).

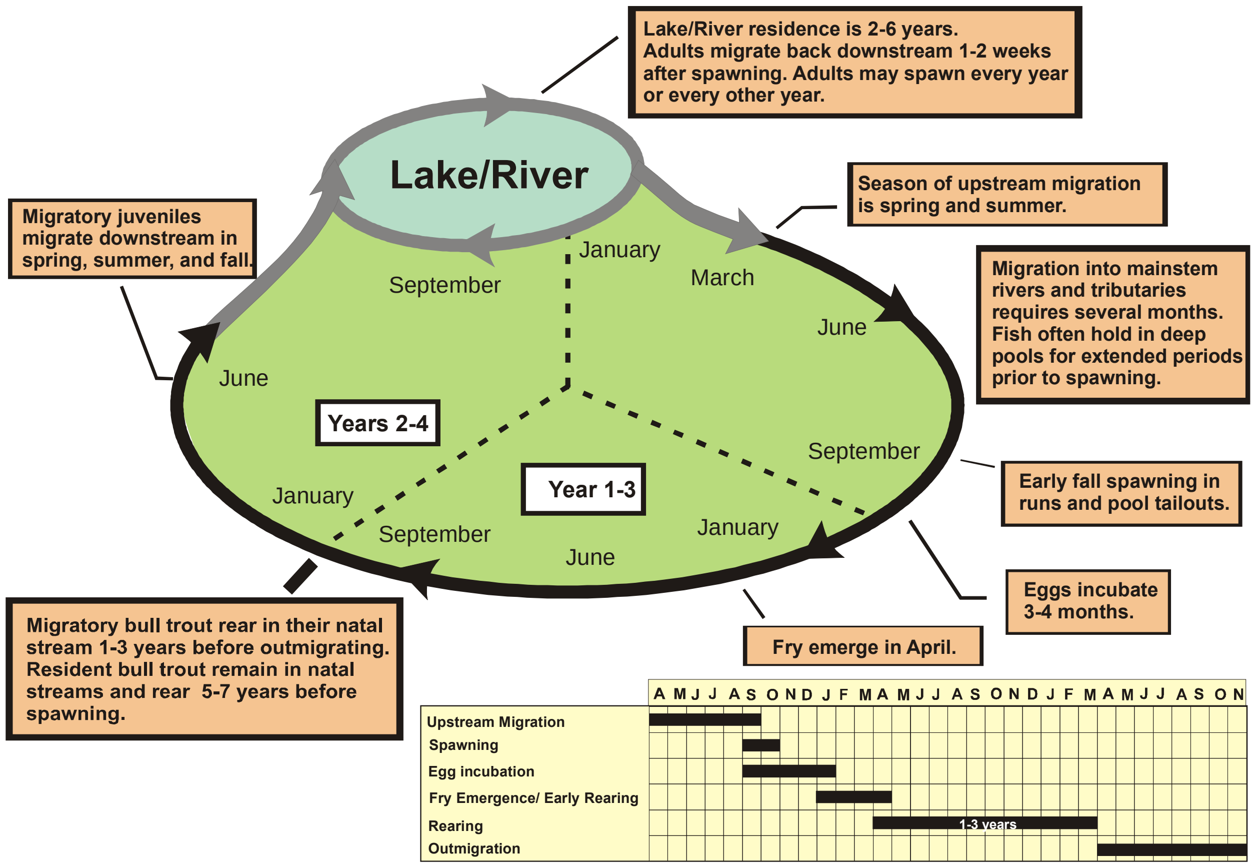

Figure 2-29. Bull trout life history.

Table 2-4. Life history and population characteristics of bull trout originating in Washington portions of the lower Columbia.

Characteristic	Life History Form	
	Migratory	**Resident**
Upstream spawning migration	April – September	April – September
Spawn timing	Early fall	Early fall
Spawning habitat type	Runs and tail-outs	Runs and tail-outs
Emergence timing	January – May	January – May
Natal area rearing	1-3 years	5-7 years
Downstream migration of juveniles	April - November	n/a
Rearing habitat	Lake or large river	Headwater streams, higher gradient
Lake/river residence	2-6 years	n/a
Age at spawning	4-12 years with annual or intermittent spawning	4-12 years with annual or intermittent spawning
Natural spawners	~10-40 in Cougar Creek, Yale Reservoir, Lewis River (1988-2003) ~100-900 in Rush/Pine Creeks, Swift Reservoir, Lewis River (1994-2003)	Unknown
Hatchery adults	None	None

Because of widespread distribution, isolated populations, and variations in life history, bull trout populations are grouped by distinct population segments (DPS). Bull trout are also grouped by recovery units, which serve as subsets of a DPS. On June 10, 1998, the USFWS issued a final rule announcing the listing of bull trout in the Columbia and Klamath River basins as threatened under the ESA. According to WDFW, the bull trout populations in the Lewis River basin are considered at moderate risk of extinction. The Columbia Basin Bull Trout DPS includes three Lower Columbia River recovery units: the Lower Columbia River Recovery Unit which includes the Lewis River and Klickitat River core areas in Washington; the Hood River Recovery Unit which includes the Hood River and Sandy River basins in Oregon; and the Willamette Recovery Unit which includes the Upper Willamette and Clackamas Rivers. This Recovery Plan is concerned primarily with the Lower Columbia Recovery Unit as the other units do not include populations in Washington. The Willamette and Hood River Recovery Units will be discussed in greater detail in the Oregon Recovery Plan. However, fluvial bull trout have been documented in Drano Lake in the lower Columbia River. Although it is not clear where these fish originated, they likely originated from the Hood River core population. Thus, actions taken in Washington will likely affect fluvial bull trout populations in Oregon.

Historically, bull trout were likely distributed in the upper reaches of the major lower Columbia subbasins in Washington (Figure 2-30). Historical records confirm that bull trout were present In the Lewis River, Little White Salmon, Big White Salmon, and the Wind River. Bull trout have never been reported in the Wind River above Shipherd Falls (RM 2.0) (Byrne et al. 2001). Bull trout have been reported in the Little White Salmon basin but not above Little White Salmon National Fish Hatchery. Byrne et al. (2001) concluded that bull trout were not present in Lava Creek of the mainstem Little White Salmon above the hatchery, but could not confirm absence of bull trout in Moss Creek. Reports of White Salmon River bull trout are rare and it is unclear where preferred spawning areas are located. However, Byrne et al. (2001) noted that groundwater contributions in the canyon area of the White Salmon River and in Spring Creek made these areas possible bull trout habitat. It is doubtful that bull trout in the White Salmon system ventured into the mainstem Columbia due to temperature considerations (WDFW 1998). Populations might have historically inhabited the Cowlitz and Kalama subbasins, but no records of occurrence exist.

The USFWS draft recovery plan identified two core bull trout populations within the Lower Columbia River Recovery Unit: the Lewis River Core Area which consists of the mainstem Lewis River and tributaries downstream to the confluence with the Columbia River, with the exclusion of the East Fork of the Lewis River; and the Klickitat River Core Area that includes the Klickitat River and all tributaries downstream to the confluence with the Columbia River. The Klickitat River is outside the scope of this Recovery Plan but will be covered in greater detail in the Mid Columbia Recovery Plan. No existing local populations have been identified in the White Salmon River, but that area historically supported bull trout and still contains core habitat. Further once migratory obstructions are addressed, the White Salmon River could support bull trout that migrate from the Columbia River. Thus, there are two Lower Columbia Recovery Unit subbasins within the scope of this Recovery Plan.

Status of bull trout is difficult to ascertain because of the lack of harvest, hatchery production, and scarcity of data. The Lewis River bull trout population was classified as depressed because of chronically low numbers (WDFW 1998). Adfluvial populations exist in Yale and Swift reservoirs in the Lewis River system. No fish passage is in place at the dams impounding these reservoirs; bull trout are thought to move downstream during spill events. Swift Reservoir bull trout spawn in Rush and Pine creeks. Cougar Creek is the only known spawning location for bull trout in Yale Reservoir; however, there may be potential for spawning in Ole Creek if flow is augmented. Bull trout in Merwin Reservoir are thought to be present due to spill from Yale Reservoir; however, there is no spawning population in Merwin Reservoir (WDFW 1998). WDFW and PacifiCorp have engaged in a program to relocate bull trout from the Yale tailrace back to Yale Reservoir and Cougar Creek (Table 2-5). The number of bull trout spawners utilizing Cougar Creek has been documented annually since 1979. During this period, the number of adult spawners in Cougar Creek (based on annual peak counts) has ranged from 40 in 1979 to 0 in 1981 and 1982 (Figure 2-31). The low number of spawners observed in the early 1980s may be related to impacts associated with the 1980 eruption of Mt. St. Helens.

In addition to the survey work conducted in Cougar Creek, the U.S. Forest Service (USFS), WDFW, and PacifiCorp have collected distribution and abundance information on bull trout since the late 1980s. Bull trout collected at the head of Swift Reservoir have been marked with Floy (anchor) tags every spring since 1989 to facilitate mark and recapture counts in Rush and Pine creeks (i.e. the primary spawning tributaries for the Swift bull trout population; Lesko 2001). Between 1994 and 2003, the annual spawner population in Swift Reservoir has ranged from 101 to 911 fish (Lesko 2001; WDFW unpublished data). The USFWS has also recently initiated a research project on bull trout distribution and habitat use in the Lewis and White salmon rivers.

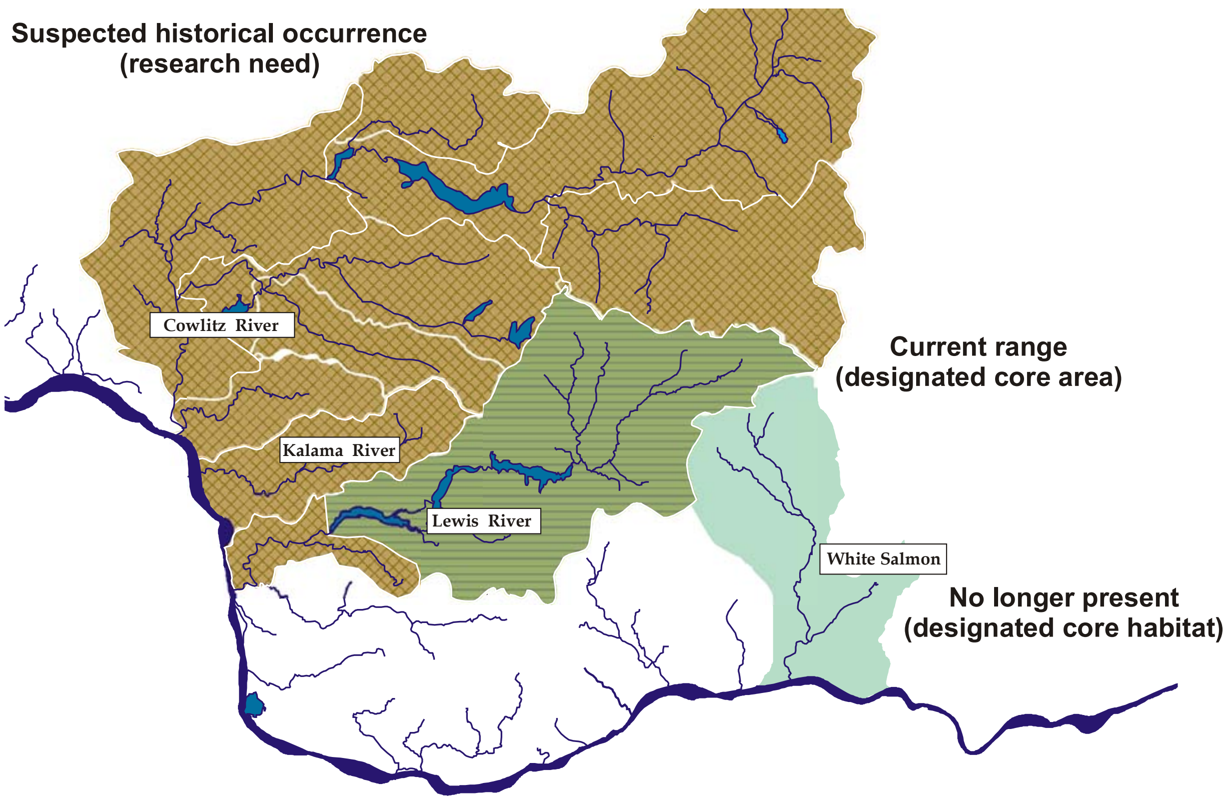

Figure 2-30. Probable historical distribution of bull trout populations among lower Columbia River subbasins.

Table 2-5. Bull trout collected from the Yale tailrace (Lake Merwin) and transferred to the mouth of Cougar Creek (Yale Reservoir) or released back into Yale Reservoir (1995–2000).

Year	No. Collected in Yale Tailrace	No. Transferred to Mouth of Cougar Creek	No. Released Back into Yale Reservoir
1995	15	9	6
1996	15	13	2
1997	10	10	0
1998	6	6	0
1999	6	0	6
2000	7	7	0
Total	**59**	**45**	**14**

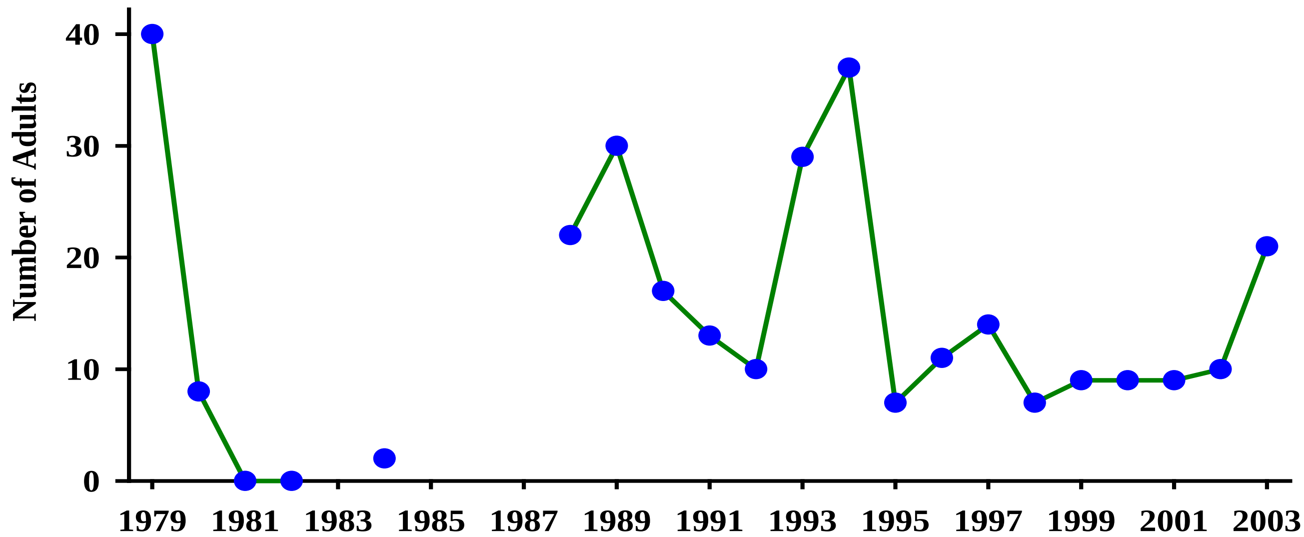

Figure 2-31. Annual peak counts of bull trout spawners observed in Cougar Creek, 1979–2003.

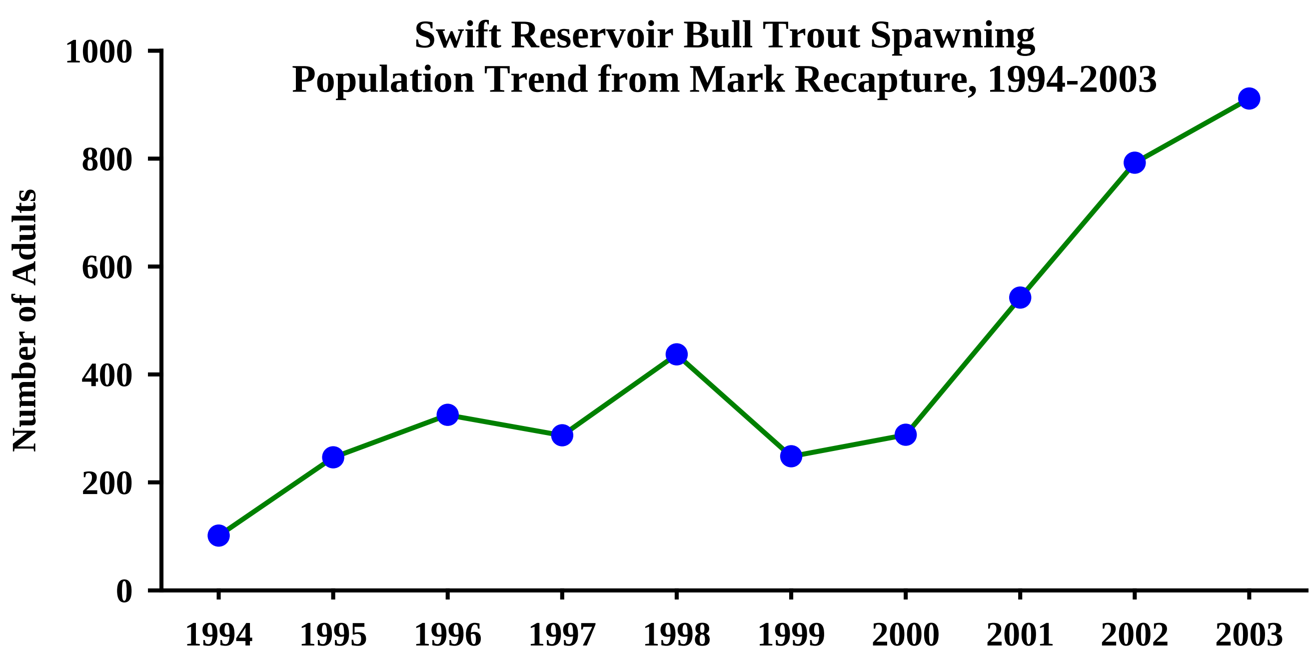

Figure 2-32. Spawning population estimate of bull trout in Swift Reservoir, 1994–2003 (source: Dan Rawding and John Weinheimer, WDFW).