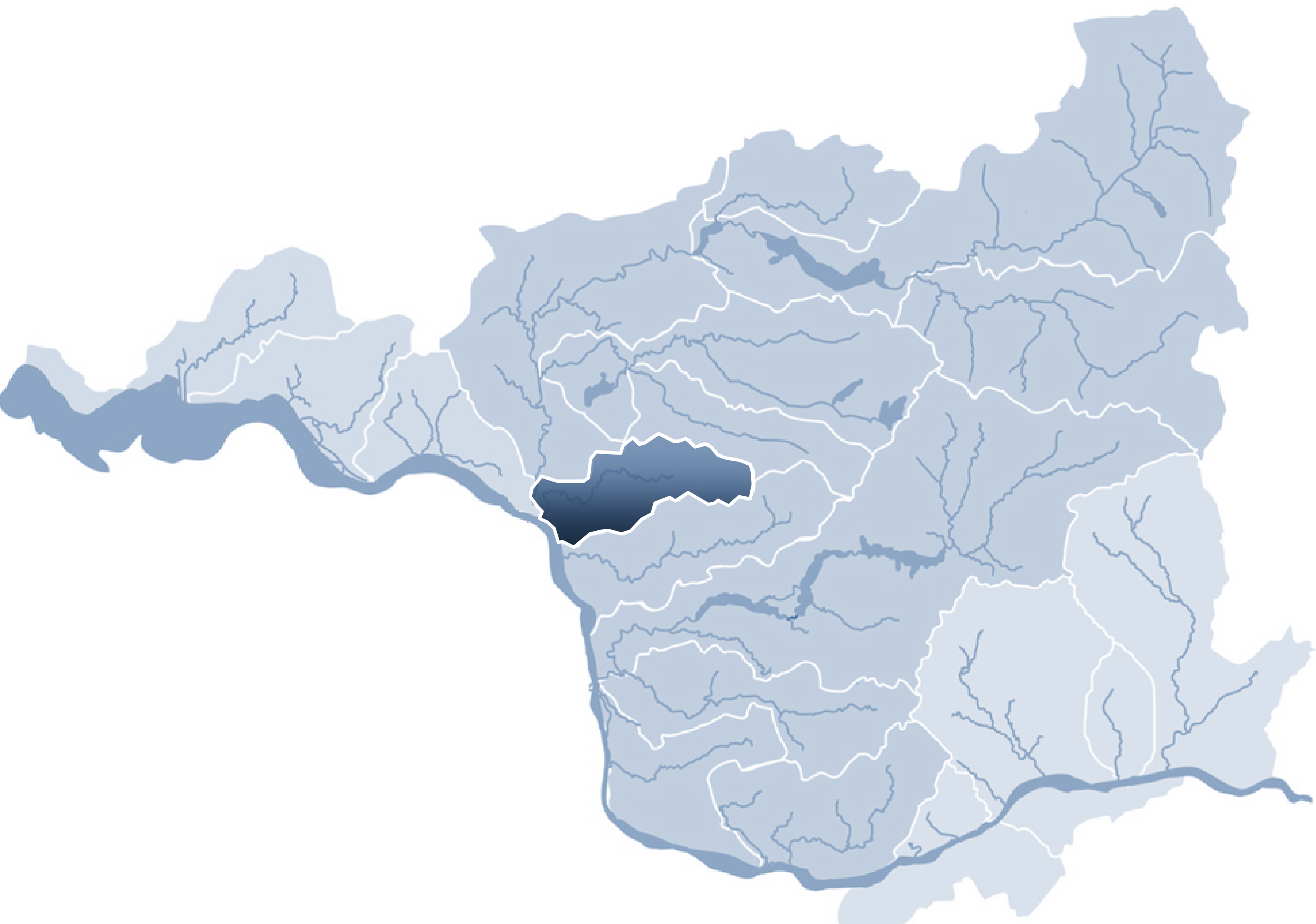
H. COWEEMAN SUBBASIN



H. COWEEMAN SUBBASIN

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H.1. Executive Summary

Figure H-1.Map of the Coweeman River.

This Plan describes a vision, strategy, and actions for recovery of listed salmon, steelhead, and trout species to healthy and harvestable levels, and mitigation of the effects of the Columbia River hydropower system in Washington lower Columbia River subbasins. Recovery of listed species and hydropower mitigation is accomplished at a regional scale. This plan for the Coweeman River Basin describes implementation of the regional approach within this subbasin, as well as assessments of local fish populations, limiting factors, and ongoing activities that underlie local recovery or mitigation actions. The plan was developed in a partnership between the Lower Columbia Fish Recovery Board (LCFRB), Northwest Power and Conservation Council, federal agencies, state agencies, tribal nations, local governments, and others.

The Coweeman River joins the mainstem Cowlitz River at RM 17 (Figure H-1). This basin historically supported thousands of fall Chinook, coho, chum, and winter steelhead. Today, numbers of naturally spawning salmon and steelhead are far below historical numbers. Chinook, chum, coho and winter steelhead have been listed as Threatened under the Endangered Species Act. The decline has occurred over decades and the reasons are many. Habitat quality has been reduced by a number of land-use practices including forestry, agriculture, and residential development. In the lower mainstem, key habitats have been isolated or eliminated by channel modifications and diking, filling, or draining floodplains and wetlands. Altered habitat conditions have increased predation. Competition and interbreeding with domesticated or nonlocal hatchery fish has reduced productivity. Fish are harvested in fresh and saltwater fisheries.

All Coweeman River salmon and steelhead will need to be restored to a high level of viability to meet regional recovery objectives. This means that the populations are productive, abundant, exhibit multiple life history strategies, and utilize significant portions of the basin.

In recent years, government agencies and other entities have actively addressed threats to salmon and steelhead, but much remains to be done. One thing is clear: no single threat is responsible for the decline in these populations. All threats and limiting factors must be reduced if recovery is to be achieved. An effective recovery plan must also reflect a realistic balance within physical, technical, social, cultural and economic constraints. The decisions that govern how this balance is attained will shape the region's future in terms of watershed health, economic vitality, and quality of life.

This plan represents the current best estimation of necessary actions for recovery and mitigation based on thorough research and analysis of the various threats and limiting factors that impact Coweeman River fish populations. Specific strategies, measures, actions and priorities have been developed to address these threats and limiting factors. The specified strategies identify the best long term and short term avenues for achieving fish restoration and mitigation goals. While it is understood that data, models, and theories have their limitations and growing knowledge will certainly spawn new strategies, the LCFRB is confident that by implementation of the recommended actions in this plan, the population goals in the Coweeman River Basin can be achieved. Success will depend on implementation of these strategies at the program and project level. It remains uncertain what level of effort will need to be invested in each area of impact to ensure the desired result. The answer to the question of precisely how much is enough is currently beyond our understanding of the species and ecosystems and can only be answered through ongoing monitoring and adaptive management against the backdrop of what is socially possible.

H.2. Key Priorities

Many actions, programs, and projects will make necessary contributions to recovery and mitigation in the Coweeman Basin. The following list identifies the most immediate priorities.

1. Manage Subbasin Forests to Restore Watershed Processes

Most of the Coweeman Basin is forested and forest management is critical to fish recovery. Past forest practices have reduced fish habitat quantity and quality by altering stream flow, increasing fine sediment, and degrading riparian zones in much of the basin. In addition, forest road culverts have blocked fish passage in small tributary streams. Effective implementation of new forest practices rules for private timber lands are expected to dramatically improve conditions by restoring passage, protecting riparian conditions, reducing sediment inputs, lowering water temperatures, improving flows, and restoring habitat diversity. Improvements will benefit all species, particularly winter steelhead and coho.

2. Manage Growth and Development to Protect Watershed Processes and Habitat Conditions

The human population in the basin is relatively low, but it is projected to grow by at least twenty percent in the next twenty years. The local economy is also in transition with reduced reliance on forest products and fisheries. These changes will provide a variety of risks and opportunities for preserving the rural character and local economic base while also protecting and restoring natural fish populations and habitats.

3. Restore Lower Mainstem Valley Floodplain Function and Stream Habitat Diversity

The lower stream reaches have been impacted by past agricultural use and are now impacted by residential development, urbanization, and transportation corridors. Dike building and bank stabilization have impacted fish habitat in these areas. Removing or modifying channel control and containment structures to reconnect the stream and its floodplain, where this is feasible and can be done without increasing risks of substantial flood damage, will restore normal habitat-forming processes to reestablish habitat complexity, off-channel habitats, and conditions favorable to fish spawning and rearing. These improvements will be particularly beneficial to fall Chinook, coho, and chum. Potentially restoring normal floodplain functions will also provide wetland and riparian habitats critical to other fish, wildlife, and plant species. Existing floodplain function and habitats will be protected through local land use ordinances, partnerships with landowners, and the acquisition of land, where appropriate. Restoration will be achieved by working with willing landowners, non-governmental organizations, conservation districts, and state and federal agencies. Existing land acquisition efforts along the lower mainstem valley just upstream of Kelso provide great floodplain restoration opportunities.

4. Address Immediate Risks with Short-term Habitat Fixes

Restoration of normal watershed processes that allow a basin to restore itself over time has proven to be the most effective strategy for long term habitat improvements. However, restoration of some critical habitats may take decades to occur. In the near term, it is important to initiate short-term measures to address current critical low numbers of some species. Examples in the Coweeman basin include construction of coho overwinter habitat with alcoves, side channels, or engineered log jams. Benefits will be temporary but will help bridge the period until normal habitat-forming processes are reestablished.

5. Align Hatchery Priorities Consistent with Conservation Objectives

Hatcheries throughout the Columbia basin historically focused on producing fish for fisheries as mitigation for hydropower development and widespread habitat degradation. Emphasis of hatchery production without regard for natural populations can pose risks to natural population viability. Hatchery priorities must be aligned to conserve natural populations, enhance natural fish recovery, and avoid impeding progress toward recovery while continuing to provide fish mitigation benefits. There are no hatcheries operating in the Coweeman Basin, however, a rearing pond on the Coweeman is used to acclimate winter steelhead from the Elochoman Hatchery.

6. Manage Fishery Impacts so they do not Impede Progress toward Recovery

This near-term strategy involves limiting fishery impacts on natural populations to ameliorate extinction risks until a combination of measures can restore fishable natural populations. There is no ocean, Columbia River, or tributary fisheries that are directed towards harvest of ESA-listed Coweeman River salmon and steelhead. This practice will continue until the populations are sufficiently recovered to withstand such pressure and remain self-sustaining. Some Coweeman River salmon and steelhead are incidentally taken in mainstem Columbia River and ocean mixed stock fisheries for strong wild and hatchery runs of fall Chinook and coho. These fisheries will be managed with strict limits to ensure this incidental take is consistent with recovery of Coweeman wild populations. Steelhead will continue to be protected from significant fishery impacts in the Columbia River and are not subject to ocean fisheries. Selective fisheries for marked hatchery steelhead and coho (and fall Chinook after mass marking occurs) will be a critical tool for limiting wild fish impacts. State and federal legislative bodies will be encouraged to develop funding necessary to implement mass-marking of fall Chinook, thus enabling a selective fishery with lower impacts on wild fish. State and federal fisheries managers will better incorporate Lower Columbia indicator populations into fisheries impact models.

7. Reduce Out-of-Subbasin Impacts so that the Benefits of In-Basin Actions can be Realized

Coweeman River salmon and steelhead are exposed to a variety of human and natural threats in migrations outside of the Cowlitz Subbasin. Human impacts include drastic habitat changes in the Columbia River estuary, effects of Columbia Basin hydropower operation on mainstem, estuary, and nearshore ocean conditions, interactions with introduced animal and plant species, and altered natural predation patterns by northern pikeminnow, birds, seals, and sea lions. A variety of restoration and management actions are needed to reduce these out-of-basin effects so that the benefits of in-basin actions can be realized. To ensure equivalent sharing of the recovery and mitigation burden, impacts in each area of effect (habitat, hydropower, etc.) should be reduced in proportion to their significance to species of interest.

H.3. Background

This plan describes a vision and framework for rebuilding salmon and steelhead populations in Washington's Coweeman River Subbasin. The plan addresses subbasin elements of a regional Recovery Plan for Chinook salmon, chum salmon, coho salmon, steelhead, and bull trout listed as Threatened under the federal Endangered Species Act (ESA). The plan also serves as the subbasin plan for the Northwest Power and Conservation Council (NPCC) Fish and Wildlife Program to address effects of construction and operation of the Federal Columbia River Power System.

Development of this plan was led and coordinated by the Washington Lower Columbia River Fish Recovery Board (LCFRB). The LCFRB was established by state statue (RCW 77.85.200) in 1998 to oversee and coordinate salmon and steelhead recovery efforts in the lower Columbia region of Washington. It is comprised of representatives from the state legislature, city and county governments, the Cowlitz Tribe, private property owners, hydro project operators, the environmental community, and concerned citizens. A variety of partners representing federal agencies, Tribal Governments, Washington state agencies, regional organizations, and local governments participated in the process through involvement on the LCFRB, a Recovery Planning Steering Committee, planning working groups, public outreach, and other coordinated efforts.

The planning process integrated four interrelated initiatives to produce a single Recovery/Subbasin Plan for Washington subbasins of the lower Columbia:

- Endangered Species Act recovery planning for listed salmon and trout.
- Northwest Power and Conservation Council (NPCC) fish and wildlife subbasin planning for eight full and three partial subbasins.
- Watershed planning pursuant to the Washington Watershed Management Act, RCW 90-82.
- Habitat protection and restoration pursuant to the Washington Salmon Recovery Act, RCW 77.85.

This integrated approach ensures consistency and compatibility of goals, objectives, strategies, priorities and actions; eliminates redundancy in the collection and analysis of data; and establishes the framework for a partnership of federal, state, tribal and local governments under which agencies can effectively and efficiently coordinate planning and implement efforts.

The plan includes an assessment of limiting factors and threats to key fish species, an inventory of related projects and programs, and a management plan to guide actions to address specific factors and threats. The assessment includes a description of the subbasin, focal fish species, current conditions, and evaluations of factors affecting focal fish species inside and outside the subbasin. This assessment forms the scientific and technical foundation for developing a subbasin vision, objectives, strategies, and measures. The inventory summarizes current and planned fish and habitat protection, restoration, and artificial production activities and programs. This inventory illustrates current management direction and existing tools for plan implementation. The management plan details biological objectives, strategies, measures, actions, and expected effects consistent with the planning process goals and the corresponding subbasin vision.

H.4. Assessment

H.4.1. Subbasin Description

Topography & Geology

The Coweeman basin encompasses approximately 200 mi^2 in Cowlitz County and lies within WRIA 26 of Washington State. The Coweeman River joins the mainstem Cowlitz at RM 17. Principal tributaries include Goble, Mulholland, Baird, O'Neill, and Butler Creeks. Elevations range from just above sea level at the mouth to over 3,000 feet. The basin is comprised of Eocene basalt flows and flow breccia. Glacial activity has influenced valley morphology and soils.

Climate

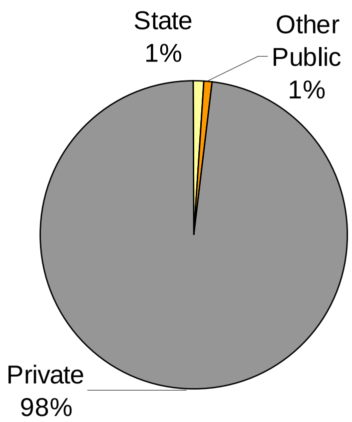
The basin has a typical northwest maritime climate. Summers are dry and warm and winters are cool, wet, and cloudy. Mean monthly precipitation ranges from 1.1 inches (July) to 8.8 inches (November) at Mayfield Dam. Mean annual precipitation is 46 inches near Kelso (WRCC 2003). Most precipitation occurs between October and March. The basin is rain-dominated, with winter snow in the higher elevations.

Land Use, Ownership, and Cover

Forestry is the dominant land use in the subbasin. Commercial forestland makes up over 90% of the Coweeman basin. Much of the lower river valleys are in agricultural and residential uses, with substantial impacts to riparian and floodplain areas in places. The largest population center is Kelso, WA, located near the river mouth. Projected population change from 2000 to 2020 for unincorporated areas in WRIA 26 is 22%. The City of Kelso has a projected change of 42% by 2020 (LCFRB 2001). The State of Washington owns, and the Washington State Department of Natural Resources (DNR) manages the beds of all navigable waters within the subbasin. Any proposed use of those lands must be approved in advance by the DNR. A breakdown of land ownership and land cover in the Coweeman basin is presented in Figure H-2 and Figure H-3.

Development Trends

The largest population center in the basin is Kelso, WA, located near the river mouth. Projected population change from 2000 to 2020 for unincorporated areas in WRIA 26 is 22%. The City of Kelso has a projected change of 42% by 2020 (LCFRB 2001). Continued population growth will increase pressures for conversion of forestry and agricultural land uses to residential uses, with potential impacts to habitat conditions.



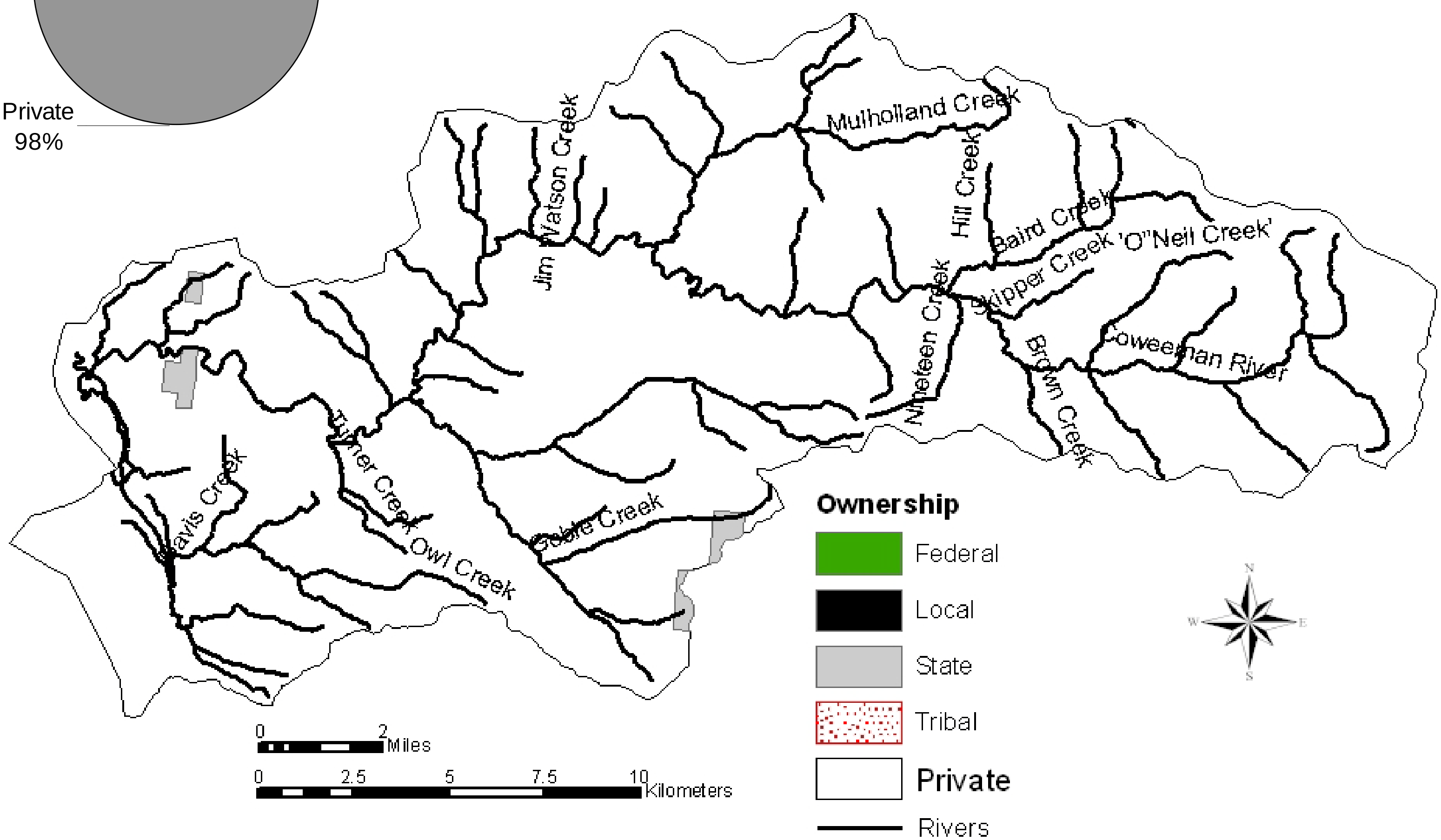


Figure H-2. Landownership within the Coweeman Basin. Data is WDNR data that was obtained from the Interior Columbia Basin Ecosystem Management Project (ICBEMP).

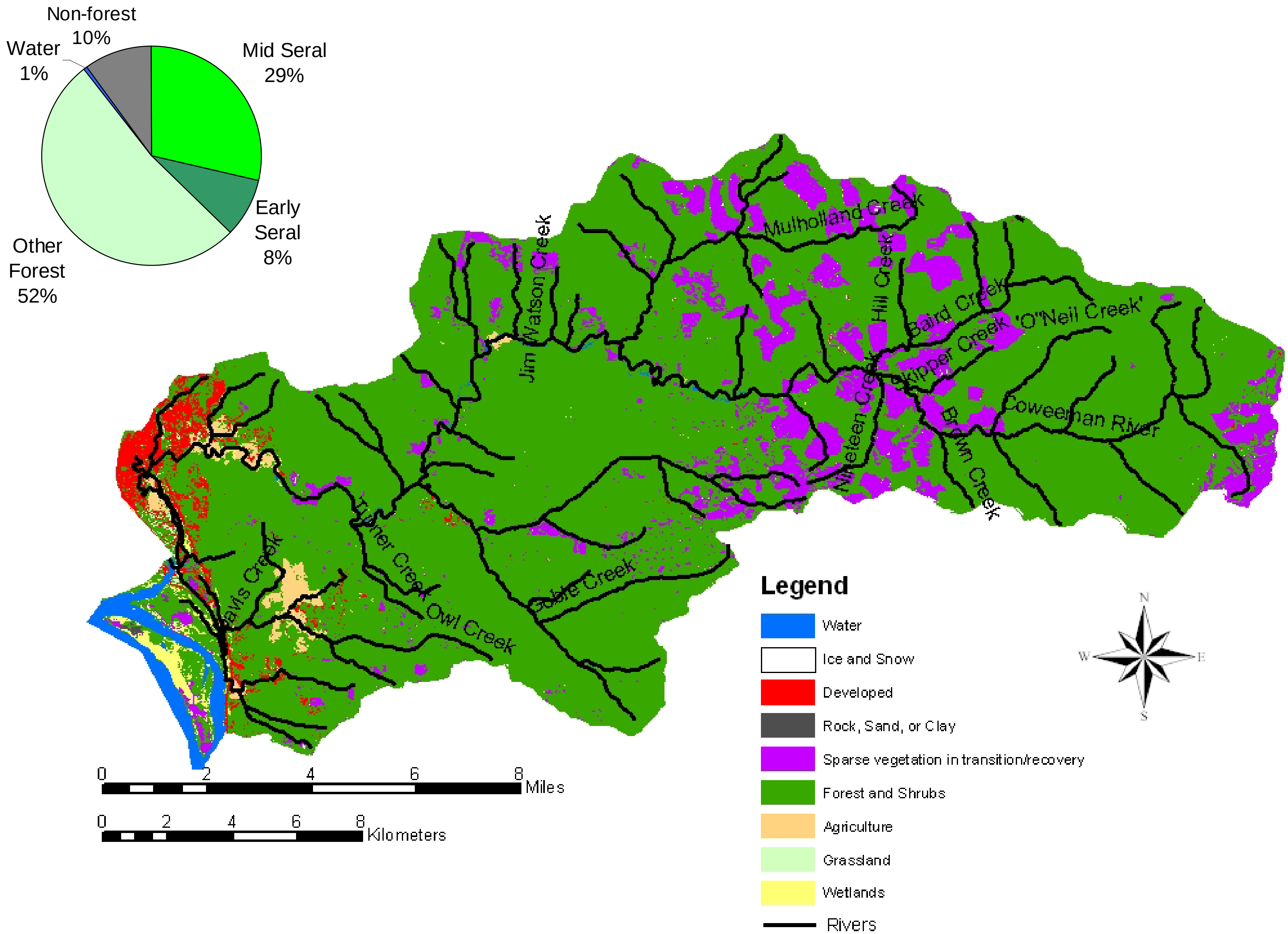


Figure H-3. Land cover within the Coweeman basin. Vegetation cover (pie chart) derived from Landsat data based on methods in Lunetta et al. (1997). Mapped data was obtained from the USGS National Land Cover Dataset (NLCD).

H.4.2. Focal and Other Species of Interest

Listed salmon, steelhead, and trout species are focal species of this planning effort for the Coweeman Basin. Other species of interest were also identified as appropriate. Species were selected because they are listed or under consideration for listing under the U.S. Endangered Species Act or because viability or use is significantly affected by the Federal Columbia Hydropower system. Federal hydropower system effects are not significant within the Coweeman River Basin although anadromous species are subject to effects in the Columbia River, estuary, and nearshore ocean. The Coweeman ecosystem supports and depends on a wide variety of fish and wildlife in addition to designated focal species. A comprehensive ecosystem-based approach to salmon and steelhead recovery will provide significant benefits to other native species through restoration of landscape-level processes and habitat conditions. Other fish and wildlife species not directly addressed by this plan are subject to a variety of other Federal, State, and local planning or management activities.

Focal salmonid species in the Coweeman River watershed includes fall Chinook, coho, chum, and winter steelhead. Bull trout do not occur in the subbasin. Chum are a subset of a larger area population which includes the lower Cowlitz, Toutle, and Coweeman rivers. Salmon and steelhead numbers have declined to only a fraction of historical levels (Table H-1). Extinction risks are significant for all focal species – the current health or viability of ranges from very low for chum and coho to low for fall Chinook and winter steelhead.

Table H-1. Status of focal salmon and steelhead populations in the Coweeman River subbasin.

Species	Population	Recovery Priority[1]	Viability Status[2]	Viability Obj[3]	Improvement[4]	Abundance Historic[5]	Abundance Current[6]	Abundance Target[7]
Fall Chinook(Tule)	Coweeman	Primary	VL	H+	80%	3,500	300	900
Chum	L. Cowlitz	Contributing	VL	M	>500%	195,000	<300	900
Winter Steelhead	Coweeman	Primary	L	H	25%	900	350	500
Coho	Coweeman	Primary	VL	H	170%	5,000	<50	1,200

1 Primary, Contributing, and Stabilizing designations reflect the relative contribution of a population to major population group recovery goals.
2 Baseline viability is based on Technical Recovery Team viability rating approach.
3 Viability objective is based on the scenario contribution.
4 Improvement is the relative increase in population production required to reach the prescribed viability goal
5 Historical population size inferred from presumed habitat conditions using Ecosystem Diagnosis and Treatment Model and NMFS back-of-envelope calculations.
6 Approximate current annual range in number of naturally-produced fish returning to the watershed.
7 Abundance targets were estimated by population viability simulations based on viability goals.

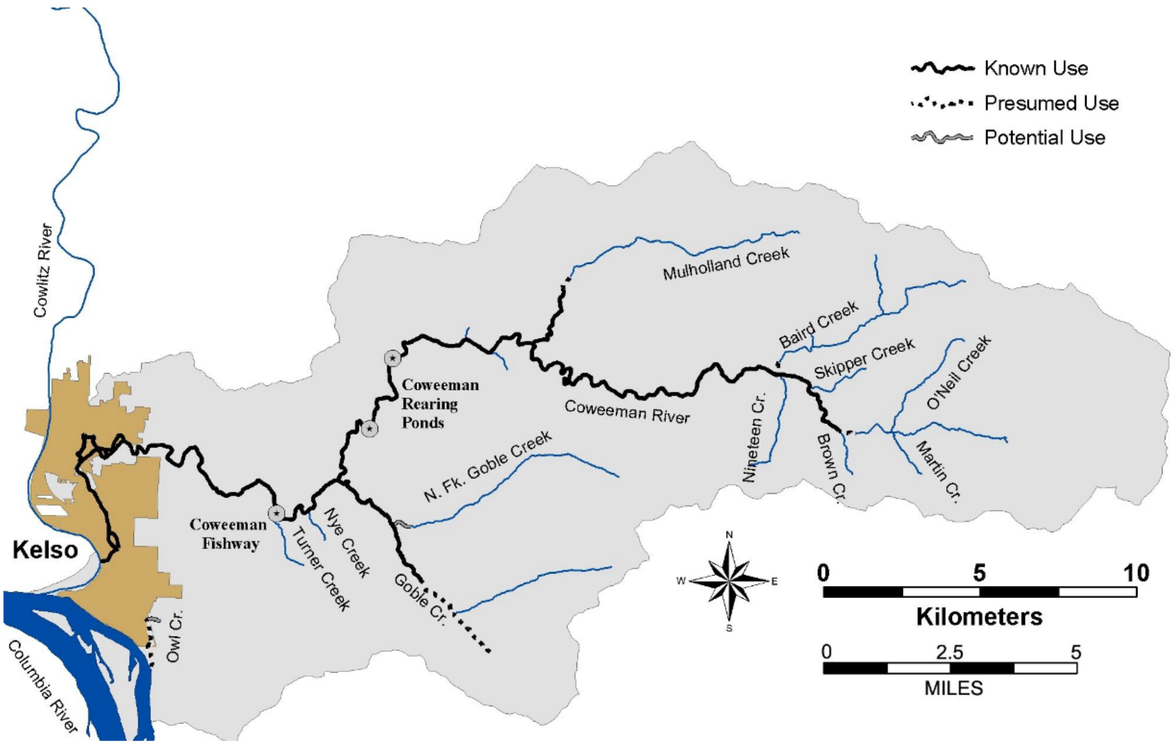
Other species of interest in the Coweeman Subbasin include coastal cutthroat trout and Pacific lamprey. These species have been affected by many of the same habitat factors that have reduced numbers of anadromous salmonids.

Brief summaries of the population characteristics and status follow. Additional information on life history, population characteristics, and status assessments may be found in Appendix A (focal species) and B (other species).

Fall Chinook— Coweeman Subbasin

ESA: Threatened 1999	SASSI: Depressed 2002

The historical adult population is estimated from 4,000-7,000 fish. The current natural spawning returns range from 100-2,100. There is no hatchery fall Chinook production in the Coweeman. Spawning occurs in the mainstem Coweeman, primarily from Mulholland Creek to the Jeep Club Bridge (about 6 miles). Juvenile rearing occurs near and downstream of the spawning areas. Juveniles migrate from the Coweeman in the spring and early summer of their first year.



Distribution

- Spawning occurs in the mainstem primarily from Mulholland Creek to the Jeep Club Bridge (~6 mi)

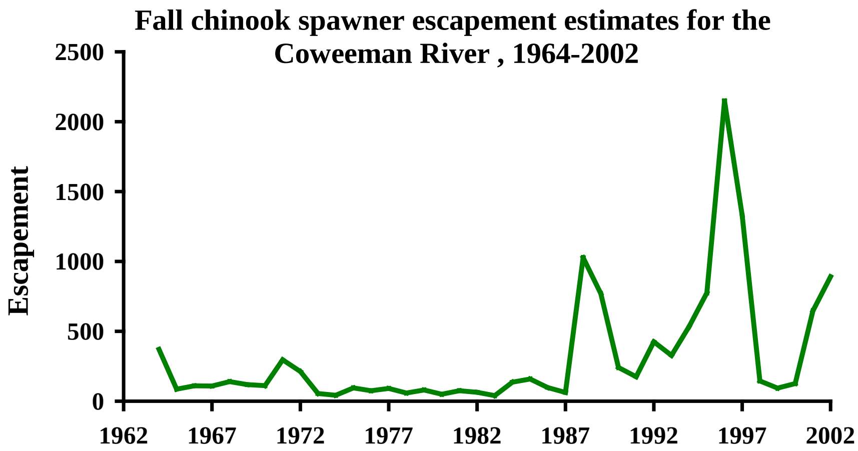
Life History

- Columbia River fall Chinook migration occurs from mid August to mid September, depending partly on early fall rain
- Natural spawning occurs between late September and mid November, usually peaking in mid October
- Age ranges from 2-year-old jacks to 6-year-old adults, with dominant adult age of 4
- Fry emerge around early April, depending on time of egg deposition and water temperature; fall Chinook fry spend the spring in fresh water, and emigrate in the late spring/summer as sub-yearlings

Diversity

- Considered a component of the tule fall Chinook population within the lower Columbia River Evolutionarily Significant Unit (ESU)
- Tule stock designated based on distinct spawning distribution and life history characteristics

- Allozyme analyses from 1996 and 1997 indicate Coweeman River fall Chinook are significantly different from all other Columbia River basin Chinook stocks, including lower Columbia River hatchery fall Chinook (most distinct Washington lower Columbia tule fall Chinook)



- Considered wild production with minimum hatchery influence
- Focal species for Endangered Species Act (ESA) monitoring because of minimum hatchery influence

Abundance

- An escapement survey in the late 1930s observed 1,746 Chinook in the Coweeman River
- In 1951, WDF estimated fall Chinook escapement to the Coweeman River was 5,000 fish
- Coweeman River spawning escapements from 1964-2001 ranged from 40 to 2,148 (average 302)
- Coweeman River current WDFW escapement goal is 1,000 fish; the goal has been met three times since 1986

Productivity & Persistence

- Baseline risk assessment determined a high to very-high risk of extinction for fall Chinook in the Coweeman River
- Smolt density model predicted natural production potential for the Coweeman River of 602,000 smolts
- One of two self sustaining natural runs in the lower Columbia River; the recent year natural run has been stable at low levels without hatchery influence

Hatchery

- Hatchery releases of fall Chinook in the Coweeman River occurred between 1951-1979; releases were from Spring Creek, Washougal, and Toutle Hatcheries; releases were discontinued in 1980
- No hatchery tags have been recovered in Coweeman River natural spawning fall Chinook in surveys conducted since 1980, indicating the population is not currently influenced by stray hatchery fish from outside the system

Harvest

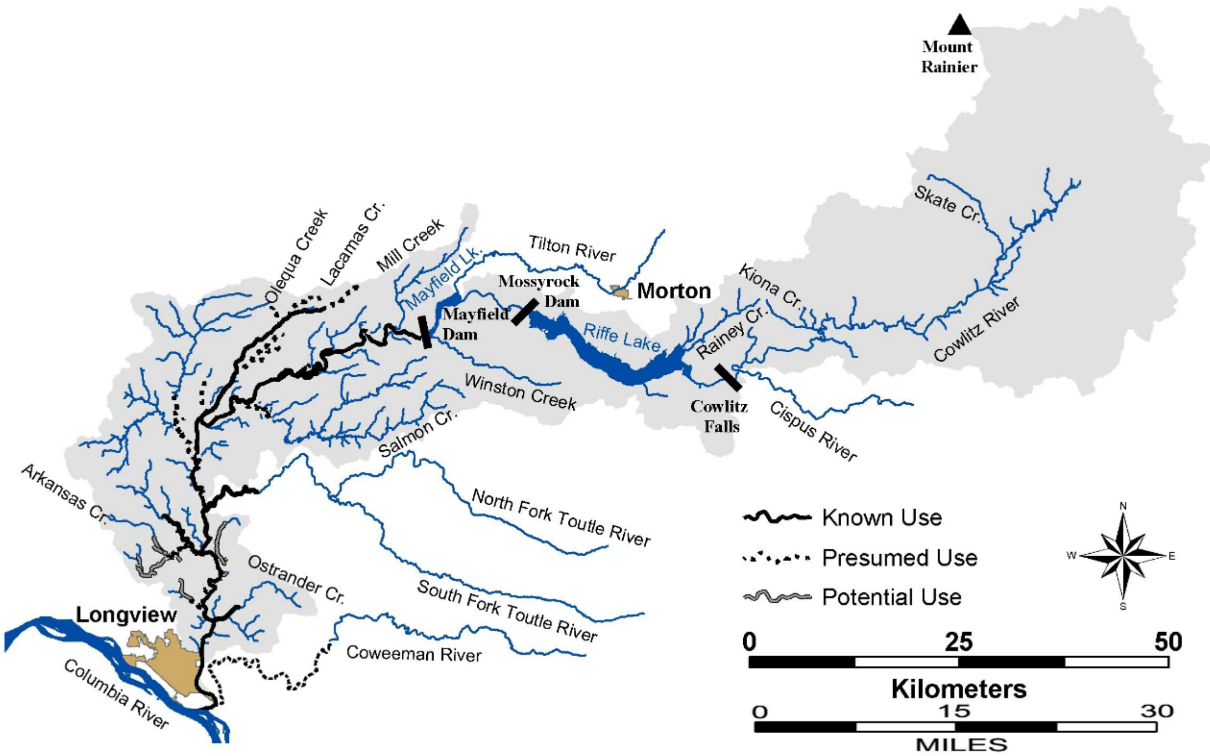
- Columbia River fall Chinook are harvested in ocean commercial and recreational fisheries from Oregon to Alaska, and in Columbia River commercial gill net and sport fisheries
- Lower Columbia tule fall Chinook are an important contributor to Washington Ocean troll and sport fisheries and to the Columbia River estuary sport (Buoy 10) fishery

- Columbia River commercial harvest occurs primarily in September, but tule flesh quality is low once the fish move from salt water; price is low compared to higher quality Upriver Bright Chinook
- Tule fall Chinook are also important to lower Columbia tributary sport fisheries
- The magnitude of harvest is variable depending on management response to annual abundance
- Coweeman River wild fall Chinook are not tagged but likely display an ocean and Columbia River harvest distribution similar to lower Columbia hatchery tule fall Chinook
- Coded-wire tag (CWT) analysis of 1989-94 brood North Toutle Hatchery fall Chinook (the closest tule population to Coweeman River; adjusted for zero harvest of fall Chinook in the Coweeman basin) indicates an ocean and Columbia River combined harvest rate of 28% and a terminal escapement of 72%
- The majority of ocean and Columbia River fishery CWT recoveries of 1992-94 brood North Toutle Hatchery fall Chinook (adjusted for zero harvest of Toutle Hatchery fall Chinook in the Coweeman basin) were distributed between British Columbia (43%), Alaska (21%), Columbia River (18%), and Washington ocean (15%) sampling areas
- Coweeman River is closed to sport harvest of Chinook
- Ocean and Columbia River harvest of Coweeman fall Chinook limited to 49% or less by ESA requirements in 2002. In 2009, the limit was set at 38%.

Chum—Coweeman Subbasin

ESA: Threatened 1999	SASSI: NA

The chum population is considered part of the lower Cowlitz population.



Distribution

- Chum were reported to historically utilize the lower Cowlitz River and tributaries downstream of the Mayfield Dam site

Life History

- Lower Columbia River chum salmon run from mid-October through November; peak spawner abundance occurs in late November
- Dominant age classes of adults are 3 and 4
- Fry emerge in early spring; chum emigrate as age-0 smolts generally from March to May

Diversity

- No hatchery releases of chum have occurred in the Cowlitz basin

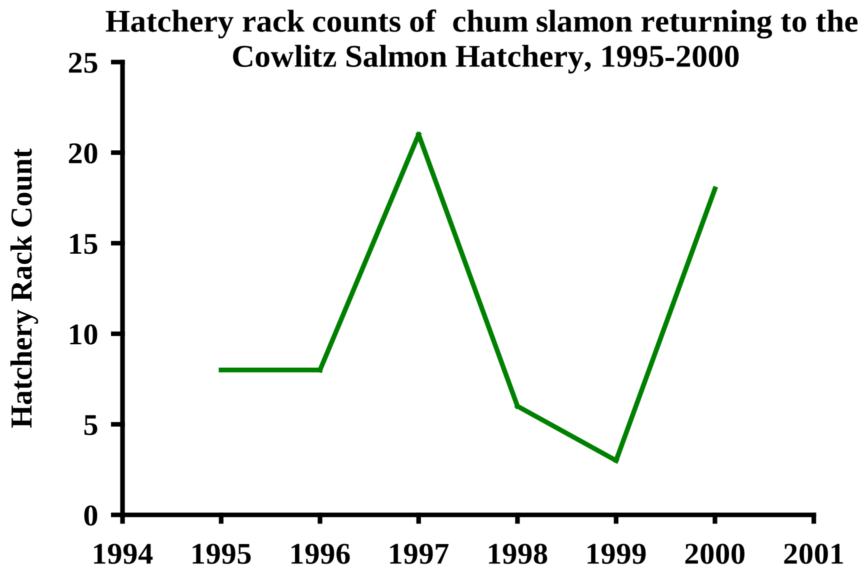
Abundance

- Estimated escapement of approximately 1,000 chum in early 1950's
- Between 1961 and 1966, the Mayfield Dam fish passage facility counted 58 chum
- Typically less than 20 adults are collected annually at the Cowlitz Salmon Hatchery

Productivity & Persistence

- Anadromous chum production primarily in lower watershed

- Harvest, habitat degradation, and to some degree construction of Mayfield and Mossyrock Dams contributed to decreased productivity



Hatchery

- Cowlitz Salmon Hatchery does not produce/release chum salmon
- Chum salmon are captured annually in the hatchery rack

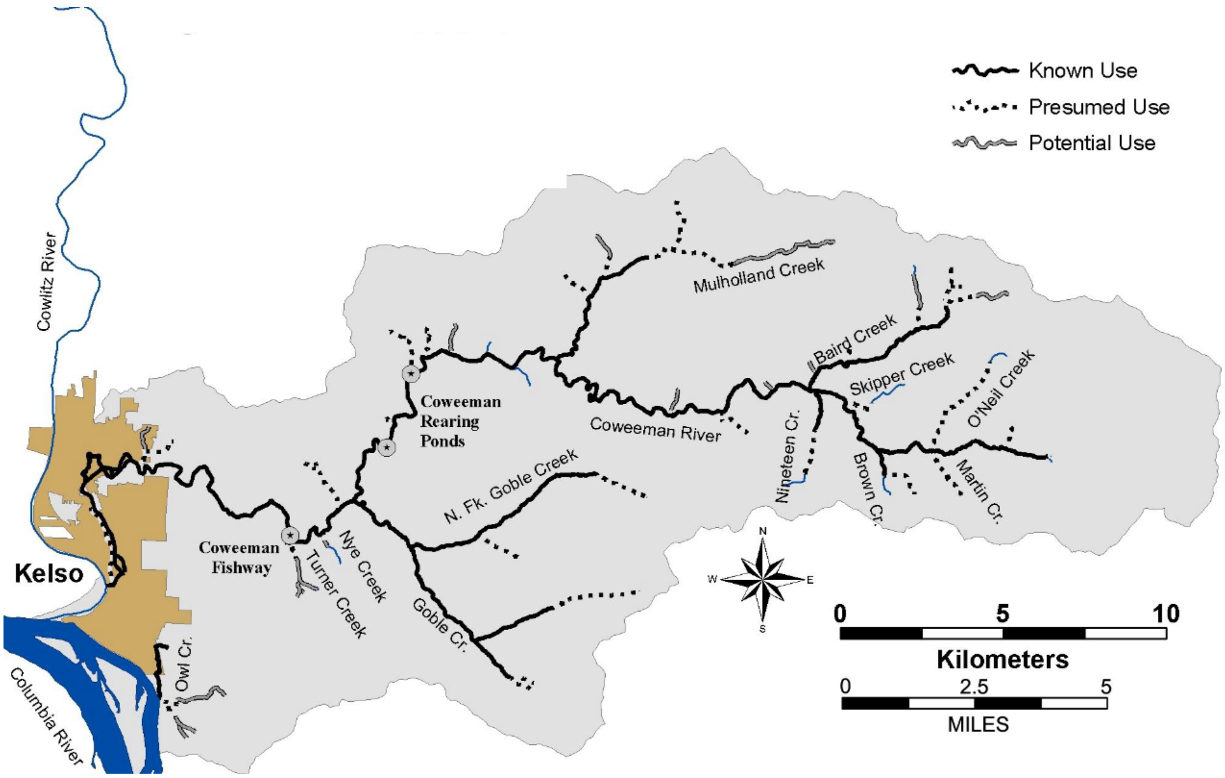
Harvest

- Currently very limited chum harvest occurs in the ocean and Columbia River and is incidental to fisheries directed at other species
- Columbia River commercial fishery historically harvested chum salmon in large numbers (80,000 to 650,000 in years prior to 1943); from 1965-1992 landings averaged less than 2,000 chum, and since 1993 less than 100 chum
- In the 1990s November commercial fisheries were curtailed and retention of chum was prohibited in Columbia River sport fisheries
- The ESA limits incidental harvest of Columbia River chum to less than 5% of the annual return

Winter Steelhead—Coweeman Subbasin

ESA: Threatened 1998	**SASSI: Depressed 2002**

The historical adult population is estimated from 3,000-7,000 fish. Current natural spawning returns range from 100-1,100. In-breeding with Chambers Creek or Skamania Hatchery produced steelhead is thought to be low because of differences in spawn timing. Spawning occurs primarily in the mainstem Coweeman, and Goble, Mulholland, and Baird creeks. Juvenile rearing occurs both downstream and upstream of the spawning areas. Juveniles rear for a full year or more before migrating from the Coweeman.



Distribution

- Winter steelhead are distributed throughout the mainstem Coweeman, Goble Creek, and the lower reaches of Mulholland and Baird Creeks
- The 1980 eruption of Mt. St. Helens had little impact on Coweeman River habitat

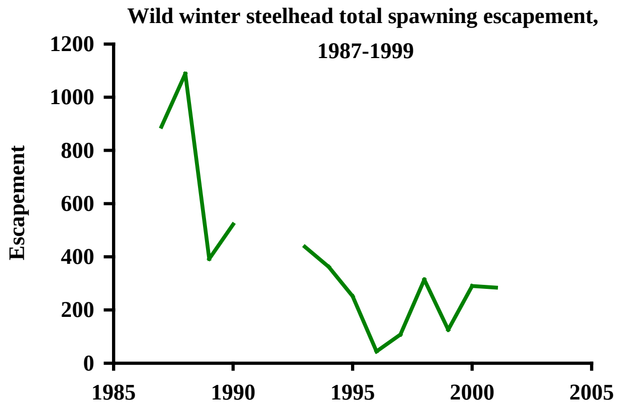
Life History

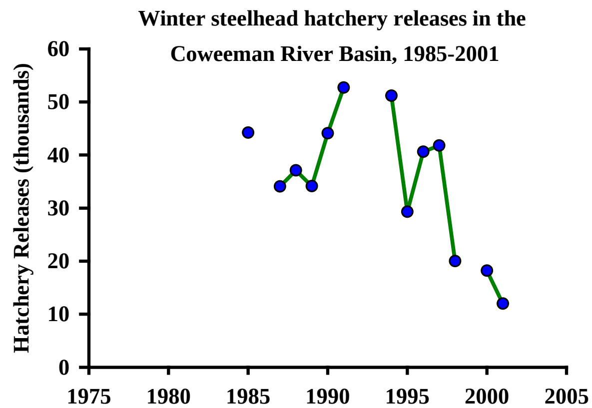
- Adult migration timing for Coweeman winter steelhead is from December through April
- Spawning timing on the Coweeman is generally from early March to early June
- Age composition data for Coweeman River winter steelhead are not available
- Wild steelhead fry emerge from March through May; juveniles generally rear in fresh water for 2 years; juvenile emigration occurs from April to May, with peak migration in early May

Diversity

- Coweeman winter steelhead stock designated based on distinct spawning distribution

- Hybridization of wild stock with Chambers Creek hatchery brood stock is unlikely because of about a three month separation in peak spawn timing





Abundance

- In 1936, steelhead were reported in the Coweeman River during escapement surveys
- Coweeman River total escapement counts from 1987-2001 ranged from 44-1,008 (average 393); escapement goal for the Coweeman is 1,064 fish; escapements have been low since 1989

Productivity & Persistence

- Estimated potential winter steelhead smolt production for the Coweeman River is 38,229
- Baseline risk assessment determined a high risk of extinction for winter steelhead in the Coweeman River

Hatchery

- The Cowlitz Trout Hatchery, located on the mainstem Cowlitz at RM 42, is the only hatchery in the basin producing winter steelhead
- Hatchery winter steelhead have been planted in the Coweeman River basin since 1957; broodstock from the Elochoman and Cowlitz Rivers and Chambers Creek have been used, but most releases have been from Chambers Creek; release data are displayed from 1985-2001
- Hatchery fish comprise most of the winter steelhead run in the Coweeman River basin; hatchery fish escapements from 1986-1990 ranged from 1,795 to 2,427; however, hatchery fish contribute little to natural production

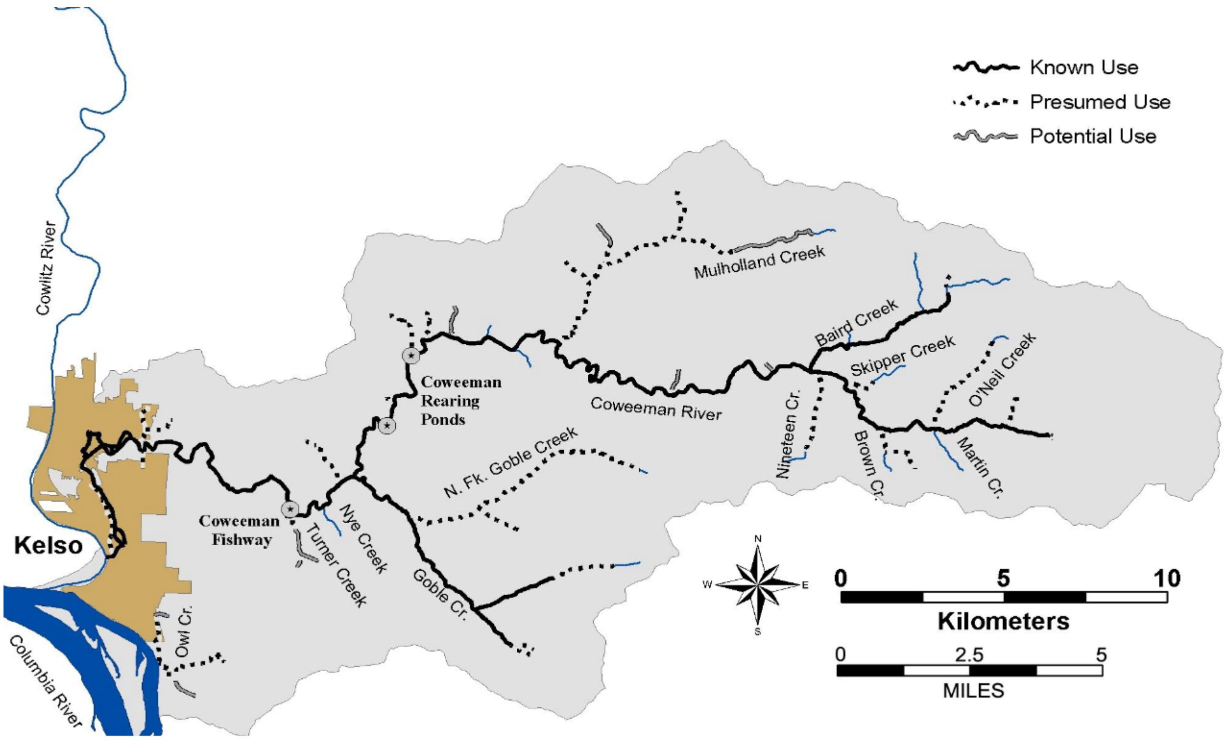
Harvest

- No directed commercial or tribal fisheries target Coweeman winter steelhead; incidental mortality currently occurs during the lower Columbia River spring Chinook tangle net fisheries
- Treaty Indian harvest does not occur in the Coweeman River
- Approximately 6.2% of returning Cowlitz River hatchery steelhead are harvested in the Columbia River sport fishery
- Winter steelhead sport harvest (hatchery and wild) in the Coweeman River from 1986-1989 ranged averaged 241 fish; since 1990, regulations limit harvest to hatchery fish only
- ESA limits fishery impact of wild winter steelhead in the mainstem Columbia River and in the Coweeman River as per the Fishery Management and Evaluation Plan submitted by WDFW to NMFS in 2003.

Cutthroat Trout—Coweeman Subbasin

ESA: Not Listed	**SASSI: Depressed 2000**

Coastal cutthroat abundance in the Coweeman has not been quantified but the population is considered depressed. Both anadromous and resident forms of cutthroat trout are found in the basin. Anadromous forms have access upstream to Washboard Falls (RM 31). Anadromous cutthroat trout enter the Coweeman from July-December and spawn from December through June. Most juveniles rear 2-4 years before migrating from their natal stream. A hatchery cutthroat program was discontinued in 1993.



Distribution

- Anadromous forms have access to most of the watershed except above Washboard Falls (RM 31)

Life History

- Anadromous, fluvial and resident forms are present
- Anadromous river entry is from August through March, with peak entry in the fall
- Anadromous spawning occurs from January through mid-April
- Fluvial and resident spawn timing is not documented but is believed to be similar to anadromous timing

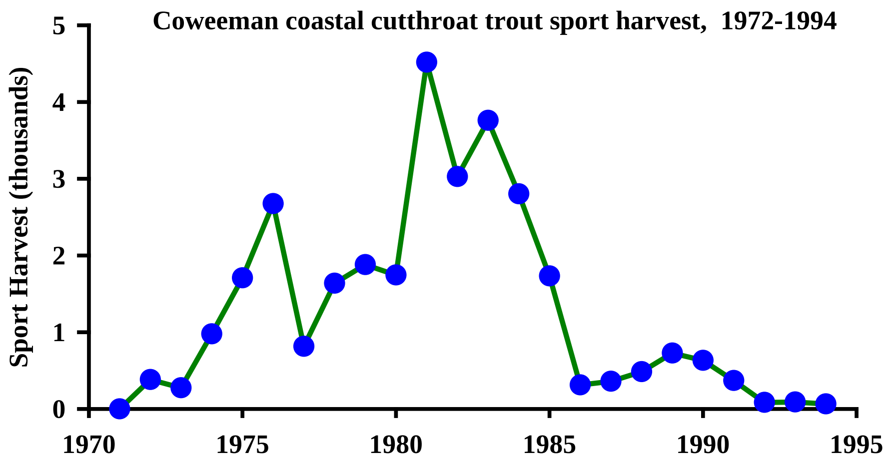
Diversity

- Distinct stock based on geographic distribution of spawning areas
- No genetic sampling has been conducted

Abundance

- No abundance information exists for resident and fluvial forms

- Anadromous forms are considered depressed due to long term negative decline in the lower Columbia River cutthroat catch
- The early 1990s harvest data are less than 5% of peak harvest counts in the early 1980s



Hatchery

- No hatcheries exist on the Coweeman River
- From 1989 to 1993 12,000 anadromous cutthroat from Beaver Creek Hatchery were released into the Coweeman River annually
- Hatchery cutthroat releases into the Coweeman River were discontinued
- Hatchery steelhead smolts are released into the Coweeman River

Harvest

- Not harvested in ocean commercial or recreational fisheries
- Angler harvest for adipose fin clipped hatchery fish occurs in mainstem Columbia River summer fisheries downstream of the Cowlitz River
- Wild Coweeman River cutthroat (unmarked fish) are released in mainstem Columbia River and Coweeman River sport fisheries

Other Species

Pacific lamprey – Information on lamprey abundance is limited and does not exist for the Coweeman population. However, based on declining trends measured at Bonneville Dam and Willamette Falls it is assumed that Pacific lamprey have declined in the Coweeman River also. The adult lamprey return from the ocean to spawn in the spring and summer. Spawning likely occurs in the small to mid-size streams of the Coweeman Basin. Juveniles rear in freshwater up to 6 years before migrating to the ocean.

H.4.3. Subbasin Habitat Conditions

This section describes the current condition of aquatic and terrestrial habitats within the subbasin. Descriptions are included for habitat features of particular significance to focal salmonid species including watershed hydrology, passage obstructions, water quality, key habitat availability, substrate and sediment, woody debris, channel stability, riparian function, and floodplain function. These descriptions will form the basis for subsequent assessments of the effects of habitat conditions on focal salmonids and opportunities for improvement.

Watershed Hydrology

Runoff is predominantly generated by rainfall, with a portion of spring flows coming from snowmelt in the upper elevations and occasional winter peaks related to rain-on-snow events. Streamflows are primarily the result of winter rainfall.

The Integrated Watershed Assessment (IWA), which is presented in greater detail later in this chapter, indicates that runoff properties are 'impaired' throughout most of the basin, with 'moderately impaired' hydrologic conditions only in the headwaters subwatersheds. High road densities and young forest stands are the primary causes of hydrologic impairment. These conditions create a risk of increased peak flow volumes.

Low flows in the Coweeman have been responsible for impeding Chinook and coho migrations as well as limiting juvenile rearing habitat. Using the Toe-Width method to assess flow suitability in 1998, it was determined that flows for fall spawning were less than optimal until November, and flows for juvenile rearing were less than optimal from mid-July through September (Caldwell et al. 1999).

Watershed Planning Assessments conducted by the Lower Columbia Fish Recovery Board (LCFRB) and Ecology indicate that the current and future projected groundwater demand in the Coweeman could exceed a one to two percent habitat impact in the Coweeman River. The draft Watershed Plan recommends domestic well use only within the basin or use of tidally-influenced waters (or City of Kelso) near the confluence with the Cowlitz River.

Passage Obstructions

Numerous culverts present full or partial barriers to anadromous fish passage in the watershed. A detailed description of the type and location of natural and artificial passage barriers is given in the Washington Conservation Commission's WRIA 26 Limiting Factors Analysis (Wade 2000).

Water Quality

The lower Coweeman was listed on the 1998 303(d) list for exceedance of temperature standards (WDOE 1998). Temperatures measured in the Coweeman near Kelso from 1950 to 1967 consistently exceeded 18ºC (64°F) June through September and often exceeded 25ºC (77°F) in July and August (Wade 2000). The Coweeman has been listed as "temperature sensitive" due to logging (WDW 1990). The tributaries Baird, Mulholland, and Goble Creeks were also listed on the 1998 303(d) list due to temperature problems. Nutrient deficits are an assumed problem due to low escapement levels of winter steelhead, coho, and chum (Wade 2000). A TMDL for fecal coliform was initiated in 1999 on Gibbons Creek.

Key Habitat Availability

The upper Coweeman has low pool frequencies and depths that are considered a concern for fish (Weyerhaeuser 1996). Information on pool habitat elsewhere in the Coweeman is lacking.

Substrate & Sediment

WDFW noted in 1990 that substrate conditions limit production of coastal cutthroat, winter steelhead, fall Chinook, and coho. The low gradient between RM 17-26 on the Coweeman contributes a large amount of persistent sediment due to the underlying parent material containing a high fraction of fines. For this reason, the area also experiences frequent mass failures and bank erosion. Sediment production in this reach is apparent as chocolate brown stormflow and as fine sediment accumulation on channel margins, backwater areas, and in side-channels. Historical splash dams throughout the Coweeman basin accumulated sediments, which the channels incised; these continue to deliver fines to downstream areas (Weyerhaeuser 1996).

Sediment supply conditions were evaluated as part of the IWA watershed process modeling, which is presented later in this chapter. The model indicates that sediment supply conditions are 'moderately impaired' throughout most of the basin, with 'impaired' conditions in the lower basin near the town of Kelso. The only 'functional' subwatersheds are located in the headwaters of Baird and Mulholland Creeks.

Sediment supply impairments are mostly the result of the forest road network within the basin. With an average road density of 6.54 mi/mi2 and over 69 miles of stream-adjacent roads, roads in the Coweeman basin are believed to increase sediment production. Several roads contributing fine sediment to streams were identified in the upper Coweeman basin as part of the watershed analysis (Weyerhaeuser 1996).

Sediment production from private forest roads is expected to decline over the next 15 years as roads are updated to meet the new forest practices standards, which include ditchline disconnect from streams and culvert upgrades. The frequency of mass wasting events should also decline due to the new regulations, which require geotechnical review and mitigation measures to minimize the impact of forest practices activities on unstable slopes.

Woody Debris

As part of the Upper Coweeman Watershed Analysis conducted by Weyerhaeser in 1996, approximately half of the surveyed streams had high near-term LWD recruitment potential and about one-third had low near-term recruitment potential.

Channel Stability

The Coweeman River between RM 4 – 7.5 has bank stability problems associated with adjacent agricultural uses. From RM 17 – 26, lateral bank stability is a problem. The upper Coweeman has experienced mass wasting related to roads. Pin Creek and Goble Creek (Coweeman tributaries) have some stability problems in their upper reaches (Weyerhaeuser 1996).

Riparian Function

According to IWA watershed process modeling, which is presented in greater detail later in this chapter, the Coweeman basin suffers from 'moderately impaired' riparian conditions throughout the basin. The only exceptions are the mainstem headwaters, which is rated as 'functional', and the lowermost portion of the basin, which is rated as 'impaired'. This pattern of riparian impairment is supported by an assessment by Lewis County GIS (2000), which identified poor riparian conditions on over 40% of stream miles in the lower Coweeman basin compared to less than 15% in the upper basin. A contributing factor to riparian impairment is the large amount of valley bottom roads (over 69 miles) that reduce or eliminate riparian function. Cattle grazing between RM 4 – 7.5 are also a concern (Wade 2000).

Riparian function is expected to improve over time on private forestlands. This is due to the requirements under the Washington State Forest Practices Rules (Washington Administrative Code Chapter 222). Riparian protection has increased dramatically today compared to past regulations and practices.

Floodplain Function

The lower four miles has been diked as part of industrial and commercial development in the Kelso area, limiting access to over-wintering habitat for juveniles. RM 4 – 7.5 provides some decent off-channel habitats, as does a small portion of floodplain habitat below RM 1. Above RM 17 are a few unconfined reaches that historically may have provided off-channel habitats but are now incised to the point that accessible off-channel areas no longer exist (Wade 2000).

H.4.4. Stream Habitat Limitations

A systematic link between habitat conditions and salmonid population performance is needed to identify the net effect of habitat changes, specific stream sections where problems occur, and specific habitat conditions that account for the problems in each stream reach. In order to help identify the links between fish and habitat conditions, the Ecosystem Diagnosis and Treatment (EDT) model was applied to Coweeman River fall Chinook, coho, and winter steelhead. A thorough description of the EDT model, and its application to lower Columbia salmonid populations, can be found in Appendix E.

Three general categories of EDT output are discussed in this section: population analysis, reach analysis, and habitat factor analysis. Population analysis has the broadest scope of all model outputs. It is useful for evaluating the reasonableness of results, assessing broad trends in population performance, comparing among populations, and for comparing past, present, and desired conditions against recovery planning objectives. Reach analysis provides a greater level of detail. Reach analysis rates specific reaches according to how degradation or restoration within the reach affects overall population performance. This level of output is useful for identifying general categories of management (i.e. preservation and/or restoration), and for focusing recovery strategies in appropriate portions of a subbasin. The habitat factor analysis section provides the greatest level of detail. Reach specific habitat attributes are rated according to their relative degree of impact on population performance. This level of output is most useful for practitioners who will be developing and implementing specific recovery actions.

Population Analysis

Population assessments that compare historical and current habitat conditions are useful for evaluating trends and establishing recovery goals. Fish population levels under current and historical habitat conditions were inferred using the EDT model based on habitat characteristics of each stream reach and a synthesis of habitat effects on fish life cycle processes.

Habitat-based assessments were completed in the Coweeman basin for fall Chinook, chum, coho and winter steelhead. Model results indicate an estimated 60- 80% decline in adult productivity for all species compared to historical estimates (Table H-2). Modeled historical adult abundance of coho and chum are more than 5 times that of current estimates (Figure H-4). Current abundance of adult fall Chinook and winter steelhead are approximately half of historical levels (Figure H-4). Diversity (as measured by the diversity index) is estimated to have remained relatively constant for fall Chinook and chum, but has declined for coho and winter steelhead (Table H-2).

Smolt productivity has also declined from historical levels for each species in the Coweeman basin (Table H-2). For fall Chinook and chum, smolt productivity has decreased by 58% and 42%, respectively. For both coho and winter steelhead the decrease was estimated at approximately 76%. Smolt abundance in the Coweeman clearly declines most dramatically for chum and coho, with respective 79% and 82% changes from historical levels. Current fall Chinook and steelhead smolt abundance levels are modeled at approximately half of historical numbers.

Table H-2. Population productivity, abundance, and diversity (of both smolts and adults) based on EDT analysis of current (P or patient) and historical (T or template)[1] habitat conditions.

	Adult Abundance		Adult Productivity		Diversity Index		Smolt Abundance		Smolt Productivity	
Species	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**
Fall Chinook	1,911	3,520	4.2	10.7	1.00	1.00	220,570	396,000	449	1,075
Chum	277	3,217	2.1	10.0	0.97	1.00	132,516	636,146	667	1,152
Coho	931	5,023	2.7	11.1	0.49	0.83	17,612	100,296	52	217
Winter Steelhead	427	895	3.3	14.3	0.76	0.98	7,680	16,160	63	270

[1] Estimate represents historical conditions in the subbasin and current conditions in the mainstem and estuary.

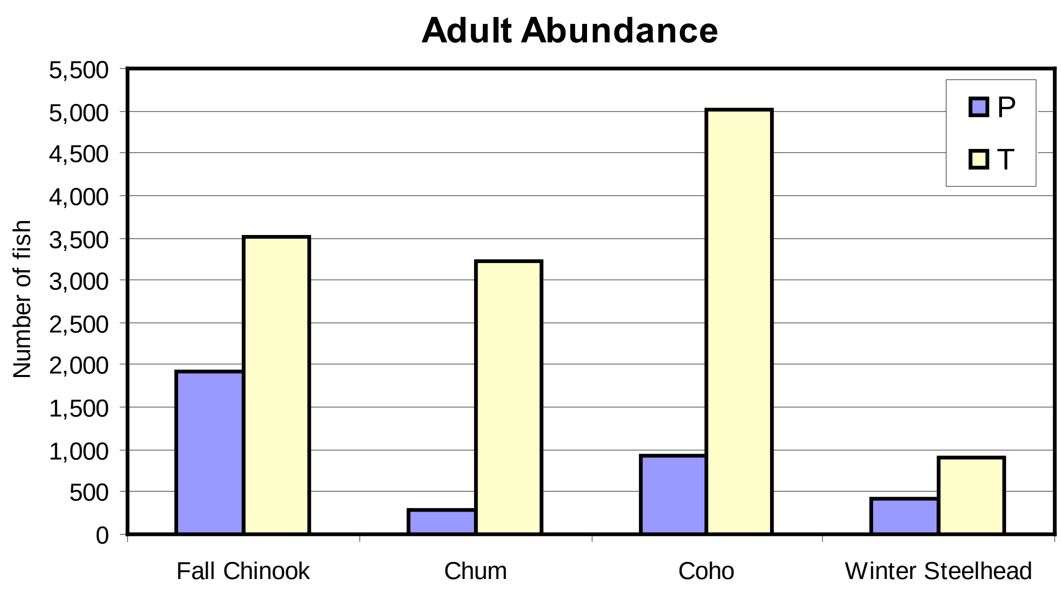


Figure H-4. Adult abundance of Coweeman River fall Chinook, coho, winter steelhead and chum based on EDT analysis of current (P or patient) and historical (T or template) habitat conditions.

Stream Reach Analysis

Habitat conditions and suitability for fish are better in some portions of a subbasin than in others. The reach analysis of the EDT model uses estimates of the difference in projected population performance between current/patient and historical/template habitat conditions to identify core and degraded fish production areas. Core production areas, where habitat degradation would have a large negative impact on the population, are assigned a high value for preservation. Likewise, currently degraded areas that provide significant potential for restoration are assigned a high value for restoration. Collectively, these values are used to prioritize the reaches within a given subbasin.

For the purposes of the EDT model, the Coweeman basin was divided into approximately 80 reaches that are used by salmon and steelhead (Figure H-5). Winter steelhead and coho utilize nearly all of these reaches, whereas fall Chinook and chum use primarily just the mainstem reaches. Reaches 1-4 are low gradient reaches that course through Kelso and the agricultural land upstream of town. Just upstream are the canyon reaches, which are mostly confined. Reaches 5 and up are moderately confined, with forestry, and in some cases residential development, as the primary impacts.

For fall Chinook, high priority reaches include the canyon reaches (Canyon 1-3, Coweeman 4, 5, & 10) (Figure H-6). These mostly show a preservation emphasis but also have restoration value (Figure H-6). Current conditions are poor for chum in the lower mainstem, however, the one high priority reach for chum, Coweeman 4, shows a preservation emphasis (Figure H-7). High priority reaches for coho are located throughout the middle and upper mainstem (Figure H-8). All of these high priority coho reaches show a restoration emphasis.

Winter steelhead reaches with a high priority ranking include upper mainstem reaches as well as reaches in Baird and Goble Creeks (Figure H-9). The upper sections, including the headwaters and the headwater tributaries, represent primary steelhead spawning and rearing areas, while the middle and lower mainstem have rearing but limited spawning potential. Nearly all of these reaches have a combined preservation and restoration emphasis.

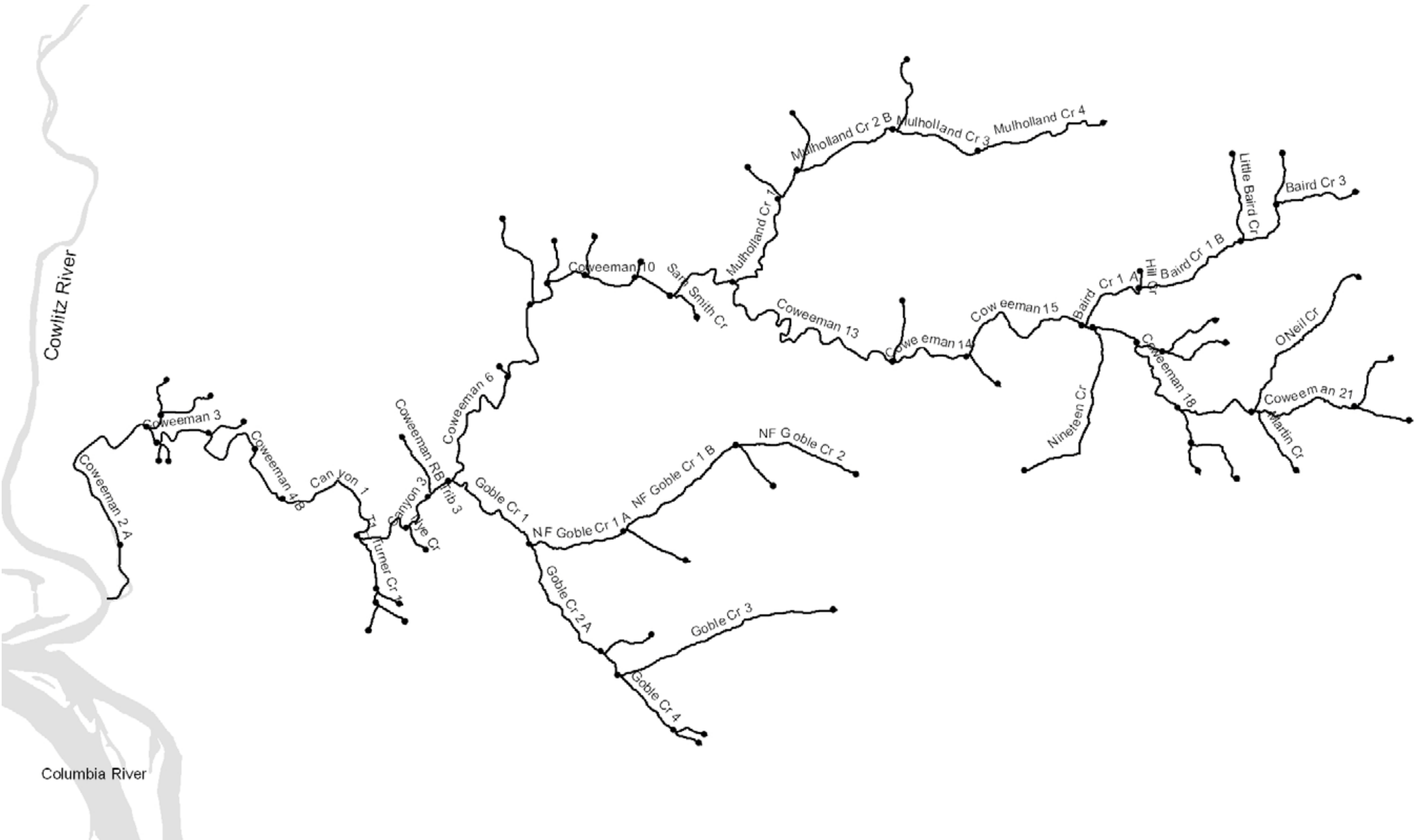


Figure H-5. Coweeman subbasin with EDT reaches identified. For readability, not all reaches are labeled.

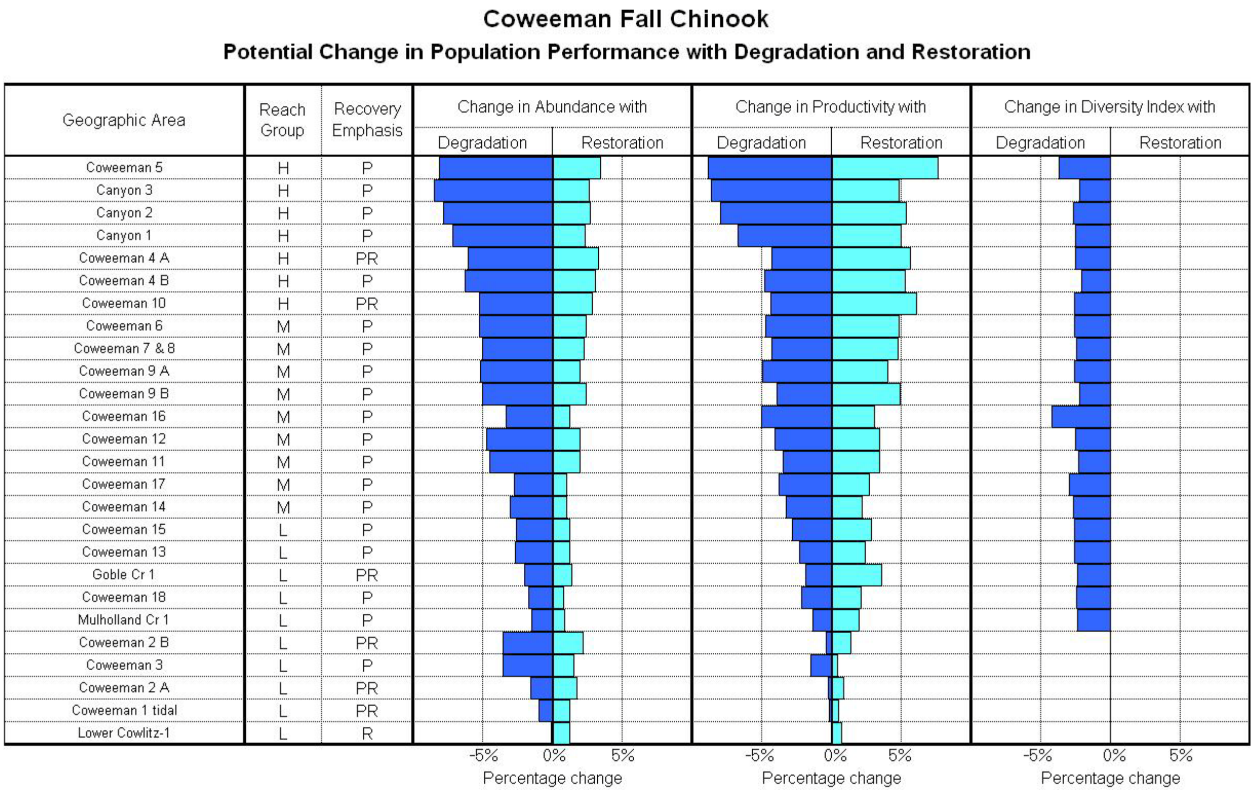


Figure H-6. Coweeman basin fall Chinook ladder diagram. The rungs on the ladder represent the reaches and the three ladders contain a preservation value and restoration potential based on abundance, productivity, and diversity. The units in each rung are the percent change from the current population. For each reach, a reach group designation and recovery emphasis designation is given. Percentage change values are expressed as the change per 1000 meters of stream length within the reach. See Appendix E Chapter 6 for more information on EDT ladder diagrams.

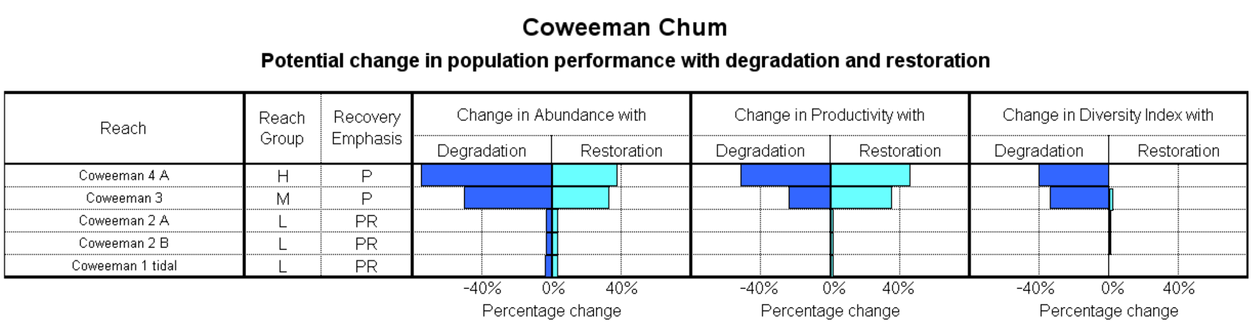


Figure H-7. Coweeman basin chum ladder diagram. The rungs on the ladder represent the reaches and the three ladders contain a preservation value and restoration potential based on abundance, productivity, and diversity. The units in each rung are the percent change from the current population. For each reach, a reach group designation and recovery emphasis designation is given. Percentage change values are expressed as the change per 1000 meters of stream length within the reach. See Appendix E Chapter 6 for more information on EDT ladder diagrams.

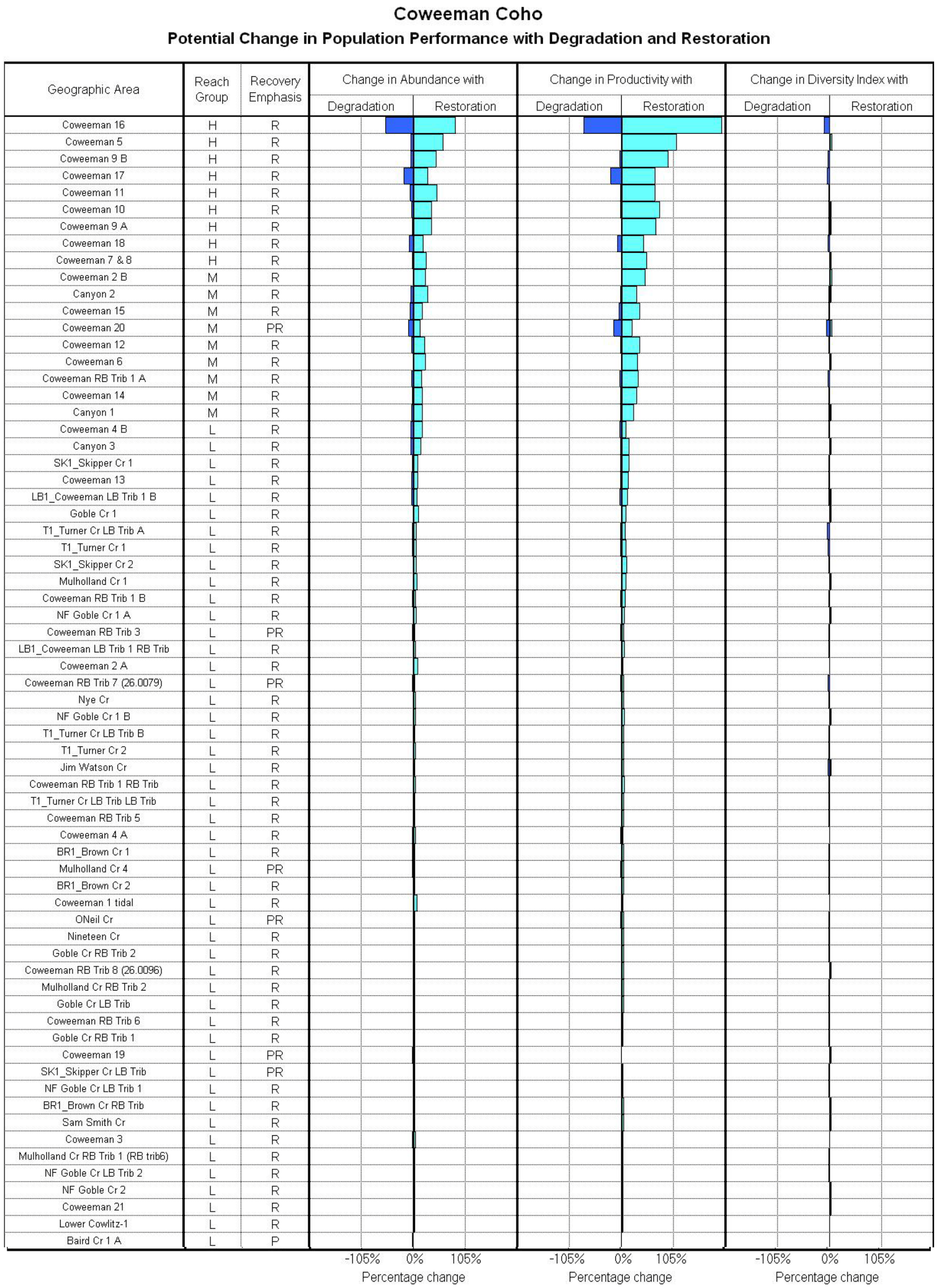


Figure H-8. Coweeman basin coho ladder diagram. Some low priority reaches are not included for display purposes. The rungs on the ladder represent the reaches and the three ladders contain a preservation value and restoration potential based on abundance, productivity, and diversity. The units in each rung are the percent change from the current population. For each reach, a reach group designation and recovery emphasis designation is given. Percentage change values are expressed as the change per 1000 meters of stream length within the reach. See Appendix E Chapter 6 for more information on EDT ladder diagrams.

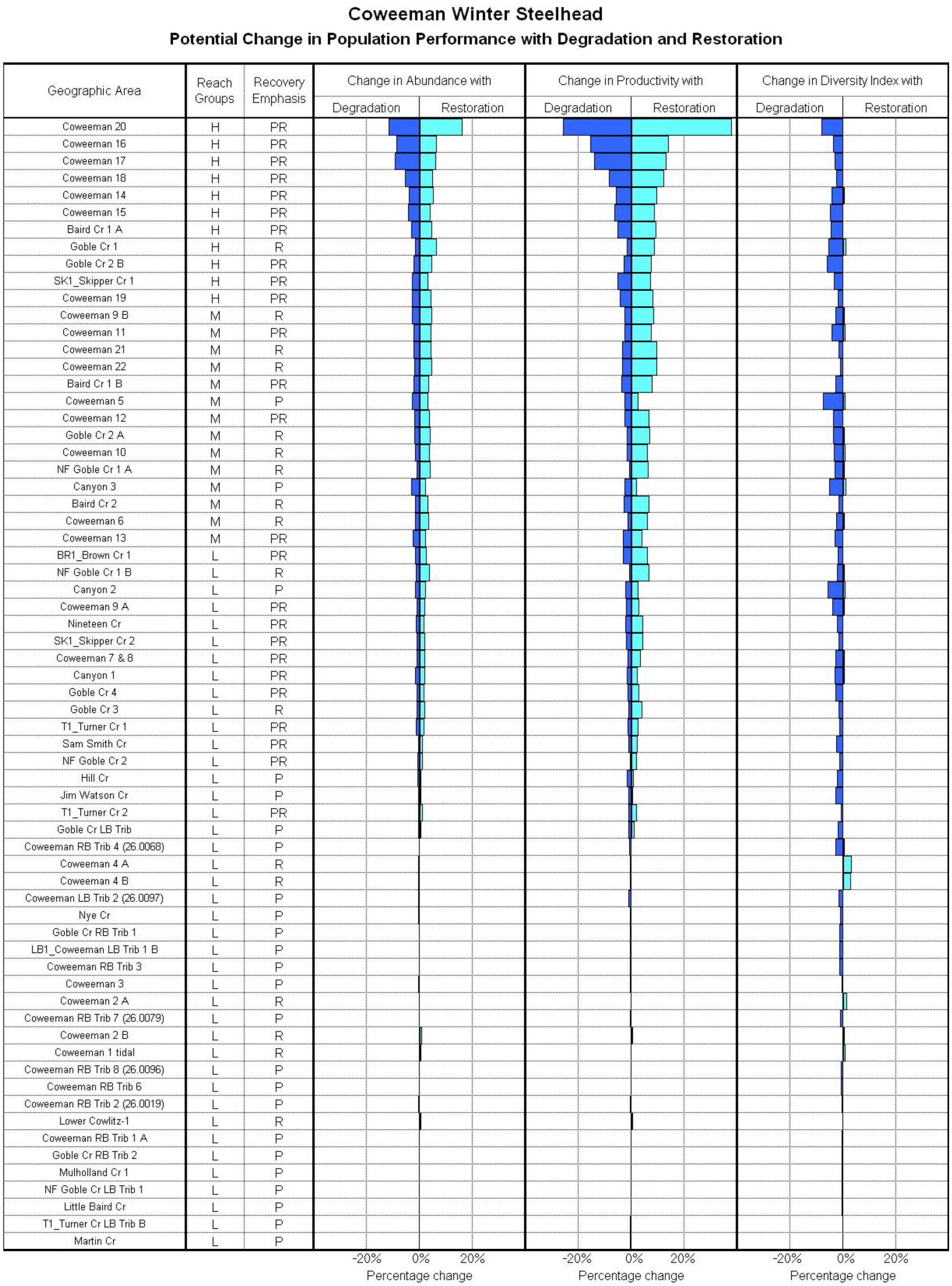


Figure H-9. Coweeman River subbasin winter steelhead ladder diagram. Some low priority reaches are not included for display purposes. The rungs on the ladder represent the reaches and the three ladders contain a preservation value and restoration potential based on abundance, productivity, and diversity. The units in each rung are the percent change from the current population. For each reach, a reach group designation and recovery emphasis designation is given. Percentage change values are expressed as the change per 1000 meters of stream length within the reach. See Appendix E Chapter 6 for more information on EDT ladder diagrams.

Habitat Factor Analysis

The Habitat Factor Analysis of EDT identifies the most important habitat factors affecting fish in each reach. Whereas the EDT reach analysis identifies reaches where changes are likely to significantly affect the fish, the Habitat Factor Analysis identifies specific stream reach conditions that may be modified to produce an effect. Like all EDT analyses, the habitat factor analysis compares current/patient and historical/template habitat conditions. For each reach, EDT generates what is referred to as a "consumer reports diagram", which identifies the degree to which individual habitat factors are acting to suppress population performance. The effect of each habitat factor is identified for each life stage that occurs in the reach and the relative importance of each life stage is indicated. For additional information and examples of this analysis, see Appendix E. Inclusion of the consumer report diagram for each reach is beyond the scope of this document. A summary of the most critical life stages and the habitat factors affecting them are displayed for each species in Table H-3.

Table H-3. Summary of the primary limiting factors affecting life stages of focal salmonid species. Results are summarized from EDT Analysis.

Coweeman Fall Chinook				
most critical	Egg incubation	sediment	channel stability, temperature	
second	Spawning	temperature	habitat diversity	sediment
third	Fry colonization	habitat diversity	flow, key habitat, channel stability	food, sediment
Coweeman Chum				
most critical	Egg incubation	sediment	channel stability	
second	Prespawning holding	habitat diversity, key habitat	flow	
third	Spawning	habitat diversity		
Coweeman Coho				
most critical	Egg incubation	sediment	channel stability	
second	0-age winter rearing	habitat diversity	flow, key habitat	channel stability, food
third	0-age summer rearing	habitat diversity	temperature, key habitat	flow, food
Coweeman Winter Steelhead				
most critical	Egg incubation	sediment	channel stability, temperature	
second	0,1-age winter rearing	habitat diversity	flow	channel stability, sediment, key habitat
third	0-age summer rearing	habitat diversity, temperature	flow, food, pathogens	

The consumer reports diagrams have also been summarized to show the relative importance of habitat factors by reach. The summary figures are referred to as habitat factor analysis diagrams and are displayed for each species below. The reaches are ordered according to their combined restoration and preservation rank. The reach with the greatest potential benefit is listed at the top. The dots represent the relative impact of habitat attributes on reach-level performance.

Restoration priorities for fall Chinook in the middle mainstem include sediment, habitat diversity, temperature, and key habitat (Figure H-11). Flow and channel stability are also important. Sediment in spawning gravels is a major concern and is mostly related to basin forestry activities. Modification of historical channel morphologies as a result of flow, sediment, and riparian changes is reflected in the channel stability attribute and also contributes to loss of key habitat. Riparian conditions in the middle mainstem are poor, with over 75% of riparian cover in early seral or 'other forest' vegetation conditions. The highway, which parallels the river in the upstream portion of this segment, contributes to riparian degradation. In addition, the road network in the middle mainstem subwatershed is extensive, with over 7.5 mi/mi^2. This is one of the most densely roaded forested subwatersheds in the region. Influence from hatchery operations is represented in the pathogen and predation impacts.

Coho in the Coweeman basin are affected by adverse habitat conditions primarily in the middle and upper mainstem reaches (Figure H-12). Habitat diversity, channel stability, key habitat availability, and fine sediment appear to be the habitat factors with the highest impacts on coho. Other contributing factors include temperature and flow. Causes for the observed impacts are similar to those discussed above for fall Chinook and below for winter steelhead.

The top priority restoration area for winter steelhead is the upper mainstem (Figure H-13). These reaches suffer from high impacts related to sediment and key habitat quantity, with moderate impacts from habitat diversity, temperature, channel stability, and flow. These impacts are mostly the result of forestry operations throughout the basin. Sediment and flow problems are related to high road densities and early seral vegetation. Road densities in upper basin subwatersheds range from 4.5 to 6.4 mi/mi^2. Habitat diversity is due to loss of instream LWD. Temperature and channel stability problems are related to loss of riparian forest structure. Over 30% of riparian buffer cover along the upper mainstem is in 'other forest' conditions, which implies shrub-like or grass conditions. Minor predation and pathogen impacts are due to the hatchery steelhead program.

Attributes with a high impact to chum (Figure H-10) are found in the lower reaches and include habitat diversity, key habitat, and sediment, with moderate channel stability, flow, and food effects. Habitat diversity is reduced by a loss of instream LWD and an increase in channel confinement. Sediment accumulates readily in the lower reaches, especially in reaches 3 and 4 as the gradient drops considerably once exiting the canyon. Reaches 1 and 2 have experienced extensive diking in this urban area (Kelso), whereas reaches 3 and 4 are bordered by agricultural lands. Reaches 3 and 4 are fairly unconstrained reaches that have adjacent abandoned oxbows and wetland habitat that may provide good restoration opportunities. Restoration efforts focused on the unconfined reaches 3 and 4 may increase the quality of spawning habitats.

Coweeman Chum

Reach Name	Channel stability	Habitat diversity	Temperature	Predation	Competition (other spp)	Competition (hatchery fish)	Withdrawals	Oxygen	Flow	Sediment	Food	Chemicals	Obstructions	Pathogens	Harassment / poaching	Key habitat quantity
Coweeman 4 A	Moderate	High							Moderate	High	Moderate					High
Coweeman 3	Moderate	High							Moderate	High	Moderate					High
Coweeman 2 A	Low	Low		Low					Low		Low				Low	Low
Coweeman 2 B	Low	Low		Low					Low		Low				Low	Low
Coweeman 1 tidal	Low	Low		Low					Low		Low				Low	Low

High Impact ● Moderate Impact • Low Impact · None Low Positive Impact + Moderate Positve Impact + High Positve Impact +

Figure H-10. Coweeman subbasin chum habitat factor analysis diagram. This chum habitat factor analysis diagram differs from the others in that the dot size represents not only the relative within-reach impact of the habitat attributes, but also the relative contribution of each reach's impact on total population performance. The dots therefore decrease in size towards the bottom of the chart.

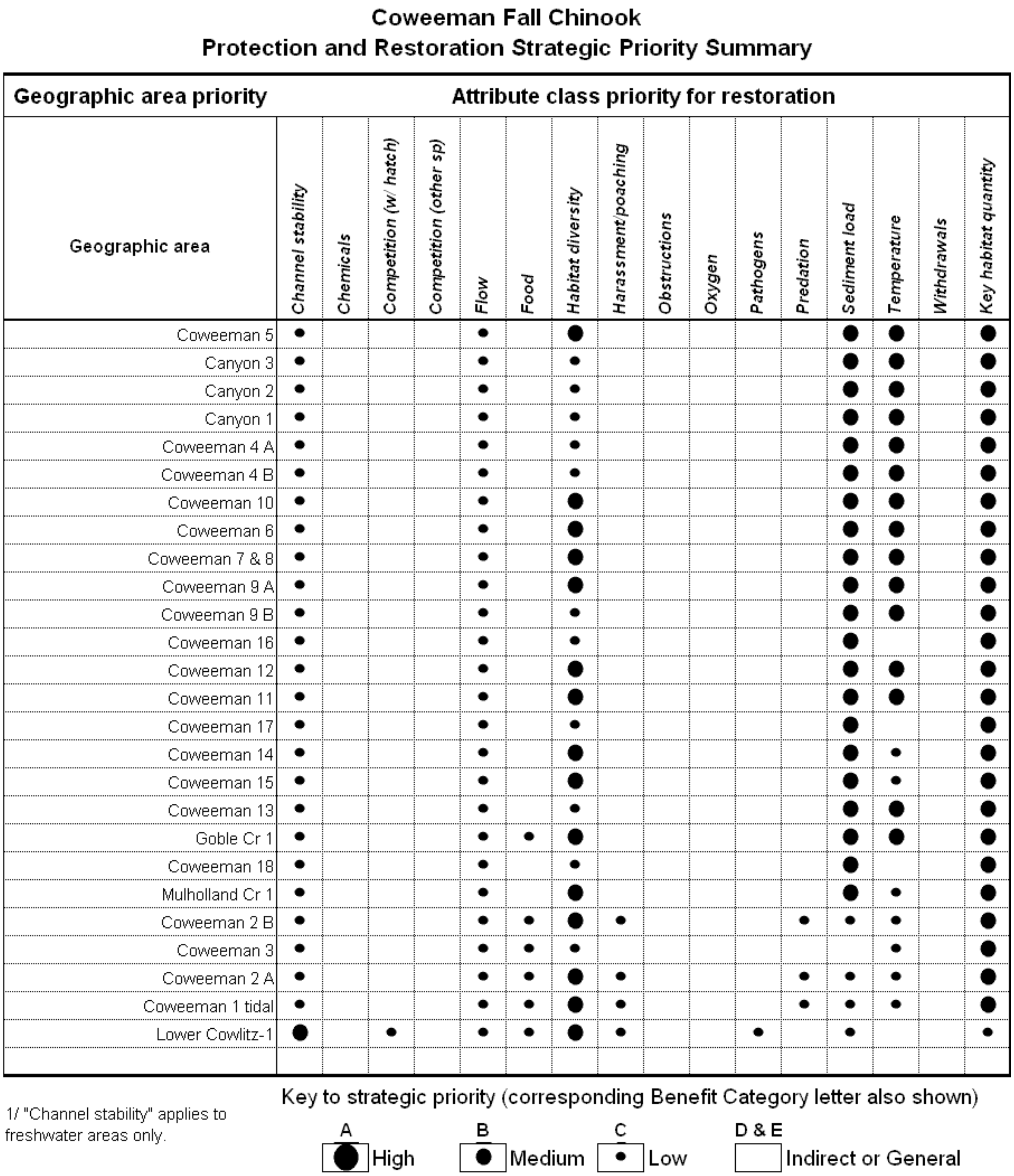


Figure H-11. Coweeman subbasin fall Chinook habitat factor analysis diagram. Diagram displays the relative impact of habitat factors in specific reaches. The reaches are ordered according to their restoration and preservation rank, which factors in their potential benefit to overall population abundance, productivity, and diversity. The reach with the greatest potential benefit is listed at the top. The dots represent the relative impact of habitat attributes on reach-level performance. See Appendix E Chapter 6 for more information on habitat factor analysis diagrams. Some low priority reaches may not be included for display purposes.

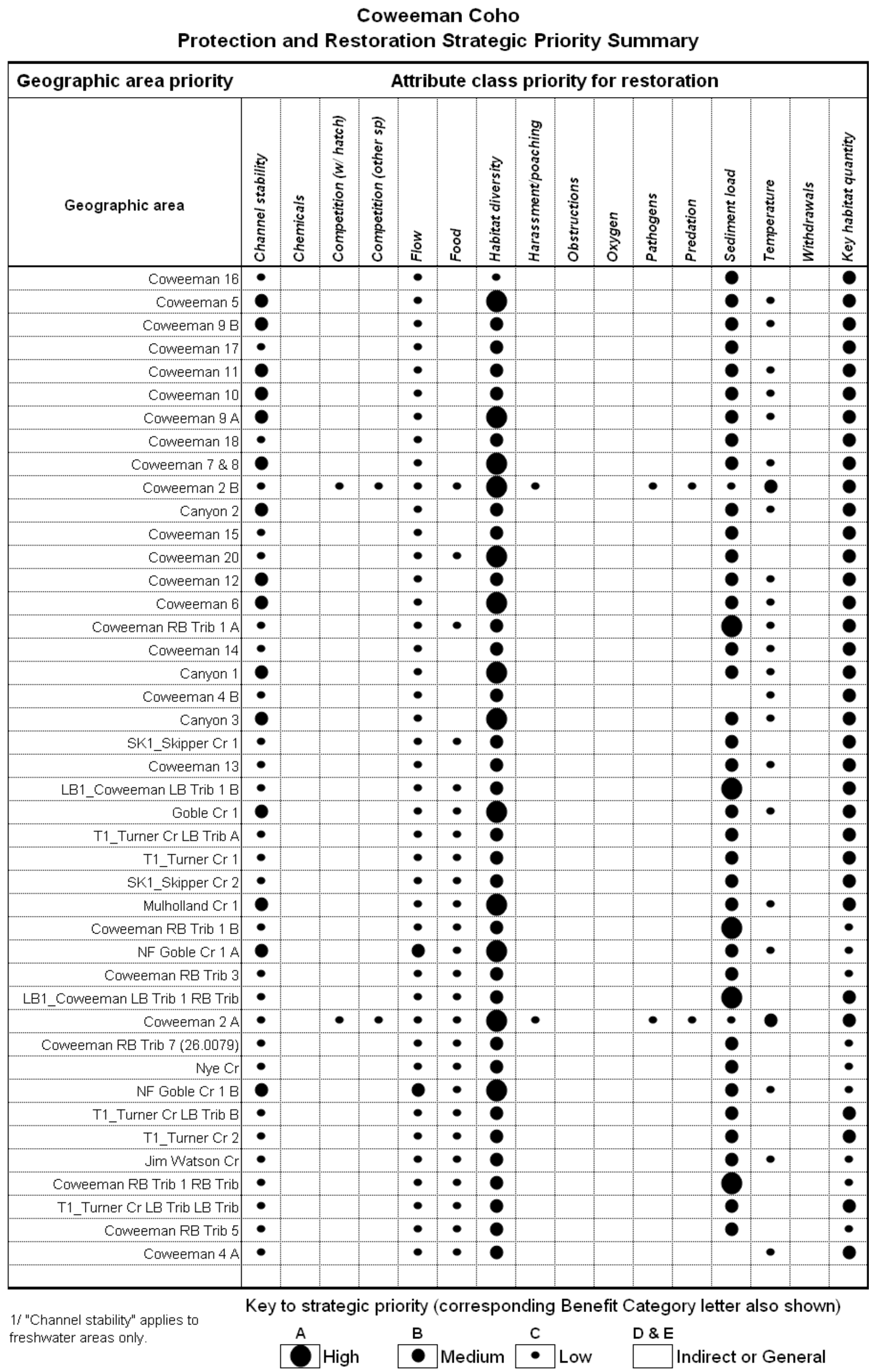


Figure H-12. Coweeman basin coho habitat factor analysis diagram. Some low priority reaches may not be included for display purposes. Diagram displays the relative impact of habitat factors in specific reaches. The reaches are ordered according to their restoration and preservation rank, which factors in their potential benefit to overall population abundance, productivity, and diversity. The reach with the greatest potential benefit is listed at the top. The dots represent the relative impact of habitat attributes on reach-level performance. See Appendix E Chapter 6 for more information on habitat factor analysis diagrams. Some low priority reaches may not be included for display purposes.

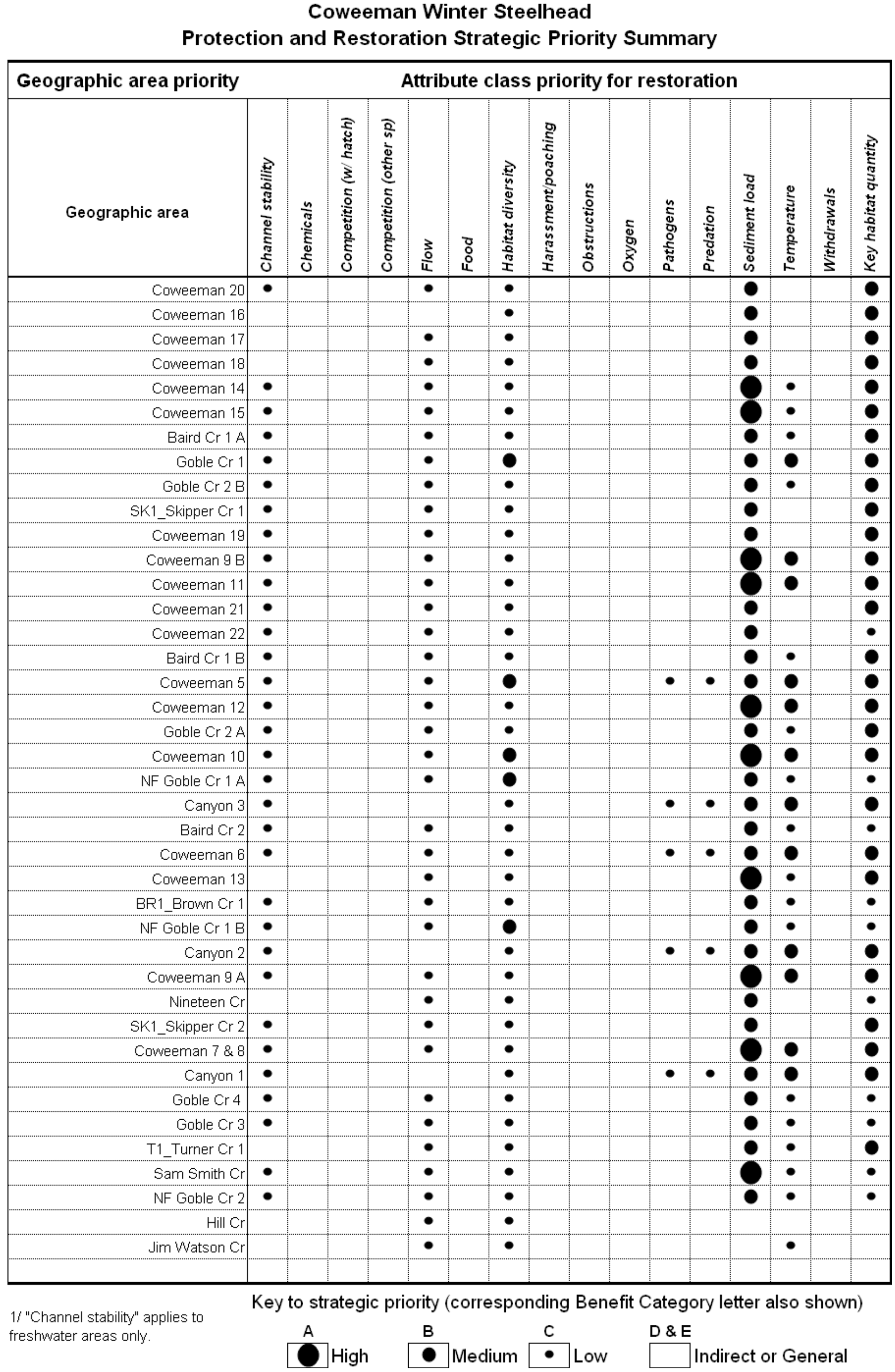


Figure H-13. Coweeman River subbasin winter steelhead habitat factor analysis diagram. Some low priority reaches may not be included for display purposes. Diagram displays the relative impact of habitat factors in specific reaches. The reaches are ordered according to their restoration and preservation rank, which factors in their potential benefit to overall population abundance, productivity, and diversity. The reach with the greatest potential benefit is listed at the top. The dots represent the relative impact of habitat attributes on reach-level performance. See Appendix E Chapter 6 for more information on habitat factor analysis diagrams. Some low priority reaches may not be included for display purposes.

H.4.5. Watershed Process Limitations

This section describes watershed process limitations that contribute to stream habitat conditions significant to focal fish species. Reach level stream habitat conditions are influenced by systemic watershed processes. Limiting factors such as temperature, high and low flows, sediment input, and large woody debris recruitment are often affected by upstream conditions and by contributing landscape factors. Accordingly, restoration of degraded channel habitat may require action outside the targeted reach, often extending into riparian and hillslope (upland) areas that are believed to influence the condition of aquatic habitats.

Watershed process impairments that affect stream habitat conditions were evaluated using a watershed process screening tool termed the Integrated Watershed Assessment (IWA). The IWA is a GIS-based assessment that evaluates watershed impairments at the subwatershed scale (3,000 to 12,000 acres). The tool uses landscape conditions (i.e. road density, impervious surfaces, vegetation, soil erodability, and topography) to identify the level of impairment of 1) riparian function, 2) sediment supply conditions, and 3) hydrology (runoff) conditions. For sediment and hydrology, the level of impairment is determined for local conditions (i.e. within subwatersheds, not including upstream drainage area) and at the watershed level (i.e. integrating the entire drainage area upstream of each subwatershed). See Appendix E for additional information on the IWA.

For the purpose of recovery planning, the Coweeman River watershed has been divided into 18 subwatersheds totaling 129,544 acres. Principal tributaries to the Coweeman River include Goble, Mulholland, Baird, O'Neil, and Butler creeks. Note that three subwatersheds within the watershed, one encompassing Stratton Creek (80201) and the other two Ostrander Creek (80101 and 80102), do not drain to the Coweeman River, but are tributary to the lower mainstem Cowlitz. A reference map showing the location of each subwatershed in the basin is presented in Figure H-14. Maps of the distribution of local and watershed level IWA results are displayed in Figure H-15.

Hydrology

Current Conditions — Viewed at the local scale, most (78%) of the subwatersheds are hydrologically impaired; the rest are moderately impaired. One subwatershed (80303) shifts from impaired to moderately impaired when upstream (i.e., watershed-level) effects are taken into account. This subwatershed is located on the upper Coweeman River mainstem immediately downstream of a cluster of four (hydrologically) moderately impaired subwatersheds. Hydrologic conditions worsen progressively on a downstream gradient. The least impaired subwatersheds (note that none receive a "functional" rating) are situated in the upper Coweeman, Baird Creek, and Mulholland Creek drainages. All of the subwatersheds downstream of the junction of the Coweeman River and Baird Creek are hydrologically impaired.

Most of the upper basin subwatersheds have been extensively logged. Furthermore, several subwatersheds in the upper basin fall within the rain-on-snow zone and present steep aspects, making them more susceptible to hydrologic disturbance.

The lower elevation subwatersheds have been heavily logged and roaded, and in some cases developed for agriculture and residential purposes, resulting in degraded hydrologic (as well as sediment and riparian conditions) throughout. These subwatersheds are also influenced by hydrologic impairments from upstream areas, which further impacts watershed conditions.

Wetlands are an uncommon feature of the Coweeman watershed other than in the lower floodplain areas. Most of the wetlands are found at lower elevations and may be classified as "riverine", that is, in close proximity and hydraulically linked to the active river channel. Subwatershed 80407, located at the mouth of the Coweeman River, contains 67% of the known wetland area delineated in the Coweeman watershed. The frequency and degree of inundation of riverine wetlands is directly linked to water table levels and seepage, channel-floodplain configuration, and streambank heights.

The effects of reduced hydrologic buffering by headwater subwatersheds are apparent. Lower than normal seasonal flows have been recorded in recent years in the lower Coweeman mainstem. Low streamflow conditions during the summer through October period are thought to limit the physical space for juvenile rearing and to reduce travel speeds of migrating Chinook and coho salmon, reducing their growth and survival (WDFW 1990). Caldwell et al. (1999) reported suboptimal flows during the fall spawning period.

Predicted Future Trends — Headwaters subwatersheds with a high percentage of mature forest cover and lower road densities are less likely to be degraded hydrologically than are areas downstream. Nevertheless, timber harvest is likely to occur on these lands over the next 20 years. Roads, already fairly extensive in portions of the upper watershed, will likely increase concomitant with timber extraction. The effect of future forest practices will be mitigated to some degree by road construction and maintenance requirements under the new Forest Practices regulations. Considering these factors, hydrologic conditions in high elevation subwatersheds are expected to remain stable over the next 20 years.

In lower and mid elevation subwatersheds, it is expected that some of the current forestland will be converted to private and commercially developed land. Despite these land-use changes, timber harvest is expected to remain the predominant land use and hydrologic conditions are expected to remain relatively stable. In the lower, floodplain areas of the lower Coweeman River, development is increasing and the development trend is likely to continue. Hydrologic condition is expected to decline in these newly developed areas.

Table H-4. IWA results for the Coweeman River Watershed

Subwatershed[a]	Local Process Conditions[b]			Watershed Level Process Conditions[c]		Upstream Subwatersheds[d]
	Hydrology	Sediment	Riparian	Hydrology	Sediment	
80401	I	M	M	I	M	80301,80302, 80303, 80304, 80305, 80306, 80307, 80404, 80405
80102	I	M	M	I	M	80101, Coweeman
80301	I	M	M	I	M	80302, 80303, 80304, 80305, 80306, 80307
80302	I	M	M	I	M	80306
80303	I	M	M	I	M	80304, 80305, 80307
80304	M	F	M	M	F	none
80305	M	M	M	M	M	none
80307	M	M	M	M	M	80305
80401	I	M	M	I	M	80301,80302, 80303, 80304, 80305, 80306, 80307, 80404, 80405
80402	I	I	I	I	M	80301,80302, 80303, 80304, 80305, 80306, 80307, 80401,80403, 80404, 80405
80403	I	M	M	I	M	80301,80302, 80303, 80304, 80305, 80306, 80307, 80401, 80404, 80405
80405	I	M	M	I	M	80404
80407	I	M	I	I	M	80301,80302, 80303, 80304, 80305, 80306, 80307, 80401,80403, 80404, 80405
80101	I	M	M	I	M	None
80102	I	M	M	I	M	None
80306	M	F	M	M	F	None
80404	I	M	M	I	M	None
80406	I	M	M	I	M	None

[a] *LCFRB subwatershed identification code abbreviation. All codes are 14 digits starting with 170800030#####.*
[b] *IWA results for watershed processes at the subwatershed level (i.e., not considering upstream effects). This information is used to identify areas that are potential sources of degraded conditions for watershed processes, abbreviated as follows: F: Functional, M: Moderately impaired, I: Impaired*
[c] *IWA results for watershed processes at the watershed level (i.e., considering upstream effects). These results integrate the contribution from all upstream subwatersheds to watershed processes and are used to identify the probable condition of these processes in subwatersheds where key reaches are present.*
[d] *Subwatersheds upstream from this subwatershed.*

Figure H-14. Map of the Coweeman Basin showing the location of the IWA subwatersheds.

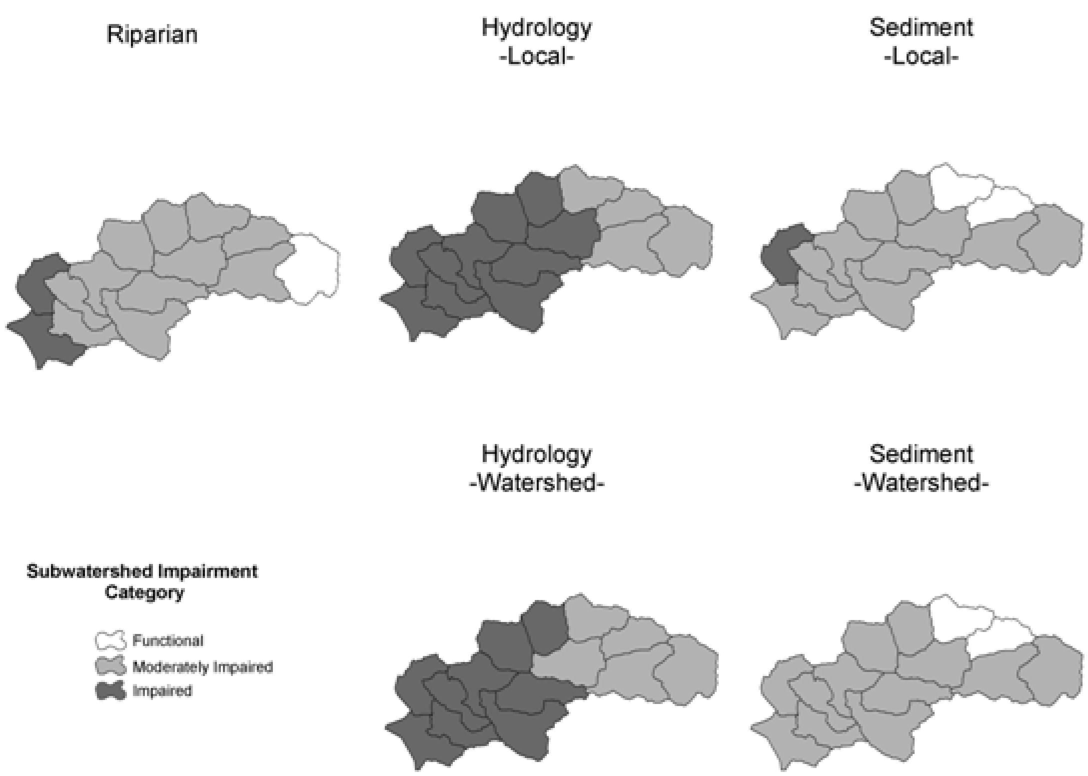


Figure H-15. IWA subwatershed impairment ratings by category for the Coweeman basin

Sediment Supply

Current Conditions— Sediment conditions throughout the Coweeman watershed are generally rated as moderately impaired. Functional conditions (local and watershed level) are found only in the upper subwatersheds of Baird and Mulholland Creeks (80304 and 80306). The one subwatershed found to be locally impaired was 80402, located near the mouth of the Coweeman River.

The underlying geologic material of the upper Coweeman watershed consists primarily of resistant volcanic rocks with local deposits of erodable alluvium. The geology in lower elevation areas of the Coweeman watershed consists of sedimentary/metamorphic rock overlain in many places by a mixture of gravel, sand, and silt alluvial deposits. These materials are highly erodable, particularly in steep terrain. The subwatersheds in this watershed are densely forested, with relatively high proportions of mature coniferous vegetation under natural conditions. Commercial forestry and road building on unstable slopes is the primary cause of human-induced sediment supply impairments.

There is evidence of sediment contribution to the mainstem Coweeman between RMs 17 and 26 (Wade 2000). Sediment delivery to this reach is apparent as turbidity during flood flows and as sediment deposits in slackwater areas after flows recede. Fine sediment accumulations in this reach are thought to limit production of coastal cutthroat, winter steelhead, fall Chinook, and coho.

Predicted Future Trends— Because the majority of the Coweeman watershed is owned and managed by large industrial timber companies, high levels of timber harvests are likely to continue under typical harvest rotation schedules for the foreseeable future. The widespread implementation of improved forestry and road management practices is expected to mitigate timber harvest impacts on sediment supply to stream channels. Given these factors, sediment conditions are predicted to trend stable over the next 20 years.

Riparian Condition

Current Conditions— The index of riparian condition is based on the proportion of streamside vegetation within different vegetation classes. The riparian condition analysis was applied only at the subwatershed level. Dense forests, some of old growth, cover the steep topography of the upper Coweeman drainage. Commercial forestland makes up over 90% of the watershed. Much of the harvestable timber has been cut at some point in the past, resulting in a patchwork of logged and unlogged areas intersected by logging roads. Areas logged in the past currently comprise immature stands of young coniferous and/or deciduous vegetation.

Riparian conditions in the Coweeman River watershed are generally rated as moderately impaired, although two of the 18 subwatersheds are rated as fully impaired. Both are the most downstream areas of the watershed and encompass development around the cities of Kelso and Longview. The lower four miles of the Coweeman (80407) are tidally influenced and contain riparian habitats of low quality due to extensive channelization and bank modifications. The Coweeman headwaters (80305) is the only subwatershed rated as functional for riparian conditions.

Predicted Future Trends— Riparian systems are considered highly vulnerable to human-caused disturbance (Naiman et al. 1993). Land uses alter riparian systems and associated processes in ways that can profoundly alter aquatic and riparian habitat (Montgomery and Buffington 1993). Because riparian systems influence the structure and function of small streams more than large streams, their condition in headwater areas is critical to watershed health.

Riparian conditions were assessed using the subwatershed-level IWA metrics in conjunction with additional landscape scale data. As noted previously, the majority of Coweeman subwatersheds were rated as moderately impaired, with two subwatersheds in the developed areas of the lower watershed rated as fully impaired. There is only one subwatershed rated as functional, located in the Coweeman headwaters.

Based on future trend data, riparian conditions are likely to remain stable with a trend towards gradual improvment in the upper watershed. However, the re-establishment of native vegetation in the middle and upper watershed may be hampered by degraded hydrologic conditions. In contrast, conditions are likely to degrade further in more downstream subwatersheds as development pressures expand. In these low-lying areas, encroachment and riparian degradation resulting from construction of roads, stream crossings, and buildings is expected to increase over time.

The most impaired ratings are found in the estuary and lower river (30406, 30401), where the majority of the mainstem has been channelized through diking and most side-channel habitat has been lost. The presence of dikes and other channel revetments reduces the potential for riparian recovery. However, conservation easements and other public-private partnerships (such as those already being developed by the Columbia Trust) offer some promise that floodplain dynamics and riparian conditions in this estuarine area may improve over the next 20 years.

H.4.6. Other Factors and Limitations

Hatcheries

Hatcheries currently release over 50 million salmon and steelhead per year in Washington lower Columbia River subbasins. Many of these fish are released to mitigate for loss of habitat. Hatcheries can provide valuable mitigation and conservation benefits but may also cause significant adverse impacts if not prudently and properly employed. Risks to wild fish include genetic deterioration, reduced fitness and survival, ecological effects such as competition or predation, facility effects on passage and water quality, mixed stock fishery effects, and confounding the accuracy of wild population status estimates. This section describes hatchery programs in the Coweeman Basin and discusses their potential effects.

There are no hatcheries operating in the Coweeman Basin. A rearing pond on the Coweeman is used to acclimate winter steelhead transfers from the Elochoman Hatchery as pre-smolts. The winter steelhead program provides for harvest opportunity in the Coweeman River. Elochoman Hatchery early timed winter steelhead are a composite stock and are genetically different from the naturally produced steelhead in the Coweeman. The main threats from hatchery steelhead are potential domestication of the naturally produced steelhead as a result of adult interactions or ecological interactions between natural juvenile salmon and hatchery released juvenile steelhead.

Table H-5. Current Coweeman subbasin hatchery production.

Hatchery	Release Location	Winter Steelhead
Elochoman	Coweeman	20,000

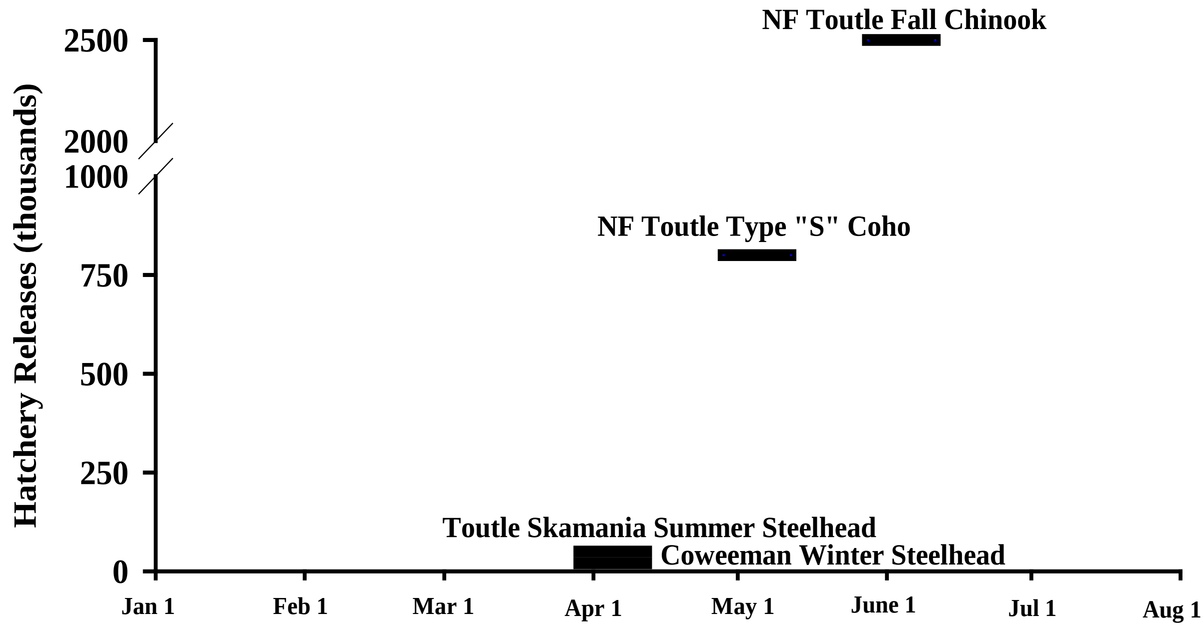


Figure H-16. **Magnitude and timing of hatchery releases in the Toutle and Coweeman River basins by species, based on 2003 brood production goals.**

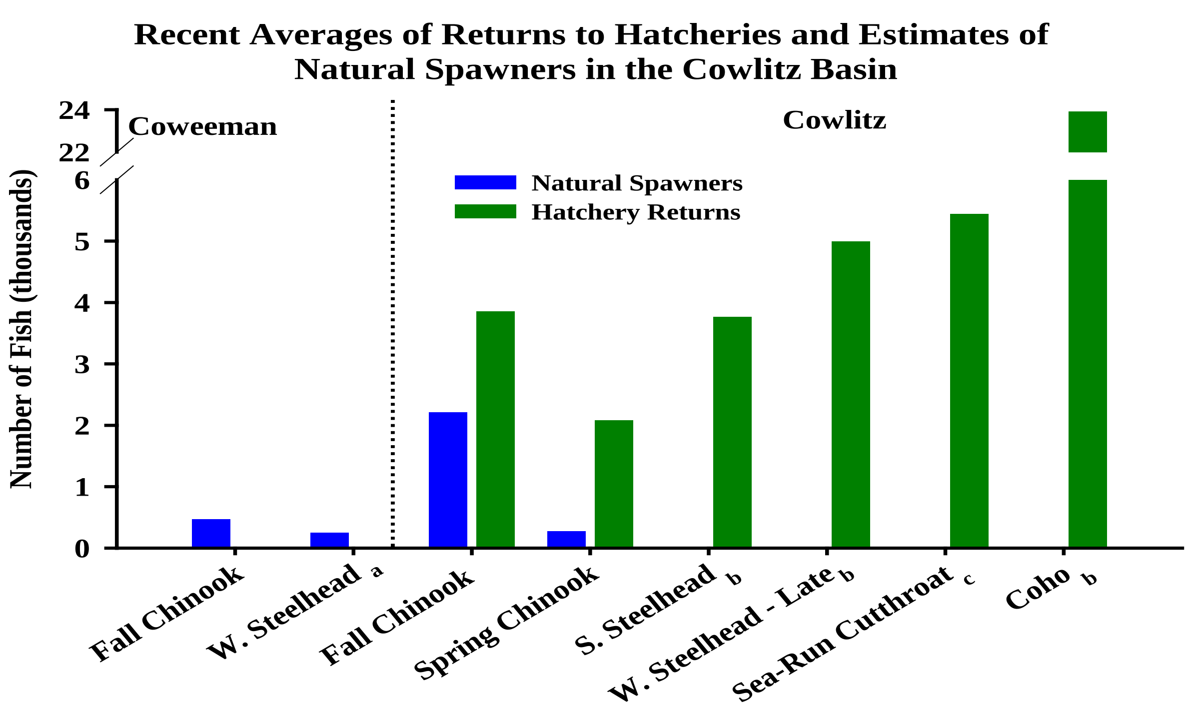


Figure H-17. **Recent average hatchery returns and estimates of natural spawning escapement in the Coweeman and Cowlitz River basins by species. The years used to calculate averages varied by species, based on available data. The data used to calculate average hatchery returns and natural escapement for a particular species and basin were derived from the same years in all cases. All data were from 1992 to the present. Calculation of each average utilized a minimum of 5 years of data, except for Grays chum (1998–2000) and Grays winter steelhead (1998 and 2000).**

Biological Risk Assessment: The evaluation of hatchery programs and implementation of hatchery reform in the Lower Columbia is occurring through several processes. These include: 1) the LCFRB recovery planning process; 2) Hatchery Genetic Management Plan (HGMP) preparation for ESA permitting; 3) FERC related plans on the Cowlitz River and Lewis River; 4) the federally mandated Artificial Production Review and Evaluation (APRE) process, and 5) the congressionally mandated, Hatchery Scientific Review Group (HSRG) review of all state, tribal and federal hatchery programs in Puget Sound and Coastal Washington, and in the Columbia River Basin. Through each of these processes, WDFW is applying a consistent framework to identify the hatchery program enhancements that will maximize fishing-related economic benefits and promote attainment of regional recovery goals. Developing hatcheries into an integrated, productive, stock recovery tool requires a policy framework for considering the acceptable risks of artificial propagation, and a scientific assessment of the benefits and risks of each proposed hatchery program.

WDFW completed a Benefit-Risk Assessment Procedure (BRAP) in 2004 to provide a framework for considerations of hatchery reforms consistent with the Recovery Plan. The BRAP evaluates hatchery programs in the ecological context of the watershed, with integrated assessment and decisions for hatcheries, harvest, and habitat. The risk assessment procedure consists of five basic steps, grouped into two blocks. A policy framework assesses population status of wild populations, develops risk tolerance profiles for all stock conditions, and assign risk tolerance profiles to all stocks. A risk assessment characterizes risk assessments for each hatchery program and identifies appropriate management actions to reduce risk.

Table H-6 identifies hazards levels associated with risks involved with hatchery programs in the Coweeman Basin. Table H-7 identifies preliminary strategies proposed to address risks identified in the BRAP for the same populations. The BRAP risk assessments and strategies to reduce risk have been key in providing the biological context to develop the hatchery recovery measures for lower Columbia River sub-basins.

The regional Hatchery Scientific Review Group (HSRG) completed an assessment of lower Columbia River hatcheries in 2009 (http://www.hatcheryreform.us/mfs/welcome_show.action). The HSRG is the independent scientific review panel of the Pacific Northwest Hatchery Reform Project established by Congress in 2000 in recognition that while hatcheries play a legitimate role in meeting harvest and conservation goals for Pacific Northwest salmon and steelhead, the hatchery system was in need of comprehensive reform. The HSRG has reviewed all state, tribal and federal hatchery programs in Puget Sound, Coastal Washington, and the Columbia River Basin. The HSRG concluded that hatcheries play an important role in the management of salmon and steelhead populations in the Columbia River Basin but that hatchery programs must be viewed not as surrogates or replacements for lost habitat, but as tools that can be managed as part of a coordinated strategy to meet watershed or regional resource goals, in concert with actions affecting habitat, harvest rates, water allocation and other important components of the human environment. The HSRG reached several critical, overarching conclusions regarding areas where current hatchery and harvest practices need to be reformed. Recommendation included:

- Manage hatchery broodstocks to achieve proper genetic integration with, or segregation from, natural populations;
- Promote of local adaptation of natural and hatchery populations;
- Minimize adverse ecological interactions between hatchery- and natural-origin fish;
- Minimize effects of hatchery facilities on the ecosystem in which they operate; and
- Maximize the survival of hatchery fish.

Table H-6. Preliminary BRAP for hatchery programs affecting populations in the Coweeman River Basin.

Symbol	Description
○	Risk of hazard consistent with current risk tolerance profile.
?	Magnitude of risk associated with hazard unknown.
●	Risk of hazard exceeds current risk tolerance profile.
(grey shading)	Hazard not relevant to population

Coweeman Population	Hatchery Program: Name	Release (millions)	Genetic: Effective Population Size	Genetic: Domestication	Genetic: Diversity	Ecological: Predation	Ecological: Competition	Ecological: Disease	Demographic: Survival Rate	Demographic: Reproductive Success	Facility: Catastrophic Loss	Facility: Passage	Facility: Screening	Facility: Water Quality
Fall Chinook	Coweeman Early W. Sthd. Acc.	0.005				?	?	○				○	○	○
	Coweeman Early W. Sthd.	0.015				?	?	○				○	○	○
Winter Steelhead	Coweeman Early W. Sthd. Acc.	0.005	○	○	?	?	?	○				○	○	○
	Coweeman Early W. Sthd.	0.015	○	○	?	?	?	○				○	○	○

Table H-7. Preliminary strategies proposed to address risks identified in the BRAP for Coweeman River Basin populations.

Coweeman Population	Hatchery Program: Name	Release (millions)	Address Genetic Risks: Mating Procedure	Address Genetic Risks: Integrated Program	Address Genetic Risks: Segregated Program	Address Genetic Risks: Research/ Monitoring	Address Genetic Risks: Broodstock Source	Address Ecological Risks: Number Released	Address Ecological Risks: Release Procedure	Address Ecological Risks: Disease Containment	Address Ecological Risks: Research/ Monitoring	Address Demographic Risks: Culture Procedure	Address Demographic Risks: Research/ Monitoring	Address Facility Risks: Reliability	Address Facility Risks: Improve Passage	Address Facility Risks: Improve Screening	Address Facility Risks: Pollution Abateme
Fall Chinook	Early W. Steelhead Acclimated	0.005						●	●		●						
	Early W. Steelhead 1+	0.015						●	●		●						

The HSRG developed a series of criteria for evaluating hatchery influence on wild populations based on Population Viability objectives identified in the Recovery Plan. Criteria are based on the proportion of effective hatchery-origin spawners (pHOS), the proportion of natural-origin adults in the broodstock (pNOB), and the proportionate natural influences (PNI) which is a product of pHOS and pNOB.

For Primary populations:

- pHOS should be less than 5% of the naturally spawning population, unless the hatchery population is integrated with the natural population.
- For integrated populations, pNOB should exceed pHOS by at least a factor of two, corresponding to a PNI (proportionate natural influence) value of 0.67 or greater and pHOS should be less than 0.30.

For Contributing populations:

- The proportion of effective hatchery-origin spawners (pHOS) should be less than 10% of the naturally spawning population, unless the hatchery population is integrated with the natural population.
- For integrated populations, pNOB should exceed pHOS, corresponding to a PNI value of 0.50 or greater and pHOS should be less than 0.30.

For Stabilizing populations:

- The current operating conditions were considered adequate to meet conservation goals. No criteria were developed for proportion of effective hatchery-origin spawners (pHOS) or PNI.

Evaluations of current hatchery programs relative to population recovery objectives and hatchery criteria led the HSRG to provide detailed recommendations for reform of specific hatchery programs for each species and programs. General recommendations are summarized below for each species. More specific recommendations for each hatchery program are detailed, along with analyses of alternatives, in the HSRG report (http://www.hatcheryreform.us/mfs/welcome_show.action). These recommendations inform the hatchery actions identified for this subbasin and hatchery reform implementation planning reflected in WDFW's Conservation and Sustainable Fisheries plans under current development.

For Chinook, the HSRG concluded that a major concern with these programs is the effect hatchery strays have on the long-term fitness of naturally spawning populations. Although programs provide significant harvest benefits, and in some cases, help preserve genetic resources in the ESU, there are many poorly segregated and poorly integrated programs. HSRG recommendations for Chinook hatchery reform included:

- In segregated programs, improve the ability to control hatchery fish on the spawning grounds so that harvest benefits can be maintained while improving natural-origin spawning abundance and productivity for instance, by installing weirs in specific drainages where straying limits the ability to meet conservation goals.
- Move production from some tributaries into larger segregated harvest programs in Select Area Fishery Evaluation areas, where excess hatchery fish can be removed by applying higher harvest rates.
- Reduce reliance of some programs on imported out-of-basin broodstock or rearing to improve homing and increase productivity.
- For integrated programs, increase the proportion of natural-origin fish used in hatchery broodstock and control the contribution of hatchery-origin fish to natural spawning areas. In some cases, meeting the criteria for the population designation requires reducing program size.

For coho, the HSRG concluded that a major concern with these programs is the effect hatchery strays have on the long-term fitness of naturally spawning populations. These programs provide significant harvest benefits, and in some cases, help preserve genetic resources in the ESU. However, the ESU is dominated by many poorly segregated and a few poorly integrated programs. HSRG recommendations for coho hatchery reform included:

- In segregated programs, improve the ability to control hatchery fish on the spawning grounds so that harvest benefits can be maintained while improving natural-origin spawning abundance and productivity for instance, by installing weirs in specific drainages where straying limits the ability to meet conservation goals.
- Move production from some tributaries into larger segregated harvest programs in Select Area Fishery Evaluation areas, where excess hatchery fish can be removed by applying higher harvest rates.
- For integrated programs, increase the proportion of natural-origin fish used in hatchery broodstock and control the contribution of hatchery-origin fish to natural spawning areas. In some cases, meeting the criteria for the population designation requires reducing program size.
- In some cases, harvest benefits could be maintained and conservation improved by developing highly integrated conservation programs with associated segregated harvest programs (stepping-stone programs).

- More emphasis on monitoring and evaluation programs to accurately estimate straying is also recommended.

For chum, the HSRG concluded that hatchery intervention can reduce demographic risk by boosting abundance and additional conservation propagation programs should be promptly initiated within each of the ESU's three geographic strata to reduce this risk. The HSRG had no recommendations to improve on single existing chum program (Grays River) and recommends its continued operation as an important safety net in the lower Columbia.

For steelhead, the HSRG concluded that all populations in this DPS meet or exceed the HSRG criteria for their population designation. No recommendations to change programs were made by the HSRG. However, due to uncertainty about the number of unharvested hatchery-origin fish from segregated programs that remain in the natural environment, the HSRG identified a need for additional monitoring to further clarify these values and to aid in assessing the ecological impacts to the natural populations.

Subbasin Specific Recommendations: The HSRG provided subbasin and population specific advice. For the Coweeman subbasin, the following recommendations were made:

Coweeman River – Fall Chinook

The HSRG observed that there is a low proportion of hatchery strays in the natural spawning escapement and recommends:

- Continue to manage the population for natural production
- Monitoring to assure that the influence of other hatchery populations is consistent with its primary population designation

Coweeman River – Coho

The HSRG observed that this population appears to be productive and abundant. Recommendations include:

- Monitor the contribution of hatchery strays in spawning escapement
- Review RSI projects and manage consistent with the Primary population designation
- Include returns from RSI projects when considering the pHOS for the population

Coweeman River – Winter Steelhead

The HSRG observed that smolts are outplanted from the Elochoman Hatchery into the Coweeman River every year. Although the population meets Primary standards, the HSRG noted the ecological effect of these fish on an ESA-listed species. The HSRG further recommends:

- Consider either eliminating the current segregated program and designating the stream a "Wild Steelhead Management Zone" or developing an integrated program (which would require facilities to capture natural brood).

Impacts: Impacts of hatchery fish on local wild populations are estimated in this plan, for the purposes of comparison with the relative magnitude of other factors, based on hatchery fractions and assumed fitness effects estimated by the HSRG. Detailed explanations of these impact estimates may be found in Volume I, Chapter 3 of this Recovery Plan.

Harvest

Fishing generally affects salmon populations through directed and incidental harvest, catch and release mortality, and size, age, and run timing alterations because of uneven fishing on different run components. From a population biology perspective, this causes reduced spawners and can alter age, size, run timing, fecundity, and genetic characteristics. Fewer spawners result in fewer eggs for future generations and diminish marine-derived nutrients delivered via dying adults, now known to be significant to the growth and survival of juvenile salmon in aquatic ecosystems. The degree to which harvest-related limiting factors influence productivity varies by species and location.

Most harvest of wild Columbia River salmon and steelhead occurs incidental to the harvest of hatchery fish and healthy wild stocks in the Columbia estuary, mainstem, and ocean. Fish are caught in the Canada/Alaska ocean, U.S. West Coast ocean, lower Columbia River commercial and recreational, tributary recreational, and in-river treaty Indian (including commercial, ceremonial, and subsistence) fisheries. Total exploitation rates have decreased for lower Columbia salmon and steelhead, especially since the 1970s as increasingly stringent protection measures were adopted for declining natural populations.

At the time of interim plan completion, fishing impact rates on lower Columbia River naturally-spawning salmon populations ranges from 2.5% for chum salmon to 45% for tule fall Chinook (Table H-89). These rates include estimates of direct harvest mortality as well as estimates of incidental mortality in catch and release fisheries. Fishery impact rates for hatchery produced chum, coho, and steelhead are higher than for naturally-spawning fish of the same species because of selective fishing regulations. These rates generally reflect recent year (2001-2003) fishery regulations and quotas controlled by weak stock impact limits and annual abundance of healthy targeted fish. Actual harvest rates will vary for each year dependent on annual stock status of multiple west coast salmon populations, however, these rates generally reflect expected impacts of harvest on lower Columbia naturally-spawning and hatchery salmon and steelhead under current harvest management plans.

Table H-8. Approximate annual exploitation rates (% harvested) for naturally-spawning lower Columbia salmon and steelhead under current management controls (represents 2001-2003 fishing period).

	AK./Can. Ocean	West Coast Ocean	Col. R. Comm.	Col. R. Sport	Trib. Sport	Wild Total	Hatchery Total	Historic Highs
Fall Chinook (Tule)	15	15	5	5	5	45	45	80
Fall Chinook (Bright)	19	3	6	2	10	40	Na	65
Chum	0	0	1.5	0	1	2.5	2.5	60
Coho	<1	9	6	2	1	18	51	85
Steelhead	0	<1	3	0.5	5	8.5	70	75

Columbia River fall Chinook are subject to freshwater and ocean fisheries from Alaska to their rivers of origin in fisheries targeting abundant Chinook stocks originating from Alaska, Canada, Washington, Oregon, and California. Columbia tule fall Chinook harvest is constrained by a Recovery Exploitation Rate (RER) developed by NMFS for management of Coweeman naturally-spawning fall Chinook. Some tributary sport fisheries (like the Coweeman) are closed to the retention of Chinook to protect wild Chinook populations. Harvest of lower Columbia bright wild fall Chinook is managed to achieve an escapement goal of 5,700 natural spawners in the North Fork Lewis.

Rates are very low for chum salmon, which are not encountered by ocean fisheries and return to freshwater in late fall when significant Columbia River commercial fisheries no longer occur. Chum are no longer targeted in Columbia commercial seasons and retention of chum is prohibited in Columbia River and Coweeman River sport fisheries. Chum are impacted incidental to fisheries directed at coho and winter steelhead.

Harvest of Coweeman coho occurs in the ocean commercial and recreational fisheries off the Washington and Oregon coasts and Columbia River as well as recreational fisheries in the Coweeman Basin. Wild coho impacts are limited by fishery management to retain marked hatchery fish and release unmarked wild fish.

Steelhead, like chum, are not encountered by ocean fisheries and non-Indian commercial steelhead fisheries are prohibited in the Columbia River. Incidental mortality of steelhead occurs in freshwater commercial fisheries directed at Chinook and coho and freshwater sport fisheries directed at hatchery steelhead and salmon. All recreational fisheries are managed to selectively harvest fin-marked hatchery steelhead and commercial fisheries cannot retain hatchery or wild steelhead.

Access to harvestable surpluses of strong stocks in the Columbia River and ocean is regulated by impact limits on weak populations mixed with the strong. Weak stock management of Columbia River fisheries became increasingly prevalent in the 1960s and 1970s in response to continuing declines of upriver runs affected by mainstem dam construction. In the 1980s coordinated ocean and freshwater weak stock management commenced. More fishery restrictions followed ESA listings in the 1990s. Each fishery is controlled by a series of regulating factors. Many of the regulating factors that affect harvest impacts on Columbia River stocks are associated with treaties, laws, policies, or guidelines established for the management of other stocks or combined stocks, but indirectly control impacts of Columbia River fish as well. Listed fish generally comprise a small percentage of the total fish caught by any fishery. Every listed fish may correspond to tens, hundreds, or thousands of other stocks in the total catch. As a result of weak stock constraints, surpluses of hatchery and strong naturally-spawning runs often go unharvested. Small reductions in fishing rates on listed populations can translate to large reductions in catch of other stocks and recreational trips to communities which provide access to fishing, resulting in significant economic consequences to those communities.

Selective fisheries for adipose fin-clipped hatchery spring Chinook (since 2001), coho (since 1999), and steelhead (since 1984) have substantially reduced fishing mortality rates for naturally-spawning populations and allowed concentration of fisheries on abundant hatchery fish. Selective fisheries occur in the Columbia River and tributaries, for spring Chinook and steelhead, and in the ocean, Columbia River, and tributaries for coho. Columbia River hatchery fall Chinook are not marked for selective fisheries, but likely will be in the future because of recent legislation enacted by Congress.

Mainstem and Estuary Habitat

Conditions in the Columbia River mainstem, estuary, and plume affect all anadromous salmonid populations within the Columbia Basin. Juvenile and adult salmon may be found in the mainstem and estuary at all times of the year, as different species, life history strategies and size classes continually rear or move through these waters. A variety of human activities in the mainstem and estuary have decreased both the quantity and quality of habitat used by juvenile salmonids. These include floodplain development; loss of side channel habitat, wetlands and marshes; and alteration of flows due to upstream hydro operations and irrigation withdrawals.

Effects on salmonids of habitat changes in the mainstem and estuary are complex and poorly understood. Effects are similar for Coweeman populations to those of most other subbasin salmonid populations. Effects are likely to be greater for chum and fall Chinook which rear for extended periods in the mainstem and estuary than for steelhead and coho which move through more quickly. Estimates of the impacts of human-caused changes in mainstem and estuary habitat conditions are available based on changes in river flow, temperature, and predation as represented by EDT analyses for the NPCC Multispecies Framework Approach (Marcot et al. 2002). These estimates generally translate into a 10-60% reduction in salmonid productivity depending on species (Appendix E). Estuary effects are described more fully in the estuary subbasin volume of this plan (Volume II-A).

Hydropower Construction and Operation

There are no hydro-electric dams in the Coweeman River Basin. However, Coweeman species are affected by changes in Columbia River mainstem and estuary related to Columbia basin hydropower development and operation. The mainstem Columbia River and estuary provide important habitats for anadromous species during juvenile and adult migrations between spawning and rearing streams and the ocean where they grow and mature. These habitats are particularly important for fall Chinook and chum, which rear extensively in the Columbia mainstem and estuary. Aquatic habitats have been fundamentally altered throughout the Columbia River basin by the construction and operation of a complex of tributary and mainstem dams and reservoirs for power generation, navigation, and flood control.

The hydropower infrastructure and flow regulation affects adult migration, juvenile migration, mainstem spawning success, estuarine rearing, water temperature, water clarity, gas supersaturation, and predation. Dams block or impede passage of anadromous juveniles and adults. Columbia River spring flows are greatly reduced from historical levels as water is stored for power generation and irrigation, while summer and winter flows have increased. These flow changes affect juvenile and adult migration, and have radically altered habitat forming processes. Flow regulation and reservoir construction have increased average water temperature in the Columbia River mainstem and summer temperatures regularly exceed optimums for salmon. Supersaturation of water with atmospheric gases, primarily nitrogen, when water is spilled over high dams causes gas bubble disease. Predation by fish, bird, and marine mammals has been exacerbated by habitat changes. The net effect of these direct and indirect effects is difficult to quantify but is expected to be less significant for populations originating from lower Columbia River subbasins than for upriver salmonid populations. Additional information on hydropower effects can be found in Volume I.

Ecological Interactions

Ecological interactions focus on how salmon and steelhead, other fish species, and wildlife interact with each other and the subbasin ecosystem. Salmon and steelhead are affected throughout their lifecycle by ecological interactions with non native species, food web components, and predators. Each of these factors can be exacerbated by human activities either by direct actions or indirect effects of habitat alternation. Effects of non-native species on salmon, effects of salmon on system productivity, and effects of native predators on salmon are difficult to quantify. Strong evidence exists in the scientific literature on the potential for significant interactions but effects are often context- or case-specific.

Predation is one interaction where effects can be estimated although interpretation can be complicated. In the lower Columbia River, northern pikeminnow, Caspian tern, and marine mammal predation on salmon has been estimated at approximately 5%, 10-30%, and 3-12%, respectively of total salmon numbers (see Appendix E for additional details). Predation has always been a source of salmon mortality but predation rates by some species have been exacerbated by human activities.

Ocean Conditions

Salmonid numbers and survival rates in the ocean vary with ocean conditions and low productivity periods increase extinction risks of populations stressed by human impacts. The ocean is subject to annual and longer-term climate cycles just as the land is subject to periodic droughts and floods. The El Niño weather pattern produces warm ocean temperatures and warm, dry conditions throughout the Pacific Northwest. The La Niña weather pattern is typified by cool ocean temperatures and cool/wet weather patterns on land. Recent history is dominated by a high frequency of warm dry years, along with some of the largest El Niños on record—particularly in 1982-83 and 1997-98. In contrast, the 1960s and early 1970s were dominated by a cool, wet regime. Many climatologists suspect that the conditions observed since 1998 may herald a return to the cool wet regime that prevailed during the 1960s and early 1970s.

Abrupt declines in salmon populations throughout the Pacific Northwest coincided with a regime shift to predominantly warm dry conditions from 1975 to 1998 (Beamish and Bouillon 1993, Hare et al 1999, McKinnell et al. 2001, Pyper et al. 2001). Warm dry regimes result in generally lower survival rates and abundance, and they also increase variability in survival and wide swings in salmon abundance. Some of the largest Columbia River fish runs in recorded history occurred during 1985–1987 and 2001–2002 after strong El Niño conditions in 1982–83 and 1997–98 were followed by several years of cool wet conditions.

The reduced productivity that accompanied an extended series of warm dry conditions after 1975 has, together with numerous anthropogenic impacts, brought many weak Pacific Northwest salmon stocks to the brink of extinction and precipitated widespread ESA listings. Salmon numbers naturally ebb and flow as ocean conditions vary. Healthy salmon populations are productive enough to withstand these natural fluctuations. Weak salmon populations may disappear or lose the genetic diversity needed to withstand the next cycle of low ocean productivity (Lawson 1993).

Recent improvements in ocean survival may portend a regime shift to generally more favorable conditions for salmon. The large spike in recent runs and a cool, wet climate would provide a respite for many salmon populations driven to critical low levels by recent conditions. The National Research Council (1996) concluded: "*Any favorable changes in ocean conditions—which could occur and could increase the productivity of some salmon populations for a time—should be regarded as opportunities for improving management techniques. They should not be regarded as reasons to abandon or reduce rehabilitation efforts, because conditions will change again".* Additional details on the nature and effects of variable ocean conditions on salmonids can be found in Volume I.

H.4.7. Summary of Human Impacts on Salmon and Steelhead

Stream habitat, estuary/mainstem habitat, harvest, hatchery and ecological interactions have all contributed to reductions in productivity, numbers, and population viability. Pie charts in Figure H-18 describe the relative magnitude of potentially-manageable human impacts in each category of limiting factor for Coweeman Basin salmon and steelhead. Impact values were developed for a base period corresponding to species listing dates. This depiction is useful for identifying which factors are most significant for each species and where improvements might be expected to provide substantial benefits. Larger pie slices indicate greater significance and scope for improvement in an impact for a given species. These numbers also serve as a working hypothesis for factors limiting salmonid numbers and viability. Chum pie charts are not included in this report but can be found in the lower Cowlitz River report.

This assessment indicates that current salmonid status is the result of large impacts distributed among several factors. No single factor accounts for a majority of effects on all species. Thus, substantial improvements in salmonid numbers and viability will require significant improvements in several factors. Loss of tributary habitat quality and quantity accounts for the largest relative impact on all species, except fall Chinook where harvest is most significant. Predation is relatively important for all species but more so for winter steelhead. Loss of estuary habitat quality and quantity are relatively important for all species. Harvest has a sizeable effect on fall Chinook and coho. Hatchery impacts are assumed to be low for all species. Hydrosystem impacts appear to be relatively minor for all species.

Impacts were defined as the proportional reduction in average numbers or productivity associated with each effect. Tributary and estuary habitat impacts are the differences between the pre-development historical baseline and current conditions. Hydro impacts identify the percentage of historical habitat blocked by impassable dams and the mortality associated with juvenile and adult passage of other dams. Fishing impacts are the direct and indirect mortality in ocean and freshwater fisheries. Hatchery impacts include the equilibrium effects of reduced natural population productivity caused by natural spawning of less-fit hatchery fish and also effects of inter-specific predation by larger hatchery smolts on smaller wild juveniles. Hatchery impacts do not include other potentially negative indirect effects or potentially beneficial effects of augmentation of natural production. Predation includes mortality from northern pikeminnow, Caspian terns, and marine mammals in the Columbia River mainstem and estuary. Predation is not a direct human impact but was included because of widespread interest in its relative significance. Methods and data for these analyses are detailed in Appendix E.

Potentially-manageable human impacts were estimated for each factor based on the best available scientific information. Proportions are standardized to a total of 1.0 for plotting purposes. The index is intended to illustrate order-of-magnitude rather than fine-scale differences. Only the subset of factors we can potentially manage were included in this index – natural mortality factors beyond our control (e.g. naturally-occuring ocean mortality) are excluded. Not every factor of interest is included in this index – only readily-quantifiable impacts are included.

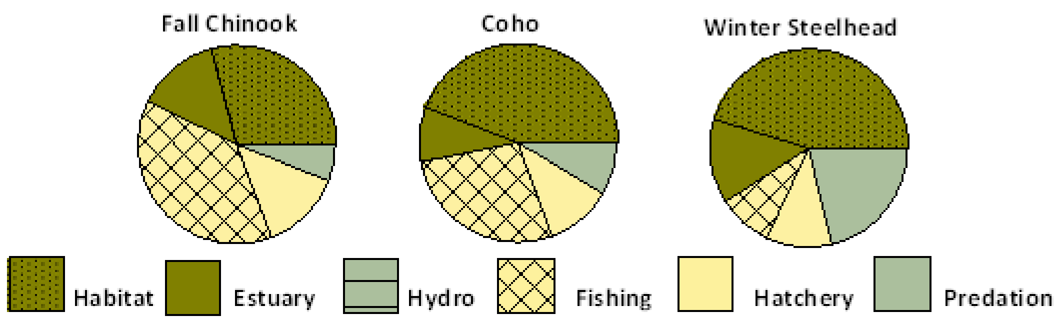


Figure H-18. Relative contribution of potentially manageable impacts on Coweeman River salmonid populations.

H.5. Key Programs and Projects

This section provides brief summaries of current federal, state, local, and non-governmental programs and projects pertinent to recovery, management, and mitigation measures and actions in this subbasin. These descriptions provide a context for descriptions of specific actions and responsibilities in the management plan portion of this subbasin plan. More detailed descriptions of these programs and projects can be found in the Comprehensive Program Directory (Appendix C).

H.5.1. Federal Programs

NMFS

NMFS is responsible for conserving, protecting and managing pacific salmon, ground fish, halibut, marine mammals and habitats under the Endangered Species Act, the Marine Mammal Protection Act, the Magnuson-Stevens Act, and enforcement authorities. NMFS administers the ESA under Section 4 (listing requirements), Section 7 (federal actions), and Section 10 (non-federal actions).

US Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) is the Federal government's largest water resources development and management agency. USACE programs applicable to Lower Columbia Fish & Wildlife include: 1) Section 1135 – provides for the modification of the structure or operation of a past USACE project, 2) Section 206 – authorizes the implementation of aquatic ecosystem restoration and protection projects, 3) Hydroelectric Program – applies to the construction and operation of power facilities and their environmental impact, 4) Regulatory Program – administration of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act (CWA).

Environmental Protection Agency

The Environmental Protection Agency (EPA) is responsible for the implementation of the CWA. The broad goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters so that they can support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water. The CWA requires that water quality standards (WQS) be set for surface waters. WQS are aimed at translating the broad goals of the CWA into waterbody-specific objectives and apply only to the surface waters (rivers, lakes, estuaries, coastal waters, and wetlands) of the United States.

Natural Resources Conservation Service

Formerly the Soil Conservation Service, the USDA Natural Resources Conservation Service (NRCS) works with landowners to conserve natural resources on private lands. The NRCS accomplishes this through various programs including, but not limited to, the Conservation Technical Assistance Program, Soil Survey Program, Conservation Reserve Enhancement Program, and the Wetlands Reserve Program. The NRCS works closely with local Conservation Districts; providing technical assistance and support.

Northwest Power and Conservation Council

The Northwest Power and Conservation Council, an interstate compact of Idaho, Montana, Oregon, and Washington, has specific responsibility in the Northwest Power Act of 1980 to mitigate the effects of the hydropower system on fish and wildlife of the Columbia River Basin. The Council does this through its Columbia River Basin Fish and Wildlife Program, which is funded by the Bonneville Power

Administration. Beginning in Fiscal Year 2006, funding is guided by locally developed subbasin plans that are expected to be formally adopted in the Council's Fish and Wildlife Program in December 2004.

H.5.2. State Programs

Washington Department of Natural Resources

The Washington Department of Natural Resources governs forest practices on non-federal lands and is steward to state owned aquatic lands. Management of DNR public forest lands is governed by tenets of their proposed Habitat Conservation Plan (HCP). Management of private industrial forestlands is subject to Forest Practices regulations that include both protective and restorative measures.

Washington Department of Fish & Wildlife

WDFW's Habitat Division supports a variety of programs that address salmonids and other wildlife and resident fish species. These programs are organized around habitat conditions (Science Division, Priority Habitats and Species, and the Salmon and Steelhead Habitat Inventory and Assessment Program); habitat restoration (Landowner Incentive Program, Lead Entity Program, and the Conservation and Reinvestment Act Program, as well as technical assistance in the form of publications and technical resources); and habitat protection (Landowner Assistance, GMA, SEPA planning, Hydraulic Project Approval, and Joint Aquatic Resource Permit Applications).

Washington Department of Ecology

The Department of Ecology (Ecology) oversees: the Water Resources program to manage water resources to meet current and future needs of the natural environment and Washington's communities; the Water Quality program to restore and protect Washington's water supplies by preventing and reducing pollution; and Shoreline and the Environmental Assistance program for implementing the Shorelines Management Act, the State Environmental Protection Act, the Watershed Planning Act, and 401 Certification of USACE Permits.

Washington Department of Transportation

The Washington State Department of Transportation (WSDOT) must ensure compliance with environmental laws and statutes when designing and executing transportation projects. Programs that consider and mitigate for impacts to salmonid habitat include: the Fish Passage Barrier Removal program; the Regional Road Maintenance ESA Section 4d Program, the Integrated Vegetation Management & Roadside Development Program; Environmental Mitigation Program; the Stormwater Retrofit Program; and the Chronic Environmental Deficiency Program.

Washington Recreation and Conservation Office

Created through the enactment of the Salmon Recovery Act (Washington State Legislature, 1999), the Salmon Recovery Funding Board provides grant funds to protect or restore salmon habitat and assist related activities with local watershed groups known as lead entities. SRFB has helped finance over 500 salmon recovery projects statewide. The Aquatic Lands Enhancement Account (ALEA) was established in 1984 and is used to provide grant support for the purchase, improvement, or protection of aquatic lands for public purposes, and for providing and improving access to such lands. The Washington Wildlife and Recreation Program (WWRP), established in 1990 and administered by the RCO, provides funding assistance for a broad range of land protection, park development, preservation/conservation, and outdoor recreation facilities.

Lower Columbia Fish Recovery Board

The Lower Columbia Fish Recovery Board encompasses five counties in the Lower Columbia River Region. The 15-member board has four main programs, including habitat protection and restoration activities, watershed planning for water quantity, quality, habitat, and instream flows, facilitating the development of an integrated recovery plan for the Washington portion of the lower Columbia Evolutionarily Significant Units, and conducting public outreach activities.

H.5.3. Local Government Programs

Cowlitz County

Cowlitz County updated its Comprehensive Plan to the minimum requirements of the Growth Management Act (GMA) by adding a Critical Areas Ordinance (CAO) in 1996, but it is not fully planning under the GMA. Cowlitz County manages natural resources primarily through its CAO.

City of Kelso

The City of Kelso's Comprehensive Plan was adopted in 1980. Natural resource impacts are managed primarily through critical areas protections, shorelines management, and floodplain management.

Cowlitz / Wahkiakum Conservation District

The Cowlitz/Wahkiakum CD provides technical assistance, cost-share assistance, project and water quality monitoring, community involvement and education, and support of local stakeholder groups within the two county service area. The CD is involved in a variety of projects, including fish passage, landowner assistance an environmental incentive program an education program, and water quality monitoring.

H.5.4. Non-governmental Programs

Columbia Land Trust

The Columbia Land Trust is a private, non-profit organization founded in 1990 to work exclusively with willing landowners to find ways to conserve the scenic and natural values of the land and water. Landowners donate the development rights or full ownership of their land to the Land Trust. CLT manages the land under a stewardship plan and, if necessary, will legally defend its conservation values.

Lower Columbia Fish Enhancement Group

The Washington State Legislature created the Regional Fisheries Enhancement Group Program in 1990 to involve local communities, citizen volunteers, and landowners in the state's salmon recovery efforts. RFEGs help lead their communities in successful restoration, education and monitoring projects. Every group is a separate, nonprofit organization led by their own board of directors and operational funding from a portion of commercial and recreational fishing license fees administered by the WDFW, and other sources. The mission of the Lower Columbia RFEG (LCFEG) is to restore salmon runs in the lower Columbia River region through habitat restoration, education and outreach, and developing regional and local partnerships.

H.5.5. Tribal Programs

Cowlitz Indian Tribe

The Cowlitz Indian Tribe's Natural Resources program participates in research and restoration efforts in the lower Columbia region. The focus of their fish research and restoration efforts includes salmon, steelhead, eulachon, and lamprey.

H.5.6. NPCC Fish & Wildlife Program Projects

There are no NPCC Fish & Wildlife Program Projects in the Coweeman Basin.

H.5.7. Washington Salmon Recovery Funding Board Projects

Type	Project Name	Subbasin
Restoration	Rauth: Coweeman Tributary Restoration	Coweeman
Restoration	Zmrhal's Coweeman River Project	Coweeman
Restoration	Zmrhal/Rauth Coweeman Restoration	Coweeman

H.6. Management Plan

H.6.1. Vision

Washington lower Columbia salmon, steelhead, and bull trout are recovered to healthy, harvestable levels that will sustain productive sport, commercial, and tribal fisheries through the restoration and protection of the ecosystems upon which they depend and the implementation of supportive hatchery and harvest practices.

The health of other native fish and wildlife species in the lower Columbia will be enhanced and sustained through the protection of the ecosystems upon which they depend, the control of non-native species, and the restoration of balanced predator/prey relationships.

The Coweeman Subbasin will play a key role in the regional recovery of salmon and steelhead. Salmonid recovery efforts will provide broad ecosystem benefits to a variety of subbasin fish and wildlife species. Recovery will be accomplished through a combination of improvements in subbasin, Columbia River mainstem, and estuary habitat conditions as well as careful management of hatcheries, fisheries, and ecological interactions among species.

Habitat protection or restoration will involve a wide range of Federal, State, Local, and non-governmental programs and projects. Success will depend on effective programs as well as a dedicated commitment to salmon recovery across a broad section of society.

Some hatchery programs will be realigned to focus on protection, conservation, and recovery of native fish. The need for hatchery measures will decrease as productive natural habitats are restored. Where consistent with recovery, other hatchery programs will continue to provide fish for fishery benefits for mitigation purposes in the interim until habitat conditions are restored to levels adequate to sustain healthy, harvestable natural populations.

Directed fishing on sensitive wild populations will be eliminated and incidental impacts of mixed stock fisheries in the Columbia River and ocean will be regulated and limited consistent with wild fish recovery needs. Until recovery is achieved, fishery opportunities will be focused on hatchery fish and harvestable surpluses of healthy wild stocks.

This plan uses a planning period or horizon of 25 years. The goal is to achieve recovery of the listed salmon species and the biological objectives for other fish and wildlife species of interest within this time period. It is recognized, however, that sufficient restoration of habitat conditions and watershed processes for all species of interest will likely take 75 years or more.

H.6.2. Biological Objectives

Biological objectives for Coweeman subbasin salmonid populations are based on recovery criteria developed by scientists on the Willamette/Lower Columbia Technical Recovery Team convened by NMFS. Criteria involve a hierarchy of ESU, Strata (i.e. ecosystem areas within the ESU – Coast, Cascade, and Gorge), and Population standards. A recovery scenario describing population-scale biological objectives for all species in all three strata in the lower Columbia ESUs was developed through a collaborative process with stakeholders based on biological significance, expected progress as a result of existing programs, the absence of apparent impediments, and the existence of other management opportunities. Under the preferred alternative, individual populations will variously contribute to recovery according to habitat quality and the population's perceived capacity to rebuild. Criteria, objectives, and the regional recovery scenario are described in greater detail in Volume I.

Focal populations in the Coweeman subbasin are targeted to improve to a level that contributes to recovery of the species. The scenario differentiates the role of populations by designating primary, contributing and stabilizing categories. *Primary populations* are those that would be restored to high or better probabilities of persistence. *Contributing populations* are those where low to medium improvements will be needed to achieve stratum-wide average of moderate persistence probability. *Stabilizing populations* are those maintained at current levels.

The Coweeman subbasin was identified as one of the most significant areas for salmon recovery among Washington Cascade strata subbasins based on fish population significance and realistic prospects for restoration. Recovery goals call for restoring fall Chinook, coho, and winter steelhead populations to a high or better viability level. This level will provide for a 95% or better probability of population survival over 100 years. Chum, which are part of the Lower Cowlitz population, will be restored to a medium viability level, providing for a 75-94% or better probability of survival over 100 years. Cutthroat will benefit from improvements in stream habitat conditions for anadromous species. Lamprey are also expected to benefit from habitat improvements in the estuary, Columbia River mainstem, and Coweeman subbasin although specific spawning and rearing habitat requirements are not well known. Bull trout do not occur in the subbasin.

Table H-9. Current viability status of Coweeman populations and the biological objective status that is necessary to meet the recovery criteria for the Cascade strata and the lower Columbia ESU.

		Recovery	Viability		Improve-	Abundance		
Species	Population	Priority[1]	Status[2]	Obj.[3]	ment[4]	Historic[5]	Current[6]	Target[7]
Fall Chinook(Tule)	Coweeman	Primary	VL	H+	80%	3,500	300	900
Chum	L. Cowlitz	Contributing	VL	M	>500%	195,000	<300	900
Winter Steelhead	Coweeman	Primary	L	H	25%	900	350	500
Coho	Coweeman	Primary	VL	H	170%	5,000	<50	1,200

[1] Primary, contributing, and stabilizing designations reflect the relative contribution of a population to major population group recovery goals.
[2] Baseline viability is based on Technical Recovery Team viability rating approach.
[3] Viability objective is based on the scenario contribution.
[4] Improvement is the relative increase in population production required to reach the prescribed viability goal
[5] Historical population size inferred from presumed habitat conditions using EDT Model and NMFS back-of-envelope calculations.
[6] Approximate current annual range in number of naturally-produced fish returning to the watershed.
[7] Abundance targets were estimated by population viability simulations based on viability goals.

H.6.3. Integrated Strategy

An Integrated Regional Strategy for recovery emphasizes that: 1) it is feasible to recover Washington lower Columbia natural salmon and steelhead to healthy and harvestable levels; 2) substantial improvements in salmon and steelhead numbers, productivity, distribution, and diversity will be required; 3) recovery cannot be achieved based solely on improvements in any one factor; 4) existing programs are insufficient to reach recovery goals, 5) all manageable effects on fish and habitat conditions must contribute to recovery, 6) actions needed for salmon recovery will have broader ecosystem benefits for all fish and wildlife species of interest, and 7) strategies and measures likely to contribute to recovery can be identified but estimates of the incremental improvements resulting from each specific action are highly uncertain. The strategy is described in greater detail in Volume I.

The Integrated Strategy recognizes the importance of implementing measures and actions that address each limiting factor and risk category, prescribing improvements in each factor/threat category in proportion to its magnitude of contribution to salmon declines, identifying an appropriate balance of strategies and measures that address regional, upstream, and downstream threats, and focusing near term actions on species at-risk of extinction while also ensuring a long term balance with other species and the ecosystem.

Population productivity improvement increments identify proportional improvements in productivity needed to recover populations from current status to medium, high, and very high levels of population viability consistent with the role of the population in the recovery scenario. Productivity is defined as the inherent population replacement rate and is typically expressed as a median rate of population increase (as in the Population Change Criteria Model) or a recruit per spawner rate (as in the EDT Model). Corresponding improvements in spawner numbers, juvenile outmigrants, population spatial structure, genetic and life history diversity, and habitat are implicit in productivity improvements.

Improvement targets were developed for each impact factor based on desired population productivity improvements and estimates of potentially manageable impacts (see Vol I. Ch. 3). Impacts are estimates of the proportional reduction in population productivity associated with human-caused and other potentially manageable impacts from stream habitats, estuary/mainstem habitats, hydropower, harvest, hatcheries, and selected predators. Reduction targets were driven by the regional strategy of equitably allocating recovery responsibilities among the six manageable impact factors. Given the ultimate uncertainty in the effects of recovery actions and the need to implement an adaptive recovery program, this approximation should be adequate for developing order-of-magnitude estimates to which recovery actions can be scaled consistent with the current best available science and data. Objectives and targets will need to be confirmed or refined during plan implementation based on new information and refinements in methodology.

Table H-1011 identifies population and factor-specific improvements consistent with the biological objectives for this subbasin. Per factor increments are less than the population net because factor affects are compounded at different life stages and density dependence is largely limited to freshwater tributary habitat. For example, productivity of Coweeman River fall Chinook must increase by 55% to reach population viability goals. This requires impact reductions equivalent to a 15% improvement in productivity or survival for each of six factor categories. Thus, tributary habitat impacts on fall Chinook must decrease from a 50% to a 43% impact in order to achieve the required 15% increase in tributary habitat productivity from the current 50% of the historical potential to 57% of the historical potential.

Table H-10. Productivity improvements consistent with biological objectives for the Coweeman subbasin.

Species	Net increase	Per factor	Hab.	Estuary	Baseline impacts Dams	Pred.	Fishery	Hatch.
Fall Chinook	80%	18%	0.50	0.23	0.00	0.10	0.65	0.01
Chum[a]	>500%	50%	0.96	0.25	0.00	0.03	0.05	0.00
Coho	170%	23%	0.80	0.16	0.00	0.15	0.50	0.01
Winter Steelhead	25%	13%	0.50	0.15	0.00	0.24	0.10	0.00

[a] *Data is from the lower Cowlitz River*

H.6.4. Tributary Habitat

Habitat assessment results were synthesized in order to develop specific prioritized measures and actions that are believed to offer the greatest opportunity for species recovery in the subbasin. As a first step toward measure and action development, habitat assessment results were integrated to develop a multi-species view of 1) priority areas, 2) factors limiting recovery, and 3) contributing land-use threats. For the purpose of this assessment, limiting factors are defined as the biological and physical conditions serving to suppress salmonid population performance, whereas threats are the land-use activities contributing to those factors. Limiting Factors refer to local (reach-scale) conditions believed to be directly impacting fish. Threats, on the other hand, may be local or non-local. Non-local threats may impact instream limiting factors in a number of ways, including: 1) through their effects on habitat-forming processes – such as the case of forest road impacts on reach-scale fine sediment loads, 2) due to an impact in a contributing stream reach – such as riparian degradation reducing wood recruitment to a downstream reach, or 3) by blocking fish passage to an upstream reach.

Priority areas and limiting factors were determined through the technical assessment, including primarily EDT analysis and the Integrated Watershed Assessment (IWA). As described later in this section, priority areas are also determined by the relative importance of subbasin focal fish populations to regional recovery objectives. This information allows for scaling of subbasin recovery effort in order to best accomplish recovery at the regional scale. Land-use threats were determined from a variety of sources including Washington Conservation Commission Limiting Factors Analyses, the IWA, the State 303(d) list, air photo analysis, the Barrier Assessment, personal knowledge of investigators, or known cause-effect relationships between stream conditions and land-uses.

Priority areas, limiting factors and threats were used to develop a prioritized suite of habitat measures. Measures are based solely on biological and physical conditions. For each measure, the key programs that address the measure are identified and the sufficiency of existing programs to satisfy the measure is discussed. The measures, in conjunction with the program sufficiency considerations, were then used to identify specific actions necessary to fill gaps in measure implementation. Actions differ from measures in that they address program deficiencies as well as biophysical habitat conditions. The process for developing measures and actions is illustrated in Figure H-19 and each component is presented in detail in the sections that follow.

Priority Habitat Factors and Areas

Priority habitat areas and factors in the subbasin are discussed below in two sections. The first section contains a generalized (coarse-scale) summary of conditions throughout the basin. The second section is a more detailed summary that presents specific reach and subwatershed priorities.

Summary: Decades of human activity in the Coweeman River Basin have significantly altered watershed processes and reduced both the quality and quantity of habitat needed to sustain viable populations of salmon and steelhead. Moreover, with the exception of fall Chinook, stream habitat conditions within the Coweeman Basin have a high impact on the health and viability of salmon and steelhead relative to other limiting factors. The following bullets provide a brief overview of each of the priority areas in the basin. These descriptions are a summary of the reach-scale priorities that are presented in the next section. These descriptions summarize the species most affected, the primary limiting factors, the contributing land-use threats, and the general type of measures that will be necessary for recovery. A tabular summary of the key limiting factors and land-use threats can be found in Table H-1112.

- **Lower mainstem** *(reaches Coweeman 1-4)* – The lower mainstem reaches contain potentially productive habitat for chum, coho, and fall Chinook, especially reach Coweeman 4, which is just downstream of the Canyon reach. This reach is impacted by changes to the channel, riparian area, and floodplain due primarily to agricultural uses. Reaches 1-3 are impacted by development around the outskirts of Kelso, WA. These reaches have preservation as well as restoration value. The most effective recovery measures will involve riparian and floodplain restoration.
- **Middle mainstem and Goble Creek** *(Canyon 1-3; Coweeman 5-12; Goble Creek)* – The middle mainstem reaches and Goble Creek are utilized most by winter steelhead, fall Chinook, and coho. They are impacted mostly by forest practices and to a limited degree by agriculture and rural residential uses. These reaches have preservation as well as restoration value. The most effective recovery measures will include riparian restoration and recovery of basin-wide watershed processes.
- **Upper mainstem and tributaries** *(Coweeman 13 – 22; Baird Creek; Mulholland Creek)* – The upper Coweeman mainstem and tributaries contain potentially productive habitat for coho, winter steelhead, and fall Chinook. These reaches have preservation as well as restoration value. They are heavily impacted by forest practices occurring throughout the upper Coweeman Basin. Restoration of basin-wide runoff and sediment supply conditions will yield the greatest benefits to fish habitat.

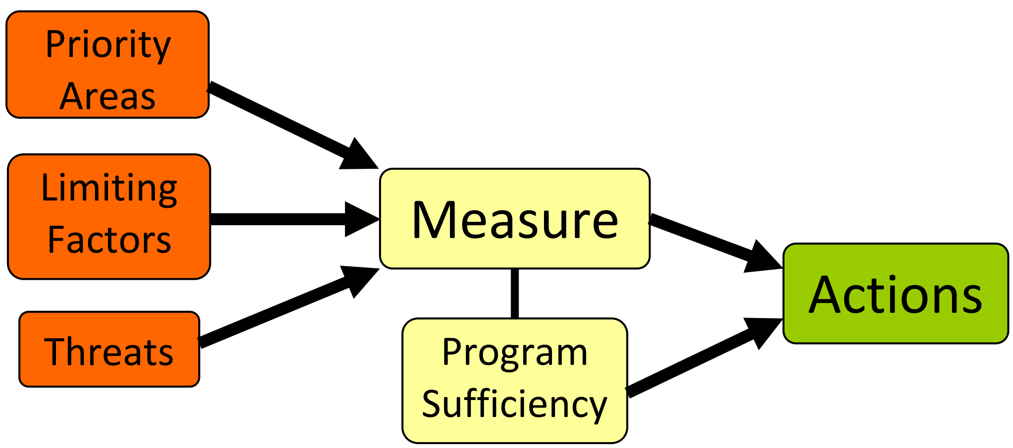


Figure H-19. Flow chart illustrating the development of subbasin measures and actions.

Table H-11. Salmonid habitat limiting factors and threats in priority areas. Priority areas include the lower mainstem (LM), middle mainstem and Goble Creek (MM), and upper mainstem and tributaries (UM) portions of the Coweeman Basin. Linkages between each threat and limiting factor are not displayed – each threat directly and indirectly affects a variety of habitat factors.

Limiting Factors	LM	MM	UM
Habitat diversity			
Lack of stable instream woody debris	✓	✓	✓
Altered habitat unit composition	✓	✓	✓
Loss of off-channel and/or side-channel habitats	✓	✓	
Channel stability			
Bed and bank erosion		✓	
Riparian function			
Reduced stream canopy cover	✓	✓	
Reduced bank/soil stability	✓	✓	
Exotic and/or noxious species	✓	✓	
Reduced wood recruitment	✓	✓	
Floodplain function			
Altered nutrient exchange processes	✓	✓	
Reduced flood flow dampening	✓	✓	
Restricted channel migration	✓	✓	
Disrupted hyporheic processes	✓	✓	
Stream flow			
Altered magnitude, duration, or rate of change	✓	✓	✓
Water quality			
Altered stream temperature regime	✓	✓	
Bacteria	✓		
Substrate and sediment			
Excessive fine sediment	✓	✓	✓
Embedded substrates	✓	✓	✓

Threats	LM	MM	UM
Agriculture/ grazing			
Clearing of vegetation	✓	✓	
Riparian grazing	✓	✓	
Floodplain filling	✓	✓	
Rural development			
Clearing of vegetation		✓	
Roads – riparian/floodplain impacts		✓	
Forest practices			
Timber harvests –sediment supply impacts	✓	✓	✓
Timber harvests – impacts to runoff	✓	✓	✓
Riparian harvests (historical)		✓	✓
Forest roads – impacts to sediment supply	✓	✓	✓
Forest roads – impacts to runoff	✓	✓	✓
Forest roads – riparian/floodplain impacts			✓
Splash-dam logging (historical)	✓	✓	✓
Channel manipulations			
Bank hardening	✓		
Channel straightening	✓		
Artificial confinement	✓		

Specific Reach and Subwatershed Priorities: Specific reaches and subwatersheds have been prioritized based on the plan's biological objectives, fish distribution, critical life history stages, current habitat conditions, and potential fish population performance. Reaches have been placed into Tiers (1-4), with Tier 1 reaches representing the areas where recovery measures would yield the greatest benefits towards accomplishing the biological objectives. The reach tiering factors in each fish population's importance relative to regional recovery objectives, as well as the relative importance of reaches within the populations themselves. Reach tiers are most useful for identifying habitat recovery measures in channels, floodplains, and riparian areas. Reach-scale priorities were initially identified within individual populations (species) through the EDT Restoration and Preservation Analysis. This resulted in reaches grouped into categories of high, medium, and low priority for each population (see Stream Habitat Limitations section). Within a subbasin, reach rankings for all of the modeled populations were combined, using population designations as a weighting factor. Population designations for this subbasin are described in the Biological Objectives section. The population designations are 'primary', 'contributing', and 'stabilizing'; reflecting the level of emphasis that needs to be placed on population recovery in order to meet ESA recovery criteria.

Spatial priorities were also identified at the subwatershed scale. Subwatershed-scale priorities were directly determined by reach-scale priorities, such that a Group A subwatershed contains one or more Tier 1 reaches. Scaling up from reaches to the subwatershed level was done in recognition that actions to protect and restore critical reaches might need to occur in adjacent and/or upstream upland areas. For example, high sediment loads in a Tier 1 reach may originate in an upstream contributing subwatershed where sediment supply conditions are impaired because of current land use practices. Subwatershed-scale priorities can be used in conjunction with the IWA to identify watershed process restoration and preservation opportunities. The specific rules for designating reach tiers and subwatershed groups are presented in Table H-1213. Reach tier designations for this basin are included in Table H-1314. Reach tiers and subwatershed groups are displayed on a map in Figure H-20.

Table H-12. Rules for designating reach tier and subwatershed group priorities. See Biological Objectives section for information on population designations.

Designation	Rule
Reaches	
Tier 1:	All high priority reaches (based on EDT) for one or more primary populations.
Tier 2:	All reaches not included in Tier 1 and which are medium priority reaches for one or more primary species and/or all high priority reaches for one or more contributing populations.
Tier 3:	All reaches not included in Tiers 1 and 2 and which are medium priority reaches for contributing populations and/or high priority reaches for stabilizing populations.
Tier 4:	Reaches not included in Tiers 1, 2, and 3 and which are medium priority reaches for stabilizing populations and/or low priority reaches for all populations.
Subwatersheds	
Group A:	Includes one or more Tier 1 reaches.
Group B:	Includes one or more Tier 2 reaches, but no Tier 1 reaches.
Group C:	Includes one or more Tier 3 reaches, but no Tier 1 or 2 reaches.
Group D:	Includes only Tier 4 reaches.

Table H-13. Reach Tiers in the Coweeman River Basin

Tier 1	Tier 2	Tier 3	Tier 4	
Baird Cr 1 A	Baird Cr 1 B	Coweeman 3	BR1_Brown Cr 1	Little Baird Cr
Canyon 1	Baird Cr 2		BR1_Brown Cr 2	Martin Cr
Canyon 2	Coweeman 12		BR1_Brown Cr RB Trib	Mulholland Cr 1
Canyon 3	Coweeman 13		Coweeman 1 tidal	Mulholland Cr 2 A
Coweeman 10	Coweeman 2 B		Coweeman 2 A	Mulholland Cr 2 B
Coweeman 11	Coweeman 21		Coweeman LB Trib 2	Mulholland Cr 3
Coweeman 14	Coweeman 22		Coweeman RB Trib 1 B	Mulholland Cr 4
Coweeman 15	Coweeman 6		Coweeman RB Trib 1 RB Trib	Mulholland Cr RB Trib 1 (RB trib6)
Coweeman 16	Coweeman RB Trib 1 A		Coweeman RB Trib 2	Mulholland Cr RB Trib 2
Coweeman 17	Goble Cr 2 A		Coweeman RB Trib 3	NF Goble Cr 1 B
Coweeman 18	NF Goble Cr 1 A		Coweeman RB Trib 4	NF Goble Cr 2
Coweeman 19			Coweeman RB Trib 5	NF Goble Cr LB Trib 1
Coweeman 20			Coweeman RB Trib 6	NF Goble Cr LB Trib 2
Coweeman 4 A			Coweeman RB Trib 7	Nineteen Cr
Coweeman 4 B			Coweeman RB Trib 8	Nye Cr
Coweeman 5			Goble Cr 3	ONeil Cr
Coweeman 7 & 8			Goble Cr 4	Sam Smith Cr
Coweeman 9 A			Goble Cr LB Trib	SK1_Skipper Cr 2
Coweeman 9 B			Goble Cr RB Trib 1	SK1_Skipper Cr LB Trib
Goble Cr 1			Goble Cr RB Trib 2	T1_Turner Cr 1
Goble Cr 2 B			Hill Cr	T1_Turner Cr 2
SK1_Skipper Cr 1			Jim Watson Cr	T1_Turner Cr LB Trib A
			LB1_Coweeman LB Trib 1 A	T1_Turner Cr LB Trib B
			LB1_Coweeman LB Trib 1 B	T1_Turner Cr LB Trib LB Trib
			LB1_Coweeman LB Trib 1 RB Trib	

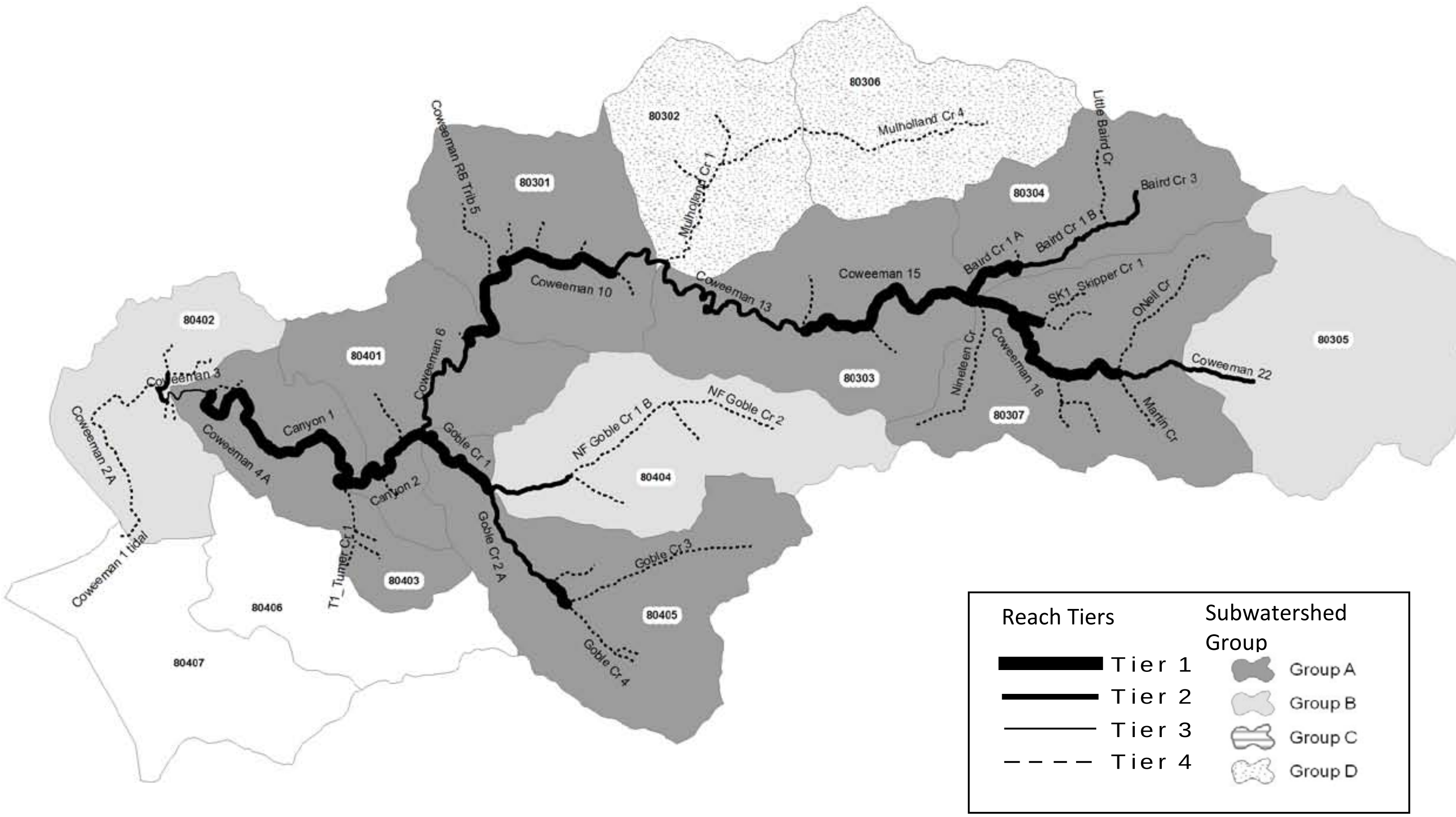


Figure H-20. Reach tiers and subwatershed groups in the Coweeman Basin. Tier 1 reaches and Group A subwatersheds represent the areas where recovery actions would yield the greatest benefits with respect to species recovery objectives. The subwatershed groups are based on Reach Tiers. Priorities at the reach scale are useful for identifying stream corridor recovery measures. Priorities at the subwatershed scale are useful for identifying watershed process recovery measures. Watershed process recovery measures for stream reaches will need to occur within the surrounding (local) subwatershed as well as in upstream contributing subwatersheds.

Habitat Measures

Measures are means to achieve the regional strategies that are applicable to the Coweeman Basin and necessary to accomplish the biological objectives for focal fish species. Measures are based on the technical assessments for this subbasin (Section 3.0) as well as on the synthesis of priority areas, limiting factors, and threats presented earlier in this section. The measures applicable to the Coweeman Subbasin are presented in priority order in Table H-1415. Each measure has a set of submeasures that define the measure in greater detail and add specificity to the particular circumstances occurring within the subbasin. The table for each measure and associated submeasures indicates the limiting factors that are addressed, the contributing threats that are addressed, the species that would be most affected, and a short discussion. Priority locations are given for some measures. Priority locations typically refer to either stream reaches or subwatersheds, depending on the measure. Addressing measures in the highest priority areas first will provide the greatest opportunity for effectively accomplishing the biological objectives.

Following the list of priority locations is a list of the programs that are the most relevant to the measure. Each program is qualitatively evaluated as to whether it is sufficient or needs expansion with respect to the measure. This exercise provides an indication of how effectively the measure is already covered by existing programs, policy, or projects; and therefore indicates where there is a gap in measure implementation. This information is summarized in a discussion of Program Sufficiency and Gaps.

The measures themselves are prioritized based on the results of the technical assessment and in consideration of principles of ecosystem restoration (e.g. NRC 1992, Roni et al. 2002). These principles include the hypothesis that the most efficient way to achieve ecosystem recovery in the face of uncertainty is to focus on the following prioritized approaches: 1) protect existing functional habitats and the processes that sustain them, 2) allow no further degradation of habitat or supporting processes, 3) re-connect isolated habitat, 4) restore watershed processes (ecosystem function), 5) restore habitat structure, and 6) create new habitat where it is not recoverable. These priorities have been adjusted for the specific circumstances occurring in the Coweeman Basin. These priorities are adjusted depending on the results of the technical assessment and on the specific circumstances occurring in the basin. For example, re-connecting isolated habitat could be adjusted to a lower priority if there is little impact to the population created from passage barriers.

Habitat Actions

The prioritized measures and associated gaps are used to develop specific actions for the subbasin. These are presented in Table H-1516. Actions are different than the measures in a number of ways: 1) actions have a greater degree of specificity than measures, 2) actions consider existing programs and are therefore not based strictly on biophysical conditions, 3) actions refer to the agency or entity that would be responsible for carrying out the action, and 4) actions are related to an expected outcome with respect to the biological objectives. Actions are not presented in priority order but instead represent the suite of activities that are all necessary for recovery of listed species. The priority for implementation of these actions must consider the priority of the measures they relate to, the “size” of the gap they are intended to fill, and feasibility considerations.

Table H-14. Prioritized measures for the Coweeman Basin.

#1 – Protect stream corridor structure and function

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Protect floodplain function and channel migration processes B. Protect riparian function C. Protect access to habitats D. Protect instream flows through management of water withdrawals E. Protect channel structure and stability F. Protect water quality G. Protect the natural stream flow regime	Potentially addresses many limiting factors	Potentially addresses many threats related to limiting factors	All Species	Reach Coweeman 3 and 4 are low gradient, alluvial reaches that contain important potential chum and fall Chinook habitat. Providing adequate protections to these reaches is important given the proximity to the expanding Longview/Kelso urban area. Other Tier 1 and Tier 2 reaches in mixed-use areas are also at risk of continuing development pressure. Preventing further degradation of stream channel structure, riparian function, and floodplain function will be an important component of recovery.

Priority Locations

1st- Tier 1 and 2 reaches with functional riparian conditions according to the IWA assessment
2nd- Tier 1 or 2 reaches in mixed-use lands at risk of further degradation
3rd- Remaining Tier 1 and 2 reaches
4th- All remaining reaches

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
NMFS	ESA Section 7 and Section 10	✓	
US Army Corps of Engineers (USACE)	Dredge & fill permitting (CWA sect. 404); Navigable waterways protection (Rivers & Harbors Act Sect, 10)	✓	
WA Department of Natural Resources (WDNR)	Forest Practices Rules, Riparian Easement Program	✓	
WA Department of Fish and Wildlife (WDFW)	Hydraulics Projects Approval	✓	
Cowlitz County	Comprehensive Planning		✓
City of Kelso	Comprehensive Planning		✓
Cowlitz/Wahkiakum Conservation District / NRCS	Agricultural Land Habitat Protection Programs		✓
Noxious Weed Control Boards (State and County level)	Noxious Weed Education, Enforcement, Control		✓
Non-Governmental Organizations (NGOs) (e.g. Columbia Land Trust) and public agencies	Land acquisition and easements		✓

Program Sufficiency and Gaps

Alterations to stream corridor structure that may impact aquatic habitats are regulated through the WDFW Hydraulics Project Approval (HPA) permitting program. Other regulatory protections are provided through USACE permitting, ESA consultations, HCPs, and local government regulations. Riparian areas within private timberlands are protected through the Forest Practices Rules (FPR) administered by WDNR. The FPRs came out of an extensive review process and are believed to adequately protect riparian areas with respect to stream shading, bank stability, and LWD recruitment. The program is new, however, and careful monitoring of the effect of the regulations is necessary. Land-use conversion and development are increasing throughout the basin and local government ordinances must ensure that new development occurs in a manner that protects key habitats. Conversion of land-use from forest or agriculture to residential use has the potential to increase impairment of aquatic habitat, particularly when residential development is paired with flood control measures. Local government ordinances can limit potentially harmful land-use conversions by thoughtfully direction growth through comprehensive planning and tax incentives, by providing consistent protection of critical areas across jurisdictions, and by preventing development in floodplains. In cases where existing programs are unable to protect critical habitats due to inherent limitations of regulatory mechanisms, conservation easements and land acquisition may be necessary. The City of Kelso has purchased valley bottom property along the lower mainstem below the canyon, presenting a great opportunity to protect floodplain processes from further degradation. Cowlitz County is attempting to acquire additional lands in the lower reaches of the Coweeman basin.

#2 – Protect hillslope processes

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Manage forest practices to minimize impacts to sediment supply processes, runoff regime, and water quality B. Manage agricultural practices to minimize impacts to sediment supply processes, runoff regime, and water quality C. Manage growth and development to minimize impacts to sediment supply processes, runoff regime, and water quality	• Excessive fine sediment • Excessive turbidity • Embedded substrates • Stream flow – altered magnitude, duration, or rate of change of flows • Water quality impairment	• Timber harvest – impacts to sediment supply, water quality, and runoff processes • Forest roads – impacts to sediment supply, water quality, and runoff processes • Agricultural practices – impacts to sediment supply, water quality, and runoff processes • Development – impacts to sediment supply, water quality, and runoff processes	All species	There currently are functional hillslope sediment processes in the Upper Baird and Upper Mulholland Creek basins. In other areas, hillslope runoff and sediment delivery processes have been degraded due to past intensive timber harvest and road building. Agriculture and development have impacted sediment and flow processes in portions of the lower basin. Urban development impacts the lower mainstem subwatershed (80402). Limiting additional degradation will be necessary to prevent further habitat impairment.

Priority Locations

1st- Functional subwatersheds contributing to Tier 1 or 2 reaches (functional for sediment *or* flow according to the IWA – local rating)
2nd- All other functional subwatersheds plus Moderately Impaired subwatersheds contributing to Tier 1 or 2 reaches
3rd- All other moderately impaired subwatersheds plus Impaired subwatersheds contributing to Tier 1 or 2 reaches

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
WDNR	Forest Practices Rules	✓	
Cowlitz County	Comprehensive Planning		✓
City of Kelso	Comprehensive Planning		✓
Cowlitz/Wahkiakum Conservation District / NRCS	Agricultural Land Habitat Protection Programs		✓

Program Sufficiency and Gaps

Hillslope processes on private forest lands are protected through Forest Practices Rules administered by the WDNR. These rules, developed as part of the Forests & Fish Agreement, are believed to be adequate for protecting watershed sediment supply, runoff processes, and water quality on private forest lands. The program is new, however, and careful monitoring of the effect of the regulations is necessary; particularly with respect to effects on watershed hydrology and sediment delivery. Small private landowners may be unable to meet some of the requirements on a timeline commensurate with large industrial landowners. Financial assistance to small owners would enable greater and quicker compliance. On non-forest lands (agriculture and developed), local government comprehensive planning is the primary nexus for protection of hillslope processes. Local governments can control impacts through zoning that protects open-space, through stormwater management ordinances, and through tax incentives to keep agricultural and forest lands from becoming developed. These protections are especially important in the lower basin due to expanding growth around Kelso. There are few to no regulatory protections of hillslope processes that relate to agricultural practices; such deficiencies could be addressed through local or state authorities. Protecting hillslope processes on agricultural lands would also benefit from the expansion of technical assistance and landowner incentive programs (NRCS, Conservation Districts). Protecting processes on agricultural lands is less of a priority than forest or rural residential lands due to the low amount of farmed land in the basin.

#3- Restore degraded hillslope processes on forest, agricultural, and developed lands

Submeasures	Table 1. Factors Addressed	Threats Addressed	Target Species	Discussion
A. Upgrade or remove problem forest roads B. Reforest heavily cut areas not recovering naturally C. Employ agricultural Best Management Practices with respect to contaminant use, erosion, and runoff D. Reduce watershed imperviousness E. Reduce effective stormwater runoff from developed areas	• Excessive fine sediment • Excessive turbidity • Embedded substrates • Stream flow – altered magnitude, duration, or rate of change of flows • Water quality impairment	• Timber harvest – impacts to sediment supply, water quality, and runoff processes • Forest roads – impacts to sediment supply, water quality, and runoff processes • Agricultural practices – impacts to sediment supply, water quality, and runoff processes • Development – impacts to water quality and runoff processes	All species	Hillslope runoff and sediment delivery processes have been degraded due to past intensive timber harvest, road building, agriculture, and development. These processes must be addressed for reach-level habitat recovery to be successful.

Priority Locations

1st- Moderately impaired or impaired subwatersheds contributing to Tier 1 reaches (mod. impaired or impaired for sediment *or* flow according to IWA – local rating)
2nd- Moderately impaired or impaired subwatersheds contributing to Tier 2 reaches
3rd- Moderately impaired or impaired subwatersheds contributing to other reaches

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
WDNR	Forest Practices Rules	✓	
WDFW	Habitat Program		✓
Cowlitz/Wahkiakum Conservation District / NRCS	Agricultural Land Habitat Restoration Programs		✓
Cowlitz County	Stormwater Management		✓
Lower Columbia Fish Enhancement Group	Habitat Projects		✓
NGOs, tribes, Conservation Districts, agencies, landowners	Habitat Projects		✓
City of Kelso	Stormwater Management		✓

Program Sufficiency and Gaps

Forest management programs including the new Forest Practices Rules (private timber lands) and the WDNR HCP (state timber lands) are expected to afford protections that will passively and actively restore degraded hillslope conditions. Timber harvest rules are expected to passively restore sediment and runoff processes. The road maintenance and abandonment requirements are expected to actively address road-related impairments within a 15 year time-frame. While these strategies are believed to be largely adequate to protect watershed processes, the degree of implementation and the effectiveness of the prescriptions will not be fully known for at least another 15 or 20 years. Of particular concern is the capacity of some forest land owners, especially small forest owners, to conduct the necessary road improvements (or removal) in the required timeframe. Additional financial and technical assistance would enable small forest landowners to conduct the necessary improvements in a timeline parallel to large industrial timber land owners. Ecological restoration of existing developed and agricultural lands occurs relatively infrequently and there are no programs that specifically require restoration in these areas. Restoring existing developed and farmed lands can involve retrofitting facilities with new materials, replacing existing systems, adopting new management practices, and creating or re-configuring landscaping. Means of increasing restoration activity include increasing landowner participation through education and incentive programs, building support for projects on public lands/facilities, requiring Best Management Practices through permitting and ordinances, and increasing available funding for entities to conduct projects.

#4 - Restore floodplain function and channel migration processes in the mainstem and major tributaries

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Set back, breach, or remove artificial confinement structures	• Bed and bank erosion • Altered habitat unit composition • Restricted channel migration • Disrupted hyporheic processes • Reduced flood flow dampening • Altered nutrient exchange processes • Channel incision • Loss of off-channel and/or side-channel habitat • Blockages to off-channel habitats	• Floodplain filling • Channel straightening • Artificial confinement	chum, fall Chinook, coho	Significant degradation of floodplain function and channel migration processes have occurred over the years in the lower mainstem (Coweeman 1 tidal – 4). This area has historically been utilized for agriculture and is experiencing increasing development pressure as nearby population centers expand. There are feasibility issues with implementation of floodplain restoration initiatives due to private lands, existing infrastructure already in place, potential flood risk to property, and large expense.

Priority Locations

1st- Tier 1 reaches with hydro-modifications (can be obtained from EDT ratings)
2nd- Tier 2 reaches with hydro-modifications
3rd- Other reaches with hydro-modifications

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
WDFW	Habitat Program		✓
USACE	Water Resources Development Act (Sect. 1135 & Sect. 206)		✓
Lower Columbia Fish Enhancement Group	Habitat Projects		✓
NGOs, tribes, Conservation Districts, agencies, landowners	Habitat Projects		✓
Cowlitz County	Land Acquisition		✓
City of Kelso	Habitat Projects; Parks and Recreation		✓

Program Sufficiency and Gaps

There currently are no programs or policy in place that set forth strategies for restoring floodplain function and channel migration processes in the Coweeman Basin. Without programmatic changes, projects are likely to occur only seldom as opportunities arise and only if financing is made available. Means of increasing restoration activity include building partnerships with landowners, increasing landowner participation in conservation programs, allowing restoration projects to serve as mitigation for other activities, and increasing funding for NGOs, government entities, and landowners to conduct projects. Floodplain restoration projects are often expensive, large-scale efforts that require partnerships among many agencies, NGOs, and landowners. Building partnerships is a necessary first step toward floodplain and CMZ restoration. The USACE is conducting a Lower Columbia River Ecosystem Restoration Study which may identify and assess potential floodplain restoration projects in the lower Coweeman Basin. The City of Kelso has purchased valley bottom property along the lower mainstem below the canyon, presenting a great opportunity to restore floodplain processes there. A potential acquisition by Cowlitz County in the same area represents additional opportunity.

#5 - Restore riparian conditions throughout the basin

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Restore the natural riparian plant community B. Exclude livestock from riparian areas C. Eradicate invasive plant species from riparian areas	• Reduced stream canopy cover • Altered stream temperature regime • Reduced bank/soil stability • Reduced wood recruitment • Lack of stable instream woody debris • Exotic and/or invasive species • Bacteria	• Timber harvest – riparian harvests • Riparian grazing • Clearing of vegetation due to agriculture and residential development	All species	Recovery of riparian vegetation is necessary throughout the basin in both forest and mixed-use areas. Much of this recovery is expected to occur passively on forest lands due to protection requirements for riparian buffers. Active measures, such as hardwood-to-conifer conversion, may be necessary in some areas. The increasing abundance of exotic and invasive species is of particular concern. Riparian restoration projects are relatively inexpensive and are often supported by landowners.

Priority Locations

1st- Tier 1 reaches
2nd- Tier 2 reaches
3rd- Tier 3 reaches
4th- Tier 4 reaches

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
WDNR	Forest Practices Rules	✓	
WDFW	Habitat Program		✓
Cowlitz/Wahkiakum Conservation District / NRCS	Agricultural Land Habitat Restoration Programs		✓
Lower Columbia Fish Enhancement Group	Habitat Projects		✓
NGOs, tribes, Conservation Districts, agencies, landowners	Habitat Projects		✓
Noxious Weed Control Boards (State and County level)	Noxious Weed Education, Enforcement, Control		✓

Program Sufficiency and Gaps

There are no regulatory mechanisms for actively restoring riparian conditions; however, existing programs will afford protections that will allow for the *passive* restoration of riparian forests. These protections are believed to be adequate for riparian areas on forest lands that are subject to Forest Practices Rules. Other lands receive variable levels of protection through the Cowlitz County Comprehensive Plan. Many degraded riparian zones in urban, agricultural, rural residential, or transportation corridors will not passively restore with existing regulatory protections and will require active measures. Riparian restoration in these areas may entail livestock exclusion, tree planting, road relocation, invasive species eradication, and adjusting current land-use in the riparian zone. Means of increasing restoration activity include building partnerships with landowners, increasing landowner participation in conservation programs, allowing restoration projects to serve as mitigation for other activities, and increasing funding for NGOs, government entities, and landowners to conduct restoration projects.

#6 – Restore access to habitat blocked by artificial barriers

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Restore access to isolated habitats blocked by culverts, dams, or other barriers	• Blockages to channel habitats • Blockages to off-channel habitats	Dams, culverts, in-stream structures	All species	As many as 9 miles of potential anadromous habitat are blocked by artificial obstructions, mostly on small tributary streams. No individual barriers account for a large share of the blocked habitat. The extent of potential habitat above these barriers is not well known but is expected to be minimal. Passage restoration projects should focus only on cases where it can be demonstrated that there is good potential benefit and reasonable project costs.

Priority Locations

Several blocking culverts on small tributary streams

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
WDNR	Forest Practices Rules, Family Forest Fish Passage		✓
WDFW	Habitat Program		✓
Lower Columbia Fish Enhancement Group	Habitat Projects		✓
Washington Department of Transportation / WDFW	Fish Passage Program		✓
Cowlitz County	Roads		✓

Program Sufficiency and Gaps

The Forest Practices Rules require forest landowners to restore fish passage at artificial barriers by 2016. Small forest landowners are given the option to enroll in the Family Forest Fish Program in order to receive financial assistance to fix blockages. The Washington State Department of Transportation, in a cooperative program with WDFW, manages a program to inventory and correct blockages associated with state highways. The Salmon Recovery Funding Board, through the Lower Columbia Fish Recovery Board, funds barrier removal projects. Past efforts have corrected major blockages and have identified others in need of repair. Additional funding is needed to correct remaining blockages. Further monitoring and assessment is needed to ensure that all potential blockages have been identified and prioritized.

#7 - Restore channel structure and stability

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Place stable woody debris in streams to enhance cover, pool formation, bank stability, and sediment sorting B. Structurally modify channel morphology to create suitable habitat C. Restore natural rates of erosion and mass wasting within river corridors	• Lack of stable instream woody debris • Altered habitat unit composition • Reduced bank/soil stability • Excessive fine sediment • Excessive turbidity • Embedded substrates	• None (symptom-focused restoration strategy)	All species	Large wood installation projects could benefit habitat conditions in many areas although watershed processes contributing to wood deficiencies should be considered and addressed prior to placing wood in streams. Other structural enhancements to stream channels may be warranted in some places, especially in lowland alluvial reaches that have been simplified through channel straightening and confinement.

Priority Locations

1st- Tier 1 reaches
2nd- Tier 2 reaches
3rd- Tier 3 reaches
4th- Tier 4 reaches

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
NGOs, tribes, agencies, landowners	Habitat Projects		✓
WDFW	Habitat Program		✓
Lower Columbia Fish Enhancement Group	Habitat Projects		✓
USACE	Water Resources Development Act (Sect. 1135 & Sect. 206)		✓
Cowlitz/Wahkiakum Conservation District / NRCS	Agricultural Land Habitat Restoration Programs		✓

Program Sufficiency and Gaps

There are no regulatory mechanisms for actively restoring channel stability and structure. Passive restoration is expected to slowly occur as a result of protections afforded to riparian areas and hillslope processes. Past projects have largely been opportunistic and have been completed due to the efforts of local NGOs and government agencies; such projects are likely to continue in a piecemeal fashion as opportunities arise and if financing is made available. The lack of LWD in stream channels, and the importance of wood for habitat of listed species, places an emphasis on LWD supplementation projects. Means of increasing restoration activity include building partnerships with landowners, increasing landowner participation in conservation programs, allowing restoration projects to serve as mitigation for other activities, and increasing funding for NGOs, government entities, and landowners to conduct restoration projects.

#8 – Restore degraded water quality with emphasis on temperature impairments

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Exclude livestock from riparian areas B. Increase riparian shading C. Decrease channel width-to-depth ratios D. Reduce delivery of chemical contaminants to streams E. Address leaking septic systems	• Bacteria • Altered stream temperature regime • Chemical contaminants	• Timber harvest – riparian harvests • Riparian grazing • Leaking septic systems • Clearing of vegetation due to rural development and agriculture • Chemical contaminants from agricultural and developed lands	• All species	Several stream segments are listed on the draft 2002-2004 303(d) list (WDOE 2004) for stream temperature impairment. A few other segments are included as a concern for temperature impairment. Temperature impairment is believed to be related primarily to degraded riparian conditions.

Priority Locations

1st- Tier 1 or 2 reaches with 303(d) listings
2nd- Other reaches with 303(d) listings
3rd- All remaining reaches

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
Washington Department of Ecology	Water Quality Program		✓
WDNR	Forest Practices Rules	✓	
WDFW	Habitat Program		✓
Lower Columbia Fish Enhancement Group	Habitat Projects		✓
Cowlitz/Wahkiakum Conservation District / NRCS	Agriculture Land Habitat Restoration Programs, Centennial Clean Water Program		✓
NGOs, tribes, Conservation Districts, agencies, landowners	Habitat Projects		✓
Cowlitz County Health Department	Septic System Program		✓

Program Sufficiency and Gaps

Ecology's Water Quality Program manages the State 303(d) list of impaired water bodies. There are several listings in the Coweeman basin and several areas of concern (WDOE 2004). A Water Quality Clean-up Plan (TMDL) is required by Ecology and it is anticipated that the TMDL will adequately set forth strategies to address the temperature impairment. It will be important that the strategies specified in the TMDLs are implementable and adequately funded. The 303(d) listings are believed to address the primary water quality concerns; however, other impairments may exist that the current monitoring effort is unable to detect. Additional monitoring is needed to fully understand the degree of water quality impairment in the basin.

#9 – Provide for adequate instream flows during critical periods

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Protect instream flows through water rights closures and enforcement B. Restore instream flows through acquisition of existing water rights C. Restore instream flows through implementation of water conservation measures	• Stream flow – maintain or improve flows during low-flow Summer months	• Water withdrawals	All species	Instream flow management strategies for the Coweeman Basin have been identified as part of Watershed Planning for WRIA 26 (LCFRB 2004). Strategies include water rights closures, setting of minimum flows, and drought management policies. This measure applies to instream flows associated with water withdrawals and diversions, generally a concern only during low flow periods. Hillslope processes also affect low flows but these issues are addressed in separate measures.

Priority Locations

Entire Basin

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
WRIA 25/26 Watershed Planning Unit	Watershed Planning	✓	
City of Kelso	Water Supply	✓	
Washington Department of Ecology	Water Resources Program		✓

Program Sufficiency and Gaps

The Water Resources Program of the Ecology, in cooperation with the WDFW and other entities, manages water rights and instream flow protections. A collaborative process for setting and managing instream flows was launched in 1998 with the Watershed Planning Act (HB 2514), which called for the establishment of local watershed planning groups who's objective was to recommend instream flow guidelines to Ecology through a collaborative process. The current status of the planning effort is to adopt a watershed plan by December 2004. Instream flow management in the Coweeman Basin will be conducted using the recommendations of the WRIA 25/26 Planning Unit, which is coordinated by the LCFRB. Products of the WRIA 25/26 watershed planning effort can be found on the LCFRB website: www.lcfrb.gen.wa.us. The recommendations of the planning unit have been developed in close coordination with recovery planning and the instream flow prescriptions developed by this group are anticipated to adequately protect instream flows necessary to support healthy fish populations. The measures specified above are consistent with the planning group's recommended strategies.

#10 – Create/restore off-channel and side-channel habitat

Submeasures	Factors Addressed	Threats Addressed	Target Species	Discussion
A. Restore historical off-channel and side-channel habitats where they have been eliminated B. Create new channel or off-channel habitats (i.e. spawning channels)	• Loss of off-channel and/or side-channel habitat	• Floodplain filling • Channel straightening • Artificial confinement	chum coho	There has been some loss of off-channel and side-channel habitats, especially along the lower mainstem below the canyon. This has limited chum spawning habitat and coho overwintering habitat. Targeted restoration or creation of habitats would increase available habitat where full floodplain and CMZ restoration is not possible.

Priority Locations

1st- Lower mainstem downstream of the canyon
2nd- Other reaches that may have potential for off-channel and side-channel habitat restoration or creation

Key Programs

Agency	Program Name	Sufficient	Needs Expansion
WDFW	Habitat Program		✓
Lower Columbia Fish Enhancement Group	Habitat Projects		✓
NGOs, tribes, Conservation Districts, agencies, landowners	Habitat Projects		✓
USACE	Water Resources Development Act (Sect. 1135 & Sect. 206)		✓

Program Sufficiency and Gaps

There are no regulatory mechanisms for creating or restoring off-channel and side-channel habitat. Means of increasing restoration activity include building partnerships with landowners, increasing landowner participation in conservation programs, allowing restoration projects to serve as mitigation for other activities, and increasing funding for NGOs, government entities, and landowners to conduct restoration projects.

Table H-15. Habitat actions for the Coweeman Basin.

Action	Status	Responsible Entity	Measures Addressed	Spatial Coverage of Target Area[1]	Expected Biophysical Response[2]	Certainty of Outcome[3]
Cowee 1. Expand standards in local government comprehensive plans to afford adequate protections of ecologically important areas (i.e. stream channels, riparian zones, floodplains, CMZs, wetlands, unstable geology)	Expansion of existing program or activity	Cowlitz County, City of Kelso	1 & 2	Medium: Private lands. Applies primarily to residential, agricultural, and forest lands at risk of development	High: Protection of water quality, riparian function, stream channel structure (e.g. LWD), floodplain function, CMZs, wetland function, runoff processes, and sediment supply processes	High
Cowee 2. Manage future growth and development patterns to ensure the protection of watershed processes. This includes limiting the conversion of agriculture and timber lands to developed uses through zoning regulations and tax incentives	Expansion of existing program or activity	Cowlitz County, City of Kelso	1 & 2	Medium: Private lands. Applies primarily to residential, agricultural, and forest lands at risk of development	High: Protection of water quality, riparian function, stream channel structure (e.g. LWD), floodplain function, CMZs, wetland function, runoff processes, and sediment supply processes	High
Cowee 3. Increase funding available to purchase easements or property in sensitive areas in order to protect watershed function where existing programs are inadequate	Expansion of existing program or activity	LCFRB, NGOs, WDFW, USFWS, BPA (NPCC)	1 & 2	Medium: Residential, agricultural, or forest lands at risk of further degradation	High: Protection of riparian function, floodplain function, water quality, wetland function, and runoff and sediment supply processes	High
Cowee 4. Increase technical assistance to landowners and increase landowner participation in conservation programs that protect and restore habitat and habitat-forming processes. Includes increasing the incentives (financial or otherwise) and increasing program marketing and outreach	Expansion of existing program or activity	NRCS, W/CCD, WDNR, WDFW, LCFEG, Cowlitz County, Kelso	All measures	High: Private lands. Applies to lands in agriculture, rural residential, and forestland uses throughout the basin	High: Increased landowner stewardship of habitat. Potential improvement in all factors	Medium
Cowee 5. Fully implement and enforce the Forest Practices Rules (FPRs) on private timber lands in order to afford protections to riparian areas, sediment processes, runoff processes, water quality, and access to habitats	Activity is currently in place	WDNR	1, 2, 3, 5, 6 & 8	High: Private commercial timber lands	High: Increase in instream LWD; reduced stream temperature extremes; greater streambank stability; reduction in road-related fine sediment delivery; decreased peak flow volumes; restoration and preservation of fish access to habitats	Medium

[1] *Relative amount of basin affected by action*
[2] *Expected response of action implementation*
[3] *Relative certainty that expected results will occur as a result of full implementation of action*

Action	Status	Responsible Entity	Measures Addressed	Spatial Coverage of Target Area[1]	Expected Biophysical Response[2]	Certainty of Outcome[3]
Cowee 6. Conduct floodplain restoration where feasible along the lower mainstem that has experienced channel confinement. Build partnerships with the City of Kelso and other landowners and provide financial incentives	New program or activity	NRCS, W/CCD, NGOs, WDFW, LCFRB, City of Kelso, USACE, Cowlitz County	4, 5, 6, 7 & 8	Low: Lower mainstem Coweeman	High: Restoration of floodplain function, habitat diversity, and habitat availability.	Medium
Cowee 7. Prevent floodplain impacts from new development through land use controls and Best Management Practices	New program or activity	Cowlitz County, Ecology, Kelso	1	Low: Private lands currently in agriculture or timber production in lowland areas.	Medium: Protection of floodplain function, CMZ processes, and off-channel/side-channel habitat. Prevention of reduced habitat diversity and key habitat availability	High
Cowee 8. Review and adjust operations to ensure compliance with the Endangered Species Act; examples include roads, parks, and weed management	Expansion of existing program or activity	Cowlitz County, Kelso	1, 3, 5, & 8	Low: Applies to lands under public jurisdiction	Medium: Protection of water quality, greater streambank stability, reduction in road-related fine sediment delivery, restoration and preservation of fish access to habitats	High
Cowee 9. Implement the prescriptions of the WRIA 25/26 Watershed Planning Unit regarding instream flows	Activity is currently in place	Ecology, WDFW, WRIA 25/26 Planning Unit, Kelso	9	High: Entire basin	Medium: Adequate instream flows to support life stages of salmonids and other aquatic biota.	Medium
Cowee 10. Increase the level of implementation of voluntary habitat enhancement projects in high priority reaches and subwatersheds. This includes building partnerships, providing incentives to landowners, and increasing funding	Expansion of existing program or activity	LCFRB, BPA (NPCC), NGOs, WDFW, NRCS, W/CCD, LCFEG	3, 4, 5, 6, 7, 8 & 10	High: Priority stream reaches and subwatersheds throughout the basin	Medium: Improved conditions related to water quality (temperature and bacteria), LWD quantities, bank stability, key habitat availability, habitat diversity, riparian function, floodplain function, sediment availability, & channel migration processes	Medium
Cowee 11. Increase technical support and funding to small forest landowners faced with implementation of Forest and Fish requirements for fixing roads and barriers to ensure full and timely compliance with regulations	Expansion of existing program or activity	WDNR	1, 2, 3, 5, 6, & 8	Medium: Small private timberland owners	High: Reduction in road-related fine sediment delivery; decreased peak flow volumes; restoration and preservation of fish access to habitats	Medium
Cowee 12. Assess the impact of fish passage barriers (especially culverts) throughout the basin and restore access to potentially productive habitats	Expansion of existing program or activity	WDFW, WDNR, Cowlitz County WSDOT, City of Kelso, LCFEG	6	Medium: As many as 9 miles of stream are potentially blocked by artificial barriers	Medium: Increased spawning and rearing capacity due to access to blocked habitat. Habitat is marginal in most cases	Medium

Action	Status	Responsible Entity	Measures Addressed	Spatial Coverage of Target Area [1]	Expected Biophysical Response [2]	Certainty of Outcome [3]
Cowee 13. Create and/or restore lost side-channel/off-channel habitat for chum spawning and coho overwintering	New program or activity	LCFRB, BPA (NPCC), NGOs, WDFW, NRCS, W/CCD, LCFEG	10	Low: Lower mainstem Coweeman	Medium: Increased habitat availability for spawning and rearing	Medium
Cowee 14. Protect and restore native plant communities from the effects of invasive species	Expansion of existing program or activity	Weed Control Boards (local and state); NRCS, W/CCD, LCFEG	1 & 5	Medium: Greatest risk is in agriculture and residential use areas	Medium: restoration and protection of native plant communities necessary to support watershed and riparian function	Low
Cowee 15. Address temperature impairments through development of water quality clean up plans (TMDLs)	Expansion of existing program or activity	Ecology	8	High: There are several reaches with temperature impairement	Medium: More suitable temperatures to support fish rearing	Medium

H.6.5. Hatcheries

This subbasin plan describes potential hatchery strategies and actions designed to address recovery objectives and hatchery risks detailed in Volume I and in hatchery program assessments described earlier in this Volume II chapter. These strategies and actions are largely based on assessments in the interim planning process that was completed in 2004. Strategies and actions are generally consistent with more recent plans based on HSRG analyses and WDFW's Conservation and Sustainable Fisheries Plan. However, in several cases, the ongoing hatchery reform and planning process has identified revisions to the alternatives presented herein.

Subbasin Hatchery Strategy

The desired future state of fish production within the Coweeman River Basin includes natural salmon and steelhead populations that are improving on a trajectory to recovery and hatchery programs that either enhance the natural fish recovery trajectory or are operated to not impede progress towards recovery. Hatchery recovery measures in each subbasin are tailored to the specific ecological and biological circumstances for each species in the subbasin. The recovery strategy includes a mixture of conservation programs and mitigation programs for lost fishing benefits. Mitigation programs involve areas or practices selected for consistency with natural population conservation and recovery objectives. A summary of the types of natural production enhancement strategies and fishery enhancement strategies to be implemented in the Coweeman River Basin are displayed by species in Table H-1617. More detailed descriptions and discussion of the regional hatchery strategy can be found in the Regional Recovery and Subbasin Plan Volume I.

Table H-16. Summary of potential natural production and fishery enhancement strategies to be implemented in the Coweeman River Basin.

		Species					
		Fall Chinook	Spring Chinook	Coho	Chum	Winter Steelhead	Steelhead
Natural Production Enhancement	Supplementation			✓			
	Hatch/Nat Conservation [1]						
	Isolation						
	Refuge	✓					
Fishery Enhancement	Hatchery Production					✓	

[1] Hatchery and natural population management strategy coordinated meet biological recovery objectives. Strategy may include integration and/or isolation over time. Strategy will be unique to biological and ecological circumstances in each watershed.

Conservation-based hatchery programs include strategies and measures which are specifically intended to enhance or protect production of a particular wild fish population within the basin. A unique conservation strategy is developed for each species and watershed depending on the status of the natural population, the biological relationship between the hatchery and natural populations, ecological attributes of the watershed, and logistical opportunities to jointly manage the populations. Four types of hatchery conservation strategies may be employed:

Natural Refuge Watersheds**:** In this strategy, certain sub-basins are designated as wild-fish-only areas for a particular species. The refuge areas include watersheds where populations have persisted with minimum hatchery influence and areas that may have a history of hatchery production but would not be subjected to future hatchery influence as part of the recovery strategy. More refuge areas may be added over time as wild populations recover. These refugia provide an opportunity to monitor population trends independent of the confounding influence of hatchery fish and will be key indicators of natural population status within the ESU. The Coweeman River Basin would be a refuge area for natural fall Chinook

Hatchery Supplementation: This strategy utilizes hatchery production as a tool to assist in rebuilding depressed natural populations. Supplementation would occur in selected areas that are producing natural fish at levels significantly below current capacity or capacity is expected to increase as a result of immediate benefits of habitat or passage improvements. This is intended to be a temporary measure to jump start critically low populations and to bolster natural fish numbers above critical levels in selected areas until habitat is restored to levels where a population can be self sustaining. This strategy would include coho in the Coweeman Basin.

Hatchery/Natural Isolation: This strategy is focused on physically separating hatchery adult fish from naturally-produced adult fish to avoid or minimize spawning interactions to allow natural adaptive processes to restore native population diversity and productivity. The strategy may be implemented in the entire watershed or more often in a section of the watershed upstream of a barrier or trap where the hatchery fish can be removed. This strategy is currently aimed at hatchery steelhead in watersheds with trapping capabilities. The strategy may also become part of spring and fall Chinook as well as coho strategy in certain watersheds in the future as unique wild runs develop. This definition refers only to programs where fish are physically sorted using a barrier or trap. Some mitigation programs for fishery benefits, particularly for steelhead, are managed to isolate hatchery and wild stocks based on run timing and release locations.

Hatchery/Natural Merged Conservation Strategy: This strategy addresses the case where natural and hatchery fish have been homogenized over time such that they are principally all one stock that includes the native genetic material for the basin. Many spring Chinook, fall Chinook, and coho populations in the lower Columbia currently fall into this category. In many cases, the composite stock productivity is no longer sufficient to support a self-sustaining natural population especially in the face of habitat degradation. The hatchery program will be critical to maintaining any population until habitat can be improved and a strictly natural population can be re-established. This merged strategy is intended to transition these mixed populations to a self-supporting natural population that is not subsidized by hatchery production or subject to deleterious hatchery impacts. Elements include separate management of hatchery and natural subpopulations, regulation of hatchery fish in natural areas, incorporation of natural fish into hatchery broodstock, and annual abundance-driven distribution. Corresponding programs are expected to evolve over time dependent on changes in the populations and in the habitat productivity. This strategy is primarily aimed at Chinook salmon in areas where harvest production occurs. There is not a Chinook harvest program in the Coweeman Basin.

Not every lower Columbia River hatchery program will be turned into a conservation program. The majority of funding for lower Columbia basin hatchery operations is for producing salmon and steelhead for harvest to mitigate for lost harvest of natural production due to hydro development and habitat degradation. Programs for fishery enhancement will continue during the recovery period, but will be managed to minimize risks and ensure they do not compromise recovery objectives for natural populations. It is expected that the need to produce compensatory fish for harvest through artificial production will reduce in the future as natural populations recover and become harvestable. There is a small fishery enhancement program for winter steelhead in the Coweeman Basin.

Hatchery Measures and Actions

Hatchery strategies and measures are focused on evaluating and reducing biological risks consistent with the recovery strategies identified for each natural population. Artificial production programs within Coweeman River facilities have been evaluated in detail through the WDFW Benefit-Risk Assessment Procedure (BRAP) relative to risks to natural populations. The BRAP results were utilized to inform the development of these program actions specific to the Coweeman River Basin (Table H-1718). These hatchery recovery actions were developed in coordination with WDFW and at the same time as the Hatchery and Genetic Management Plans (HGMP) were developed by WDFW for each hatchery program. As a result, the hatchery actions represented in this document will provide direction for specific actions which will be detailed in the HGMPs submitted by WDFW for public review and for NMFS approval. It is expected that the HGMPs and these recovery actions will be complementary and provide a coordinated strategy for the Coweeman River Basin hatchery programs. Further explanation of specific strategies and actions for hatcheries can be found in the Regional Recovery and Subbasin Plan Volume I.

Table H-17. Potential hatchery implementation actions in the Coweeman Subbasin.

Action	Hatchery Program Addressed	Natural Populations Addressed	Limiting Factors Addressed	Threats Addressed	Activity	Expected Outcome
*Adipose fin-clip mark hatchery released steelhead.	Elochoman Hatchery winter steelhead released into the Coweeman River	Coweeman winter steelhead.	Domestication, Diversity, Abundance	• In-breeding • Harvest	• Continue to mass mark Elochoman Hatchery steelhead releases to provide the means to identify hatchery fish for selective fisheries and to distinguish between hatchery and wild fish returning to the Coweeman River.	• Continue selective fishery opportunity for hatchery produced summer steelhead in the Coweeman River. Harvest impacts to wild Coweeman winter steelhead are minimal and indirect • Enable visual identification of hatchery and wild returns to provide the means to account for and manage the natural and wild escapement consistent with biological objectives
*Preclude release of hatchery produced Chinook into the Coweeman River.	All fall Chinook programs	Coweeman fall Chinook	Domestication, Diversity	• In-breeding	• Maintain Coweeman as a refugia for natural fall Chinook without genetic influence from hatchery produced fall Chinook.	• Coweeman fall Chinook population rebuilds while maintaining genetic legacy attributes. • Coweeman fall Chinook possesses genetic attributes which enable the population to reach productivity potential.
*Juvenile release strategies to minimize impacts to natural populations	Elochoman Hatchery winter steelhead released into the Coweeman.	Coweeman steelhead, coho, fall Chinook, and chum	Predation, Competition	• Hatchery smolt residence time in the Coweeman .	• Hatchery produced steelhead will be scheduled for release during the time when the maximum numbers of fish are smolted and prepared to emigrate rapidly. • Juvenile rearing strategies will be implemented to provide a	• Minimal residence time of hatchery released juvenile resulting in reduced ecological interactions between hatchery and wild juveniles. • Minimized predation by summer steelhead smolts

Action	Hatchery Program Addressed	Natural Populations Addressed	Limiting Factors Addressed	Threats Addressed	Activity	Expected Outcome
					fish growth schedule which coincides with an optimum release time for hatchery production survival and to minimize time spent in the Coweeman Basin.	upon natural produced winter and summer steelhead, coho, fall Chinook, and chum. • Improved survival of wild juveniles, resulting in increased productivity and abundance of winter and summer steelhead, coho, fall Chinook, and chum
** Hatchery programs utilized for coho supplementation	Cowlitz and/or Kalama Hatchery coho.	Coweeman coho.	Abundance, spatial distribution	• Risk of low number of natural spawners • Ecologically appropriat e brood stock.	• Utilize coho production from Cowlitz and/or Kalama hatcheries to supplement coho production in the Coweeman. Cowlitz Hatchery coho could be used for late stock supplementation and Kalama Hatchery coho for early stock supplementation.	• Supplementation, strategies in key Coweeman tributaries will assist in "kick-starting" natural coho recovery, coinciding with habitat improvements and harvest management actions.
** Monitoring and evaluation, adaptive management	All species	All species	Hatchery production performance, Natural production performance	• All of above	• Research, monitoring , and evaluation of performance of the above actions in relation to expected outcomes • Performance standards developed for each actions with measurable criteria to determine success or failure • Adaptive Management applied to adjust or change actions as necessary	• Clear standards for performance and adequate monitoring programs to evaluate actions. • Adaptive management strategy reacts to information and provides clear path for adjustment or change to meet performance standard

[1] *May include integrated and/or segregated strategy over time.*

√*Denotes new program*

H.6.6. Harvest

Fisheries are both an impact that reduces fish numbers and an objective of recovery. The long-term vision is to restore healthy, harvestable natural salmonid populations in many areas of the lower Columbia basin. The near-term strategy involves reducing fishery impacts on natural populations to ameliorate extinction risks until a combination of actions can restore natural population productivity to levels where increased fishing may resume. The regional strategy for interim reductions in fishery impacts involves: 1) elimination of directed fisheries on weak natural populations, 2) regulation of mixed stock fisheries for healthy hatchery and natural populations to limit and minimize indirect impacts on natural populations, 3) scaling of allowable indirect impacts for consistency with recovery, 4) annual abundance-based management to provide added protection in years of low abundance while allowing greater fishing opportunity consistent with recovery in years with much higher abundance, and 5) mass marking of hatchery fish for identification and selective fisheries.

Actions to address harvest impacts are generally focused at a regional level to cover fishery impacts accrued to lower Columbia salmon as they migrate along the Pacific Coast and through the mainstem Columbia River. Fisheries are no longer directed at weak natural populations but incidentally catch these fish while targeting healthy wild and hatchery stocks. Subbasin fisheries affecting natural populations have been largely eliminated. Fishery management has shifted from a focus on maximum sustainable harvest of the strong stocks to ensuring protection of the weak stocks. Weak stock protections often preclude access to large numbers of otherwise harvestable fish in strong stocks.

Fishery impact limits to protect ESA-listed weak populations are generally based on risk assessments that identify points where fisheries do not pose jeopardy to the continued persistence of a listed group of fish. In many cases, these assessments identify the point where additional fishery reductions provide little reduction in extinction risks. A population may continue to be at significant risk of extinction but those risks are no longer substantially affected by the specified fishing levels. Often, no level of fishery reduction will be adequate to meet naturally-spawning population escapement goals related to population viability. The elimination of harvest will not in itself lead to the recovery of a population. However, prudent and careful management of harvest can help close the gap in a coordinated effort to achieve recovery.

Fishery actions specific to the subbasins are addressed through the Washington State Fish and Wildlife sport fishing regulatory process. This public process includes an annual review focused on emergency type regulatory changes and a comprehensive review of sport fishing regulations which occurs every two years. This regulatory process includes development of fishing rules through the Washington Administrative Code (WAC) which are focused on protecting weak stock populations while providing appropriate access to harvestable populations. The actions consider the specific circumstances in each area of each subbasin and respond with rules that fit the relative risk to the weak populations in a given time and area of the subbasin. A summary of regulatory and protective fishery actions pertaining to the Coweeman River Basin are presented in Table H-1819. Additional tributary fishing rules detail can be found in the WDFW sport fishing regulation pamphlet.

Regional actions cover species from multiple watersheds which share the same migration routes and timing, resulting in similar fishery exposure. Regional strategies and actions for harvest are detailed in the Volume I. A number of regional strategies for harvest involve implementation of actions within specific subbasins. In-basin fishery management is generally applicable to steelhead and salmon while regional management is more applicable to salmon. Regional harvest actions with significant application to the Coweeman subbasin populations are summarized in Table H-1920.

Table H-18. Summary of regulatory and protective fishery actions in the Coweeman basin

Species	General Fishing Actions	Explanation	Other Protective Fishery Actions	Explanation
Fall Chinook	Closed to retention	Protects wild fall Chinook. No hatchery produced fall Chinook in the Coweeman	No fisheries for other salmon	Further protection of wild fall Chinook spawners
Chum	Closed to retention	Protects wild chum. Hatchery chum are not released in the Coweeman	No fisheries for other salmon	Further protection of wild chum spawners
Coho	Closed to retention	Protects wild coho. Hatchery coho are not released in the Coweeman for harvest.	No fisheries for other salmon	Further protection of wild coho spawners
Winter steelhead	Retain only adipose fin-clip marked steelhead	Selective fishery for hatchery steelhead, unmarked wild steelhead must be released	Steelhead and trout fishing closed in the spring and minimum size restrictions in affect	Spring closure Protects adult wild steelhead during spawning and minimum size protects juvenile steelhead

Table H-19. Regional harvest actions from Volume I with significant application to the Coweeman River populations.

Action	Description	Responsible Parties	Programs	Comments
	Develop a regional mass marking program for tule fall Chinook	WDFW, NMFS, USFWS, Col. Tribes	U.S. Congress, Washington Fish and Wildlife Commission	Retention of fall Chinook is prohibited in the Coweeman sport fishery, however marking of other hatchery tule fall Chinook may provide regional selective fishery options.
	Monitor and evaluate commercial and sport impacts to naturally-spawning steelhead in salmon and hatchery steelhead target fisheries.	WDFW, ODFW	Columbia Compact, BPA Fish and Wildlife Program	Includes monitoring of naturally-spawning steelhead encounter rates in fisheries and refinement of long-term catch and release handling mortality estimates. Would include assessment of the current monitoring programs and determine their adequacy in formulating naturally-spawning steelhead incidental mortality estimates.
	Continue to improve gear and regulations to minimize incidental impacts to naturally-spawning steelhead.	WDFW, ODFW	Columbia Compact, BPA Fish and Wildlife Program	Regulatory agencies should continue to refine gear, handle and release methods, and seasonal options to minimize mortality of naturally-spawning steelhead in commercial and sport fisheries.
	Maintain selective sport fisheries in Ocean, Columbia River, and tributaries and monitor naturally-spawning stock impacts.	WDFW, NMFS, ODFW, USFWS	PFMC, Columbia Compact, BPA Fish and Wildlife Program, WDFW Creel	Mass marking of lower Columbia River coho and steelhead has enabled successful ocean and freshwater selective fisheries to be implemented since 1998. Marking programs should be continued and fisheries monitored to provide improved estimates of naturally-spawning salmon and steelhead release mortality.

** Extension or improvement of existing action*

*** New action*

H.6.7. Hydropower

No hydropower facilities exist in the Coweeman Basin, hence, no in-basin hydropower actions are identified. Coweeman River anadromous fish populations will benefit from regional hydropower recovery measures and actions identified in regional plans to address habitat effects in the mainstem and estuary.

H.6.8. Mainstem and Estuary Habitat

Coweeman River anadromous fish populations will also benefit from regional recovery strategies and measures identified to address habitat conditions and threats in the Columbia River mainstem and estuary. Regional recovery plan strategies involve: 1) avoiding large scale habitat changes where risks are known or uncertain, 2) mitigating small-scale local habitat impacts to ensure no net loss, 3) protecting functioning habitats while restoring impaired habitats to functional conditions, 4) striving to understand, protect, and restore habitat-forming processes, 5) moving habitat conditions in the direction of the historical template which is presumed to be more consistent with restoring viable populations, and 6) improving understanding of salmonid habitat use in the Columbia River mainstem and estuary and their response to habitat changes. A series of specific measures are detailed in the regional plan for each of these strategies.

H.6.9. Ecological Interactions

For the purposes of this plan, ecological interactions refer to the relationships of salmon and steelhead with other elements of the ecosystem. Regional strategies and measures pertaining to exotic or non-native species, effects of salmon on system productivity, and native predators of salmon are detailed and discussed at length in the Regional Recovery and Subbasin Plan Volume I and are not reprised at length in each subbasin plan. Strategies include 1) avoiding, eliminating introductions of new exotic species and managing effects of existing exotic species, 2) recognizing the significance of salmon to the productivity of other species and the salmon themselves, and 3) managing predation by selected species while also maintaining a viable balance of predator populations. A series of specific measures are detailed in the regional plan for each of these strategies. Implementation will occur at the regional and subbasin scale.

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