Volume II, Chapter 6
Cowlitz Subbasin—Coweeman

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6.0 Cowlitz Subbasin—Coweeman River

6.1 Subbasin Description

6.1.1 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.

6.1.2 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.

6.1.3 Land Use/Land 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 town of Kelso has a projected change of 42% by 2020 (LCFRB 2001). A breakdown of land ownership and land cover in the Coweeman basin is presented in Figure 6-1 and Figure 6-2. Figure 6-3 displays the pattern of landownership for the basin. Figure 6-4 displays the pattern of land cover / land-use.

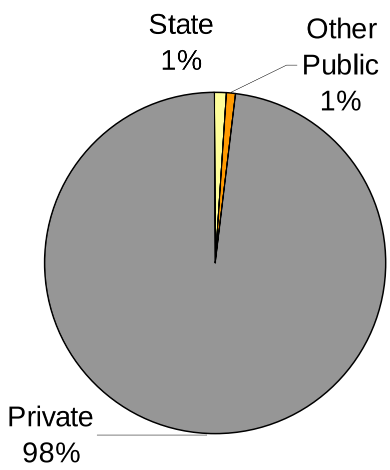


Figure 6-1. Coweeman River subbasin land ownership

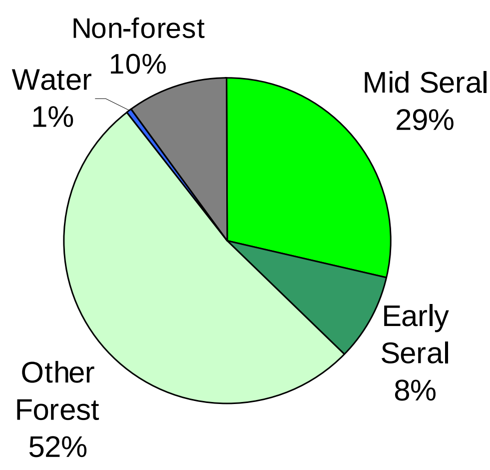


Figure 6-2. Coweeman River subbasin land cover

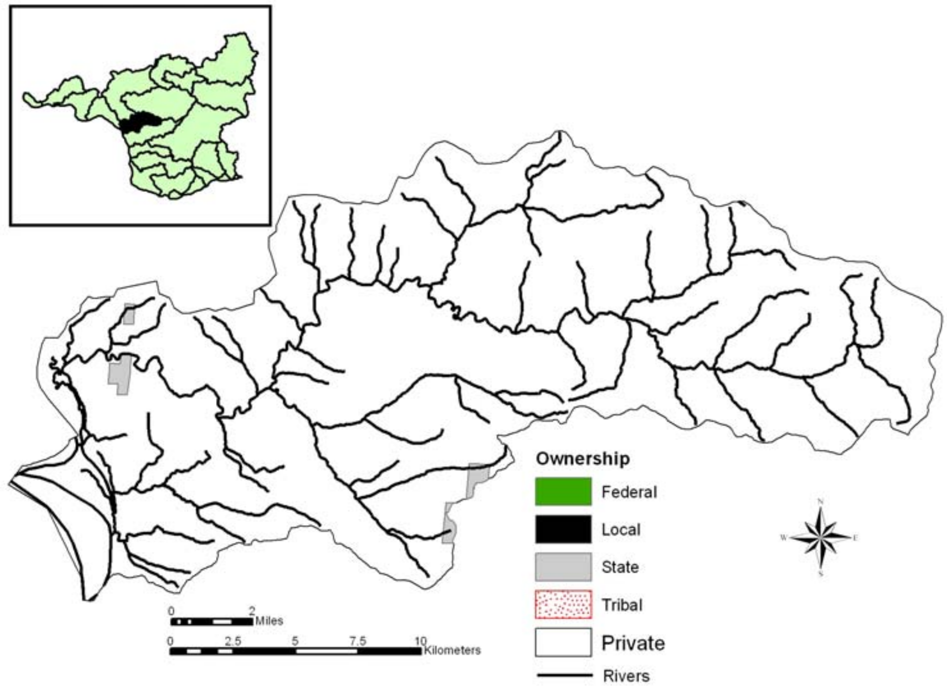


Figure 6-3. Landownership within the Coweeman basin. Data is WDNR data that was obtained from the Interior Columbia Basin Ecosystem Management Project (ICBEMP).

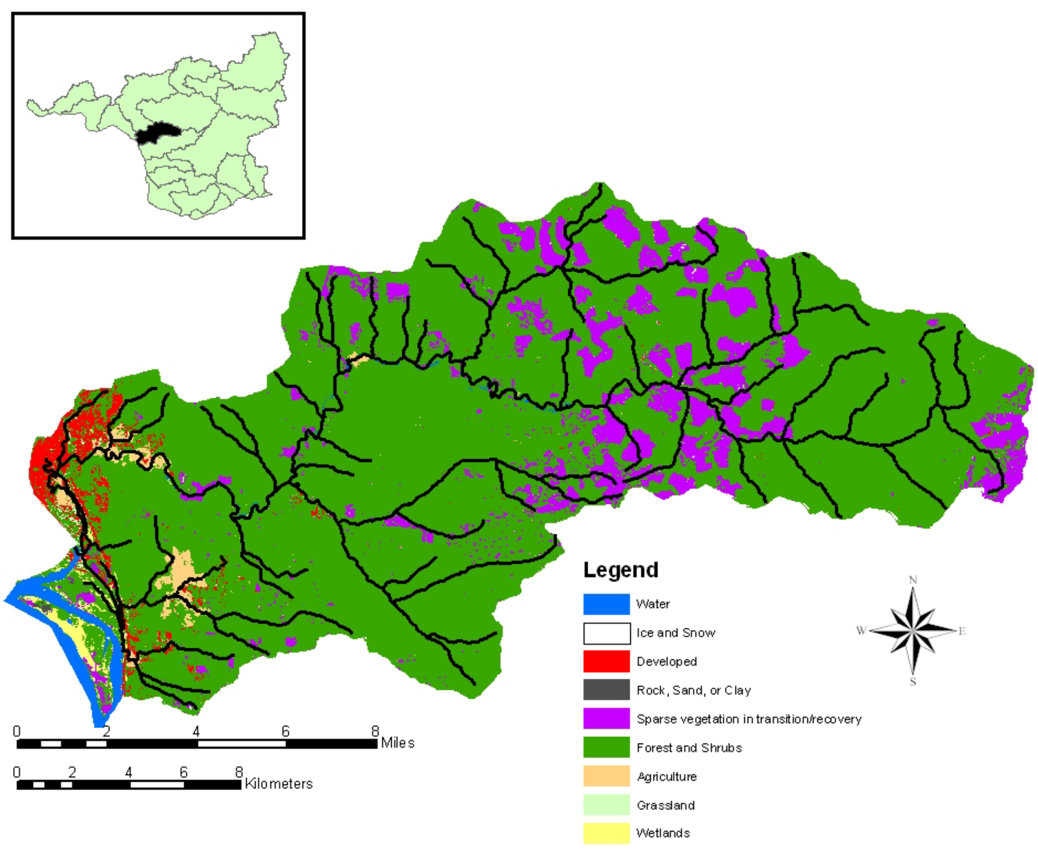
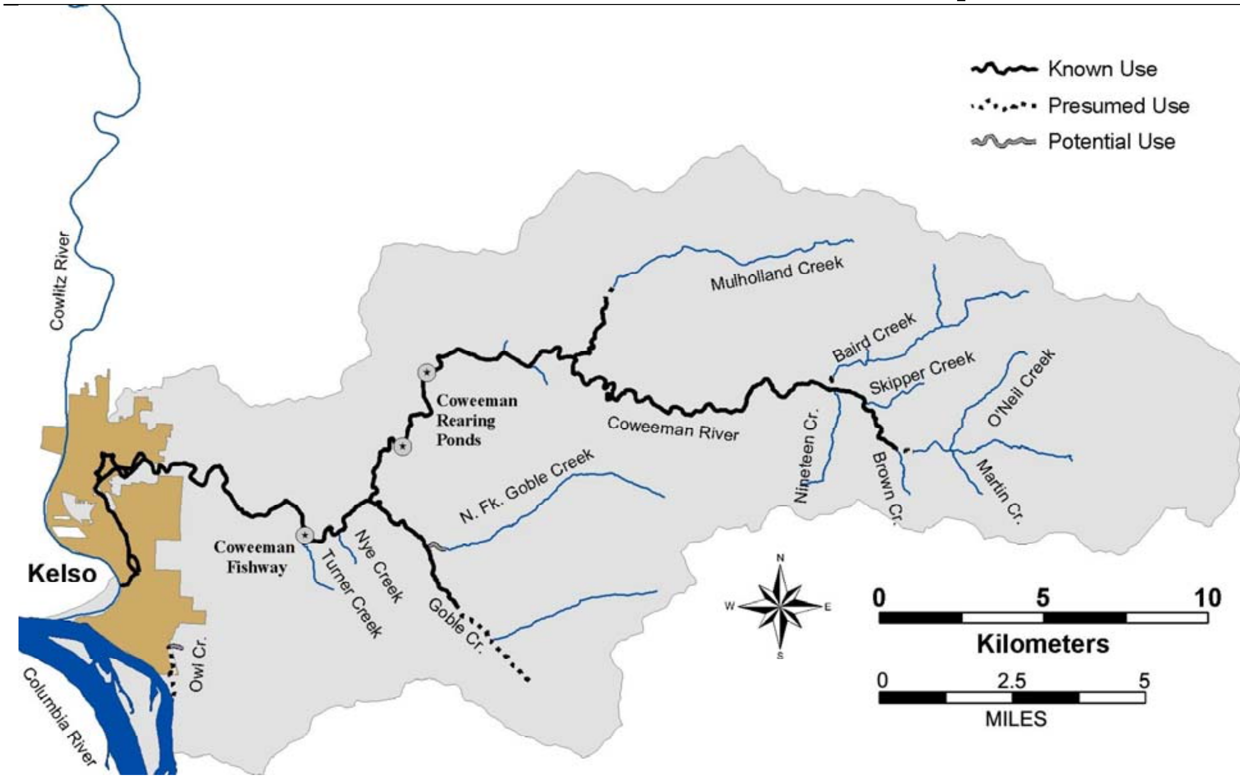


Figure 6-4. Land cover within the Coweeman basin. Data was obtained from the USGS National Land Cover Dataset (NLCD).

6.2 Focal Fish Species

6.2.1 Fall Chinook—Cowlitz Subbasin (Coweeman)

ESA: Threatened 1999 **SASSI: Depressed 2002**

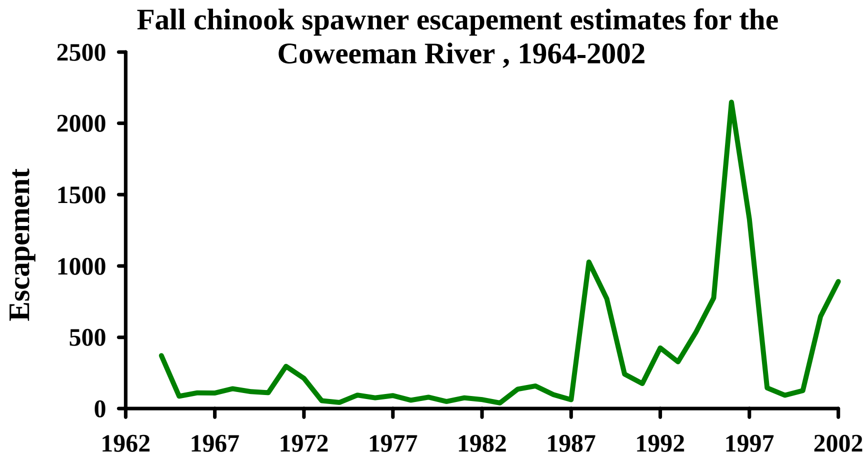


Distribution

- 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

- NMFS Status Assessment for the Coweeman River indicated zero risk of 90% decline in 25 years, 90% decline in 50 years, or extinction in 50 years
- 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

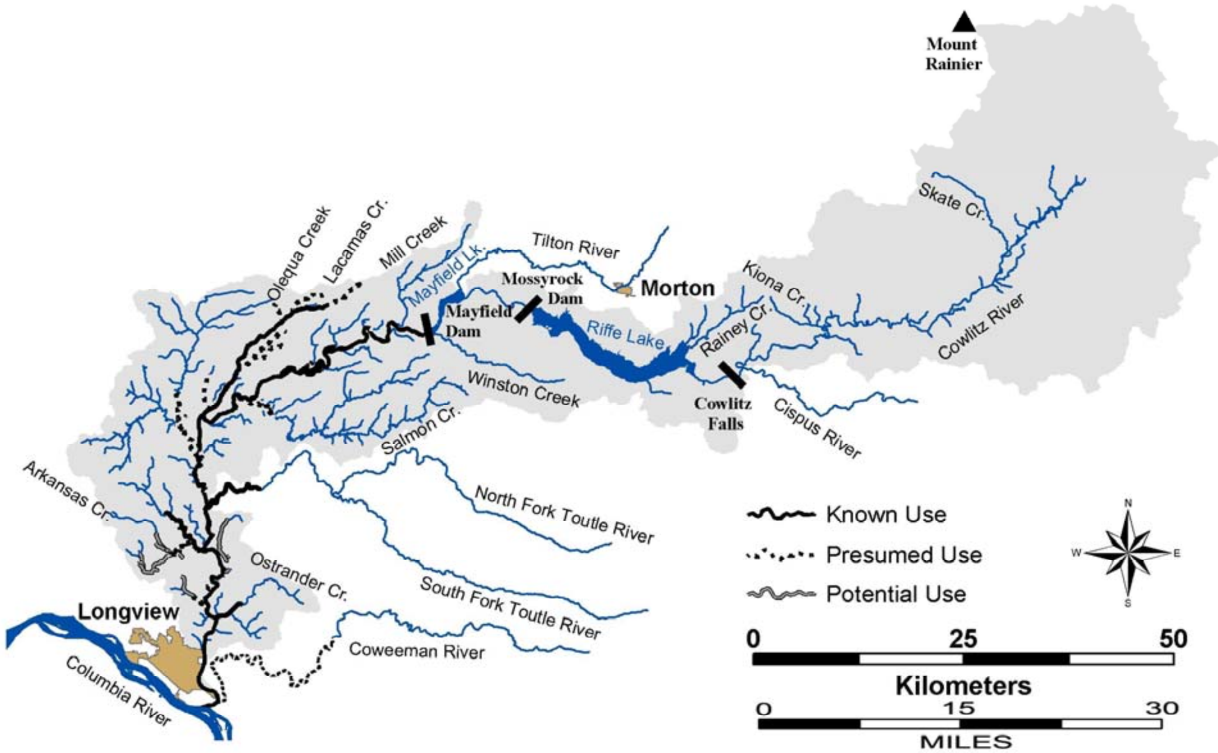
- No hatchery tags have been recovered in Coweeman River natural spawning fall chinook in surveys conducted since 1980, indicating the population is not currently influenced by stray hatchery fish from outside the system

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

6.2.2 Chum—Cowlitz Subbasin

ESA: Threatened 1999 **SASSI: NA**



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

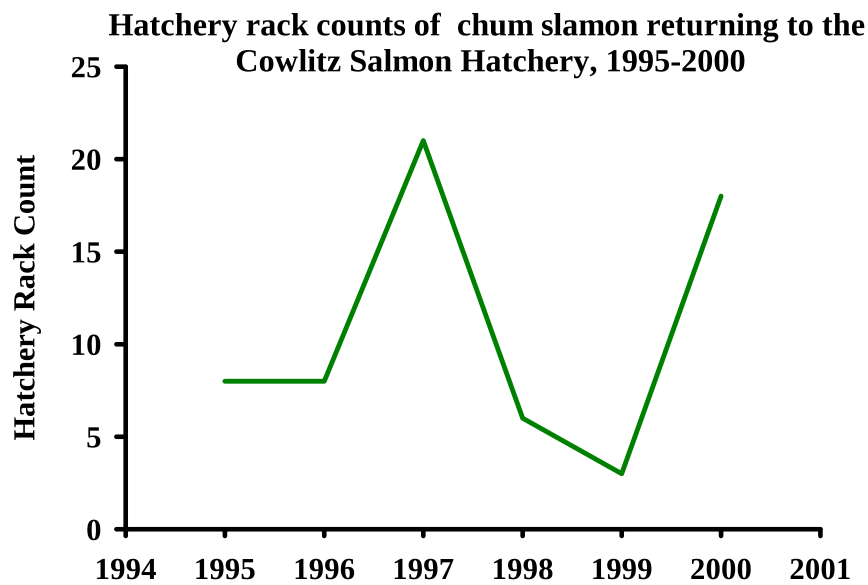
- No hatchery releases of chum have occurred in the Cowlitz basin

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

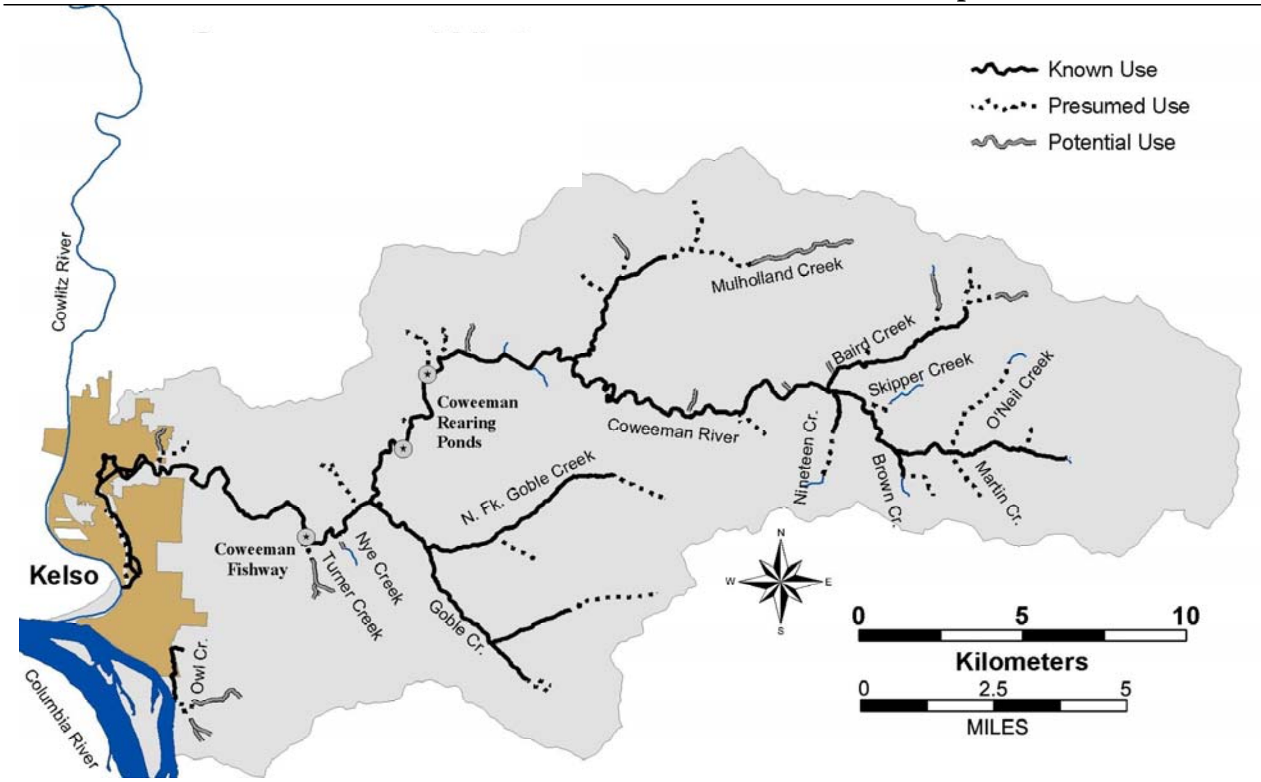
- Cowlitz Salmon Hatchery does not produce/release chum salmon
- Chum salmon are captured annually in the hatchery rack

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 then 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 then 5% of the annual return

6.2.3 Winter Steelhead—Cowlitz Subbasin (Coweeman)

ESA: Threatened 1998	SASSI: Depressed 2002



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

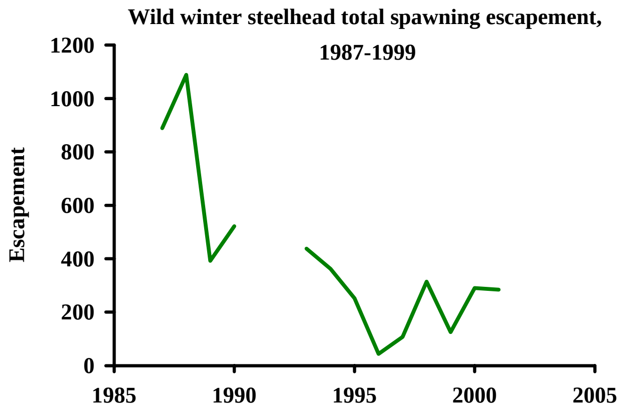
- Adult migration timing for Coweeman winter steelhead is from December through April
- Spawning timing on the Coweeman is generally from early March to early June
- Age composition data for Coweeman River winter steelhead are not available
- Wild steelhead fry emerge from March through May; juveniles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

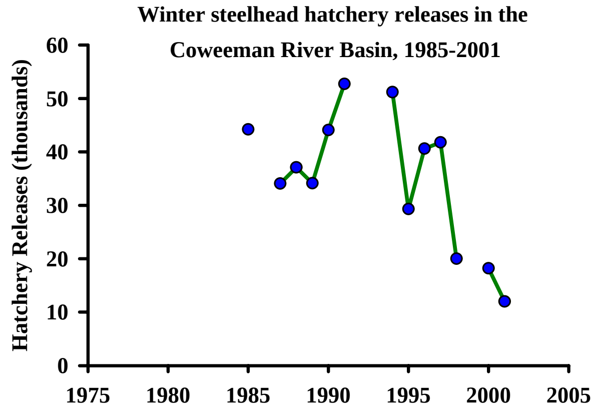
Diversity

- 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

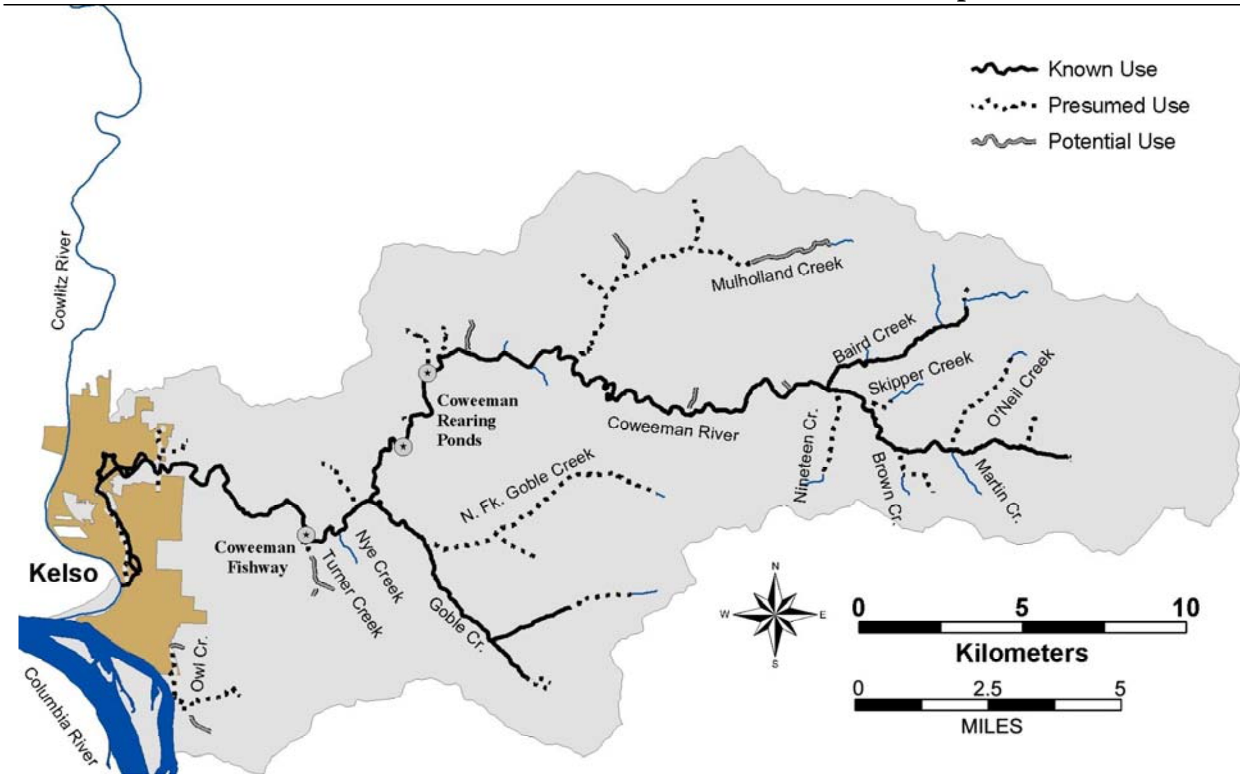
Hatchery

- 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

ESA: Not Listed	SASSI: Depressed 2000



Distribution

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

Life History

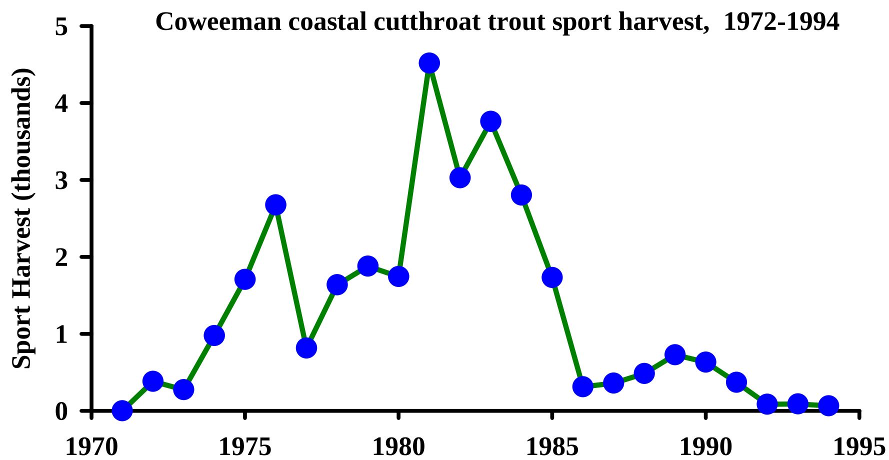
- Anadromous, fluvial and resident forms are present
- Anadromous river entry is from August through March, with peak entry in the fall
- Anadromous spawning occurs from January through mid-April
- Fluvial and resident spawn timing is not documented but is believed to be similar to anadromous timing

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

6.3 Potentially Manageable Impacts

In Volume I of this Technical Foundation, we evaluated factors currently limiting Washington lower Columbia River salmon and steelhead populations based on a simple index of potentially manageable impacts. The index incorporated human-caused increases in fish mortality, changes in habitat capacity, and other natural factors of interest (e.g. predation) that might be managed to affect salmon productivity and numbers. The index was intended to inventory key factors and place them in perspective relative to each other, thereby providing general guidance for technical and policy level recovery decisions. In popular parlance, the factors for salmon declines have come to be known as the 4-H's: hydropower, habitat, harvest, and hatcheries. The index of potentially manageable mortality factors has been presented here to prioritize impacts within each subbasin.

- Loss of tributary habitat quantity and quality has significant impacts on winter steelhead coho and chum populations. For fall chinook, loss of tributary habitat is of moderate importance. Loss of estuary habitat is moderately important to fall chinook and chum, but is of minor importance to both winter steelhead and coho.
- Harvest impacts are of high importance to both fall chinook and coho, but is of relatively minor importance to winter steelhead and chum.
- Predation is moderately important to all three populations in the Coweeman.
- Impacts from hatcheries and the hydrosystem are relatively minor for each population.

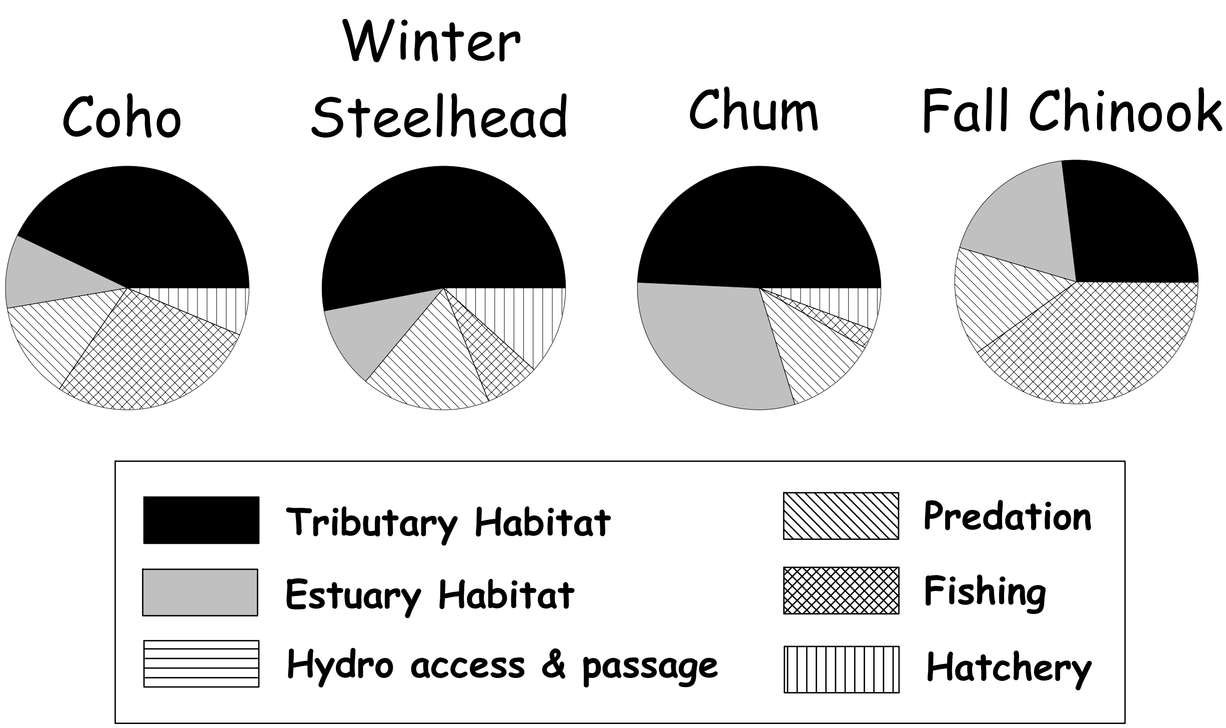


Figure 6-5. Relative index of potentially manageable mortality factors for each species in the Coweeman subbasin.

6.4 Hatchery Programs

Vol II, Chapter 8.4 contains a discussion of the hatcheries in the Cowlitz basin.

6.5 Fish Habitat Conditions

6.5.1 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 Conservaton Commission's WRIA 26 Limiting Factors Analysis (Wade 2000).

6.5.2 Stream Flow

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) indicate that the current and future projected groundwater withdrawal appears to be much less than the groundwater available in the subbasin. The extent of impact of groundwater pumping on stream flow rates appears to be minimal on a subbasin scale (LCFRB 2001).

6.5.3 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.

6.5.4 Key Habitat

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.

6.5.5 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.

6.5.6 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.

6.5.7 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).

6.5.8 Riparian Function

According to IWA watershed process modeling, which is presented in greater detail later in this chapter, the Coweeman basin suffers from 'moderately impiared' 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 is 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.

6.5.9 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).

6.6 Fish/Habitat Assessments

The previous descriptions of fish habitat conditions can help identify general problems but do not provide sufficient detail to determine the magnitude of change needed to affect recovery or to prioritize specific habitat restoration activities. 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 steelhead, chum, coho and fall chinook. A thorough description of the EDT model, and its application to lower Columbia salmonid populations, can be found in Volume VI.

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.

6.6.1 Population Analysis

Population assessments under different habitat conditions are useful for comparing fish trends and establishing recovery goals. Fish population levels under current and potential 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- 86% decline in adult productivity for all species compared to historical estimates (Table 6-1). Modeled historical adult abundance of coho and winter steelhead was nearly three times greater than current estimates (Figure 6-6). Current abundance of adult fall chinook is estimated at 56% of historical levels, while the current abundance of chum is estimated at only 8% of historical levels (Figure 6-6). Diversity (as measured by the diversity index) is estimated to have remained relatively constant for fall chinook, chum, and winter steelhead. However, diversity has declined by approximately 40% for coho (Table 6-1).

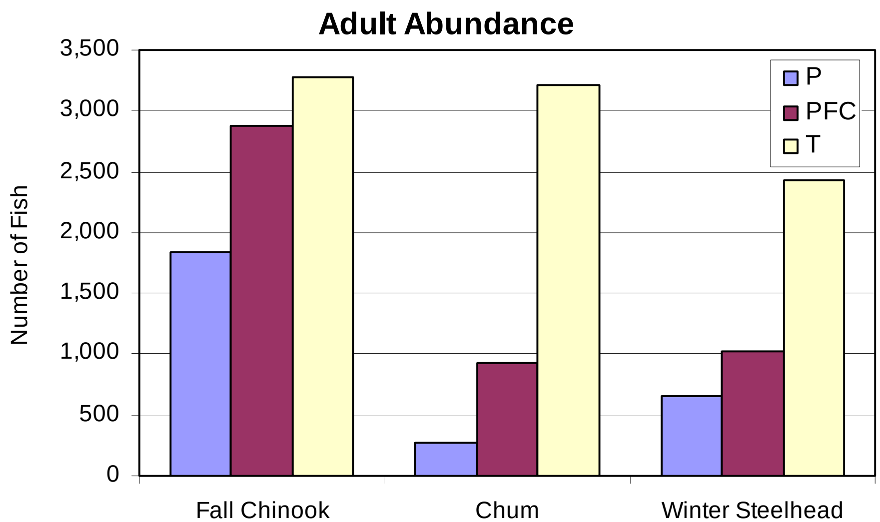
Smolt productivity has also declined from historical levels for each species in the Coweeman basin (Table 6-1). For fall chinook and chum, smolt productivity has decreased by 57% and 42%, respectively. For both coho and winter steelhead the decrease was estimated as approximately 74%. Smolt abundance in the Coweeman clearly declines most dramatically for chum and coho, with respective 79% and 81% changes from historical levels. Current fall chinook and steelhead smolt abundance levels are modeled at approximately half of historical numbers.

Model results indicate that restoration of properly functioning habitat conditions (PFC) would achieve significant benefits for all species (Table 6-1). Adult returns of both chum and coho would increase by greater than 230%. Adult returns of both fall chinook and winter steelhead would increase by greater than 50%. Smolt numbers are also estimated to increase dramatically for all species, especially for coho, which shows a 288% increase in smolt abundance with restoration of PFC.

Table 6-1. Coweeman River— Population productivity, abundance, and diversity (of both smolts and adults) based on EDT analysis of current (P or patient), historical (T or template), and properly functioning (PFC) habitat conditions.

	Adult Abundance			Adult Productivity			Diversity Index			Smolt Abundance			Smolt Productivity		
Species	**P**	**PFC**	**T[1]**	**P**	**PFC**	**T[1]**	**P**	**PFC**	**T[1]**	**P**	**PFC**	**T[1]**	**P**	**PFC**	**T[1]**
Fall Chinook	1,839	2,877	3,270	4.3	8.6	11.0	1.00	1.00	1.00	218,075	324,661	374,482	480	879	1,115
Chum	277	932	3,217	2.1	7.0	10.0	0.97	1.00	1.00	132,516	340,763	636,146	667	1,023	1,152
Coho	1,873	6,225	8,434	3.4	8.1	12.5	0.51	0.82	0.87	33,578	130,350	178,656	65	165	253
Winter Steelhead	653	1,017	2,423	3.9	9.0	28.2	0.86	0.98	1.00	11,599	18,040	22,929	73	165	275

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



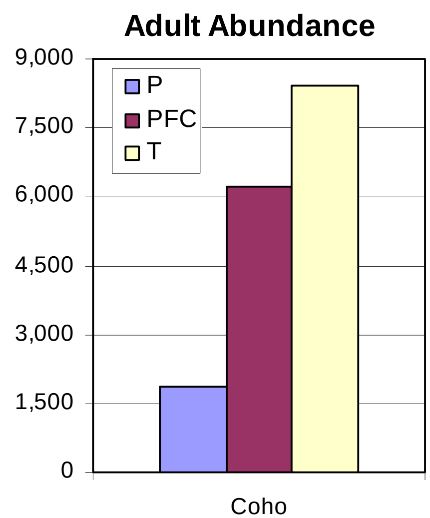


Figure 6-6. Adult abundance of Coweeman fall chinook, chum, winter steelhead and coho based on EDT analysis of current (P or patient), historical (T or template), and properly functioning (PFC) habitat conditions.

6.6.2 Restoration and Preservation 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 40 reaches that are used by salmon and steelhead (Figure 6-7). Winter steelhead utilize all of these reaches, whereas fall chinook and coho use primarily just the mainstem reaches, and chum use only the first few mainstem reaches. Reaches 1-4 are low gradient reaches that course through Kelso and the agricultural land upstream of town. In general, reaches 5 and up are moderately confined, with forestry, and in some cases residential development, as the primary impacts.

Winter steelhead reaches with a high priority ranking include those in the upper basin (Coweeman 15-16), and headwaters (Coweeman 17-22) (Figure 6-8). The upper sections, including the headwaters and the headwater tributaries, represent primary steelhead spawning and rearing areas, while the middle tributaries have rearing but limited spawning potential. Therefore, almost all of these reaches have a combined preservation and restoration emphasis (Figure 6-8). For fall chinook, high priority reaches include the middle mainstem (Canyon 2 and 3, Coweeman 5, 8, 10 and 11) and the upper Coweeman (Coweeman 16) (Figure 6-9). Both the canyon and upper reaches show a preservation only emphasis while the other middle reaches show a combined preservation and restoration emphasis (Figure 6-9). 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 6-10). High priority reaches for coho include Coweeman 4-5, 8-11, 16-18, and Canyon 3 (Figure 6-11). With the exception of Coweeman 16, which has a combined preservation and restoration emphasis, all other high priority reaches for coho show a restoration emphasis.

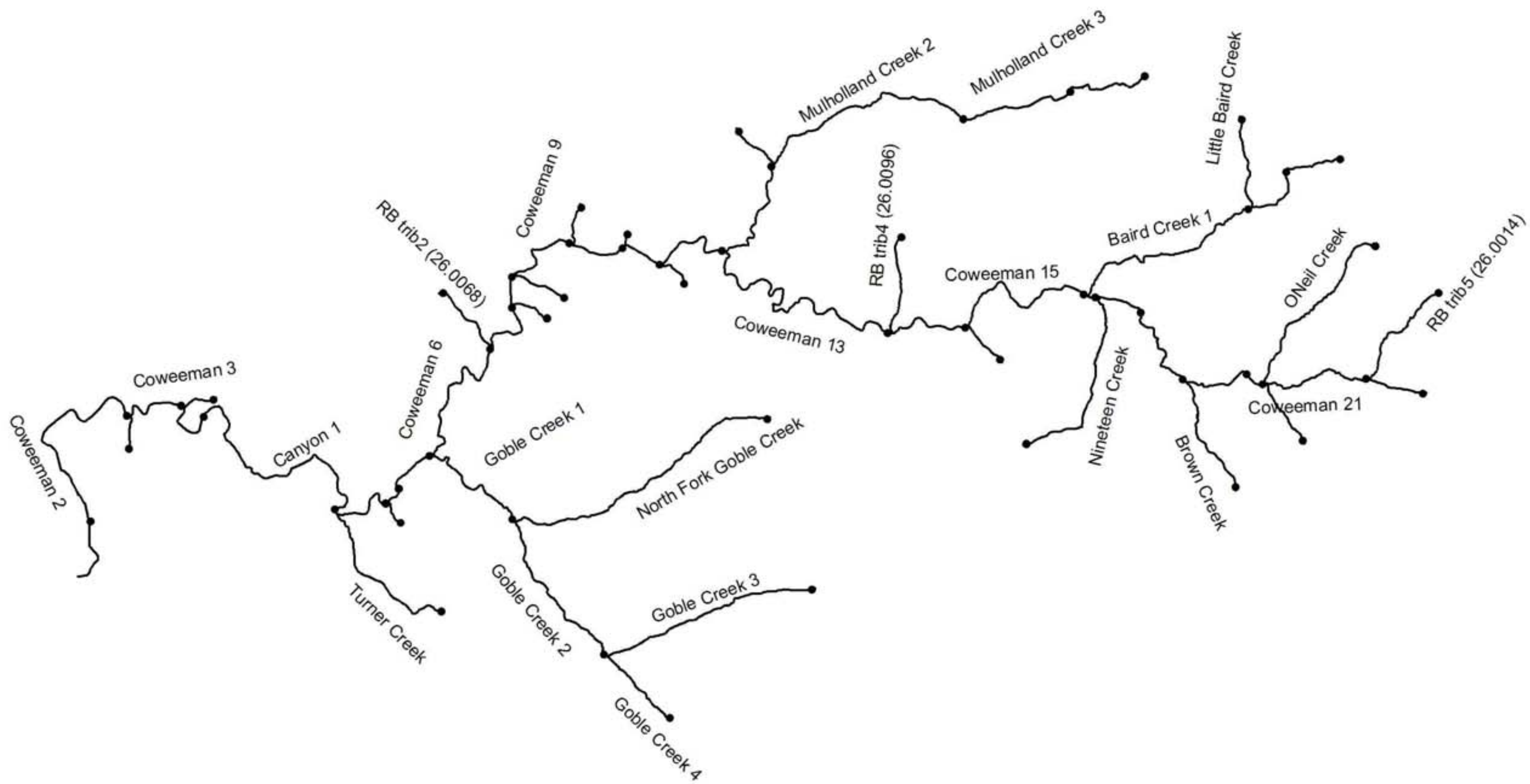


Figure 6-7. Coweeman basin with EDT reaches identified. For readability, not all reaches are labeled.

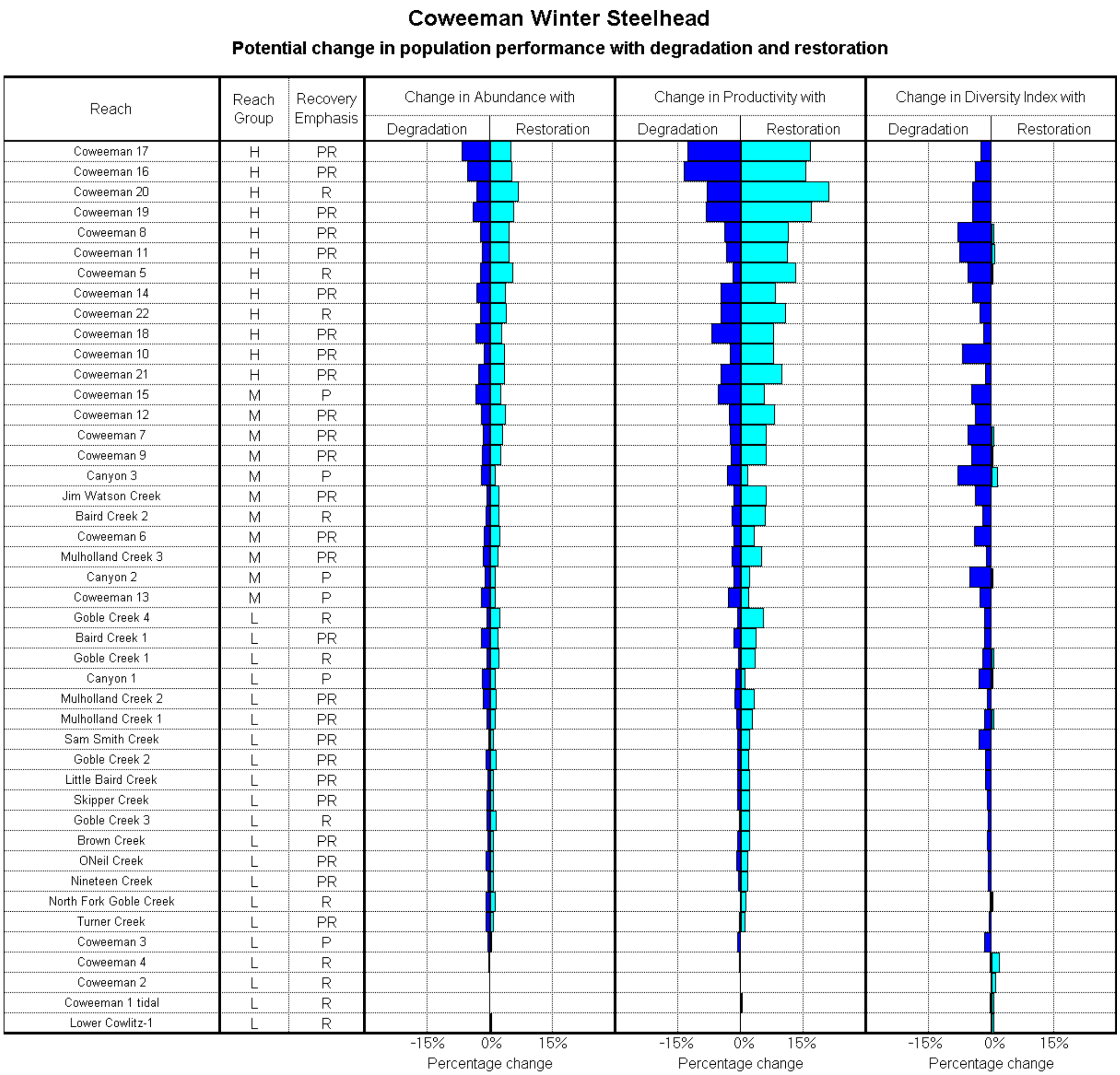


Figure 6-8. Coweeman basin winter steelhead ladder diagram. The rungs on the ladder represent the reaches and the three ladders contain a preservation value and restoration potential based on abundance, productivity, and diversity. The units in each rung are the percent change from the current population. For each reach, a reach group designation and recovery emphasis designation is given. See Volume VI for more information on EDT ladder diagrams.

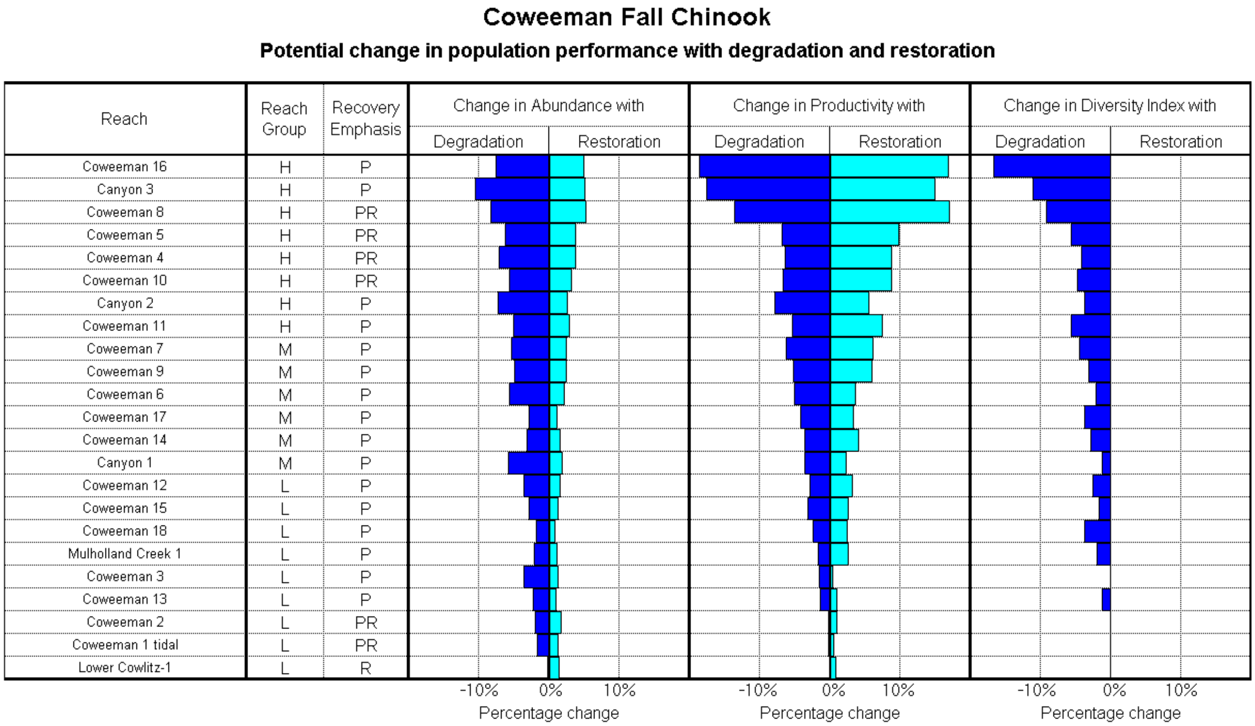


Figure 6-9. Coweeman basin fall chinook ladder diagram.

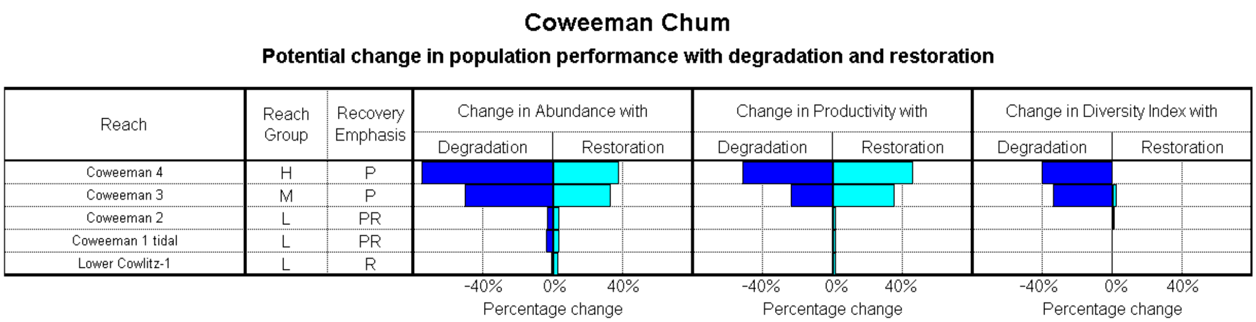


Figure 6-10. Coweeman basin chum ladder diagram.

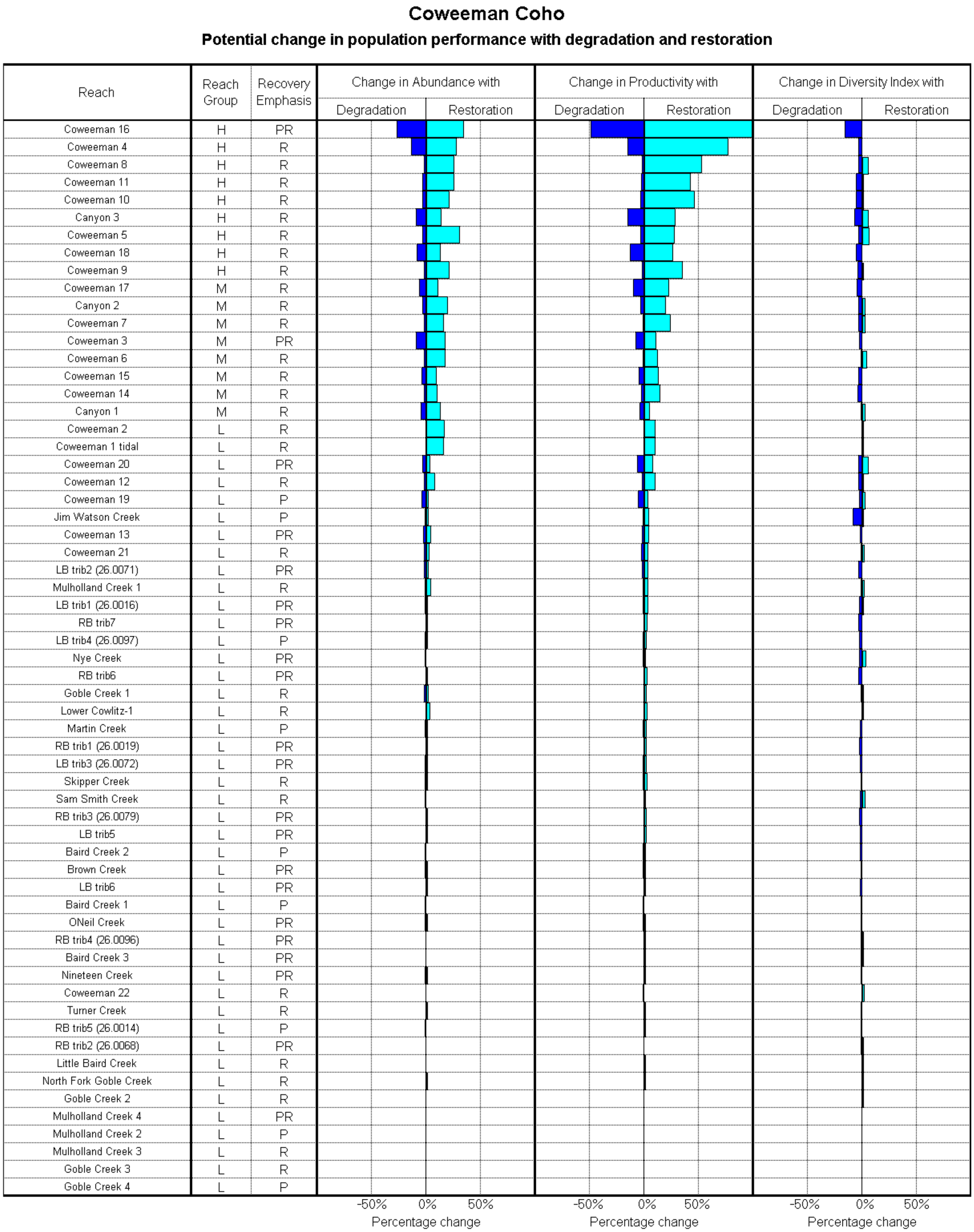


Figure 6-11. Coweeman basin coho ladder diagram.

6.6.3 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 reach analysis is based on a comparison of current/patient and historical/template habitat conditions. The figures generated by habitat factor analysis display the relative impact of habitat factors in specific reaches. The reaches are ordered according to their combined restoration rank, which factors in their relative restoration 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 degree to which overall population abundance would be affected if the habitat attributes were restored to PFC.

The top priority restoration area for winter steelhead is the upper mainstem (Figure 6-12). These reaches suffer from high impacts related to habitat diversity, sediment, and flow, with moderate impacts from temperature and channel stability. 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. A few middle mainstem reaches (Coweeman 5, 8, 10, and 11) are also ranked as high priority. These reaches have high impacts related to temperature, sediment, flow, and habitat diversity. 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.

Restoration priorities for fall chinook in the middle mainstem include sediment, habitat diversity, temperature, channel stability, and key habitat (Figure 6-13). Sediment in spawning gravels is a major concern and is mostly related to basin forestry activities as described above for steelhead. 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. The lower reaches also have high restoration priority for fall chinook and are impacted by sediment and temperature, with lesser habitat diversity, channel stability, and key habitat impacts.

Attributes with a high impact to chum (Figure 6-14) 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.

Coho in the Coweeman basin are affected by adverse habitat conditions primarily in the middle and upper mainstem reaches (Figure 6-15). In these locations, habitat diversity and sediment appear to be the habitat factors with the highest impacts on coho. Other contributing factors include channel stability, temperature, flow, and key habitat. Causes for the observed impacts are similar to those discussed above for winter steelhead.

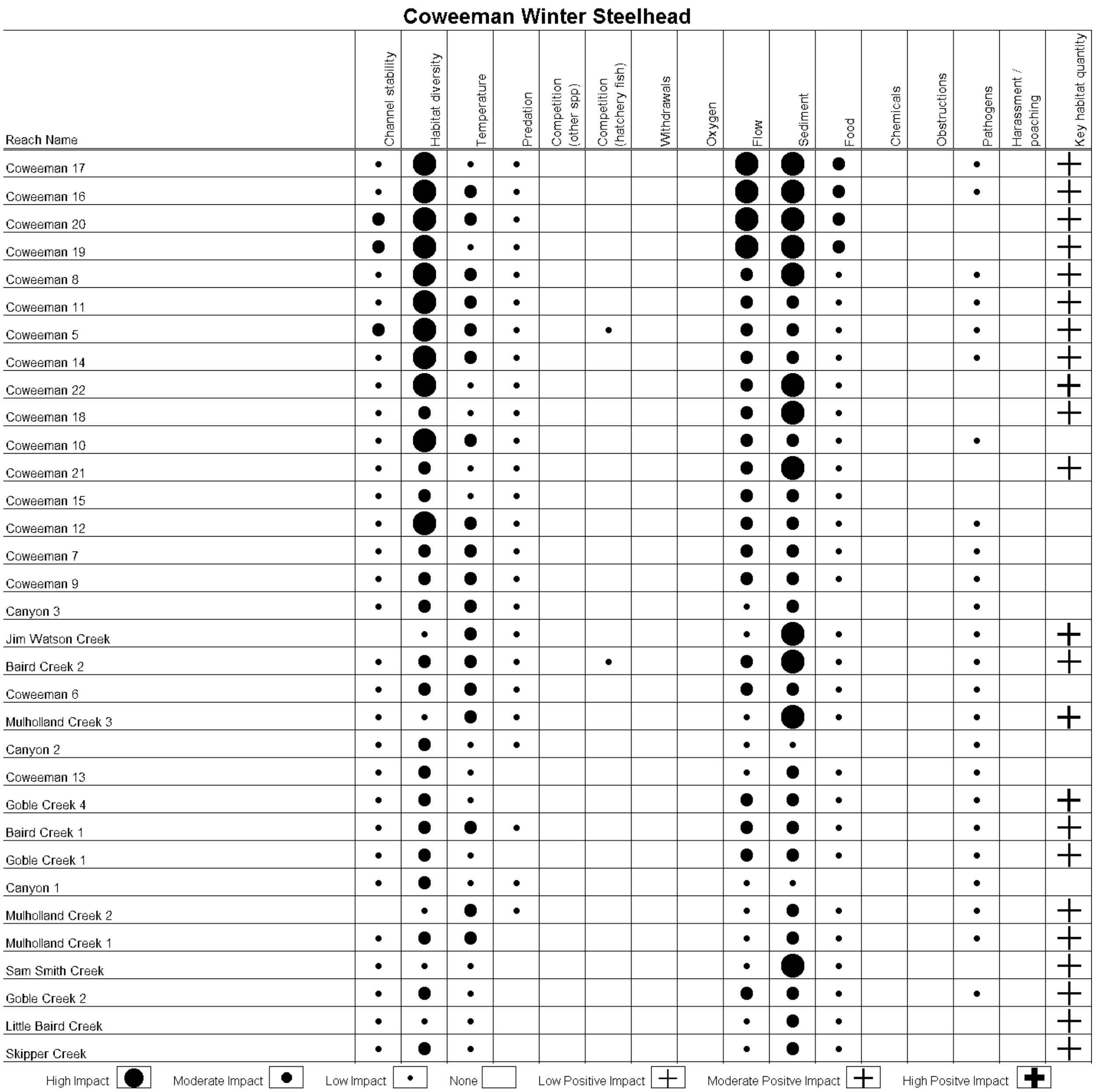


Figure 6-12. Coweeman basin winter steelhead habitat factor analysis diagram. Diagram displays the relative impact of habitat factors in specific reaches. The reaches are ordered according to their restoration and preservation rank, which factors in their potential benefit to overall population abundance, productivity, and diversity. The reach with the greatest potential benefit is listed at the top. The dots represent the relative degree to which overall population abundance would be affected if the habitat attributes were restored to template conditions. See Volume VI for more information on habitat factor analysis diagrams. Some low priority reaches are not included for display purposes

Coweeman Fall Chinook

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 16	Moderate	High	Moderate						Moderate	High	Low					Moderate
Canyon 3	Moderate	Moderate	High	Low					Low	High	Low					Moderate
Coweeman 8	Moderate	Moderate	High						Moderate	High	Low					Moderate
Coweeman 5	Moderate	Moderate	Moderate						Low	High	Low					Moderate
Coweeman 4	Moderate	Moderate	High						Low	High	Low					Moderate
Coweeman 10	Moderate	Moderate	Moderate						Moderate	High	Low					Moderate
Canyon 2	Moderate	Moderate	Moderate						Low	High	Low					Moderate
Coweeman 11	Moderate	Moderate	Moderate						Low	High	Low					Moderate
Coweeman 7	Moderate	Moderate	Moderate						Low	High	Low					Moderate
Coweeman 9	Low	Moderate	Moderate						Low	High	Low					Moderate
Coweeman 6	Moderate	Moderate	Low						Low	Moderate	Low					Moderate
Coweeman 17	Low	Moderate	Low						Low	High	Low					Low
Coweeman 14	Low	Moderate	Low						Low	High	Low					Low
Canyon 1	Low	Moderate	Low						Low	Moderate	Low					Moderate
Coweeman 12	Low	Moderate	Low						Low	High	Low					Moderate
Coweeman 15	Low	Moderate	Low						Low	Moderate	Low					Moderate
Coweeman 18	Low	Moderate	Low						Low	High	Low					Low
Mulholland Creek 1	Low	Moderate	Low						Low	High	Low					Low
Coweeman 3	Low	Moderate	Low			Low			Low	Low	Low					Moderate
Coweeman 13	Low	Moderate	Low						Low	Moderate	Low					Low
Coweeman 2	Low	Moderate	Low	Low	Low	Low			Low	Low	Low			Low	Low	Moderate
Coweeman 1 tidal	Low	Moderate	Low	Low					Low	Low	Low			Low	Low	Moderate
Lower Cowlitz-1	Low	Moderate	Low	Low		Low			Low	Low	Low			Low	Low	Low

High Impact · Moderate Impact · Low Impact · None · Low Positive Impact · Moderate Positve Impact · High Positve Impact

Figure 6-13. Coweeman basin fall chinook habitat factor analysis diagram.

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	Moderate	High							Moderate	High	Moderate					High
Coweeman 3	Moderate	High							Moderate	High	Moderate					High
Coweeman 2	Low	Low		Low					Low		Low				Low	Low
Coweeman 1 tidal	Low	Low		Low					Low		Low				Low	Low
Lower Cowlitz-1	Low	Low							Low		Low					Low

High Impact · Moderate Impact · Low Impact · None · Low Positive Impact · Moderate Positve Impact · High Positve Impact

Figure 6-14. Coweeman basin chum habitat factor analysis diagram.

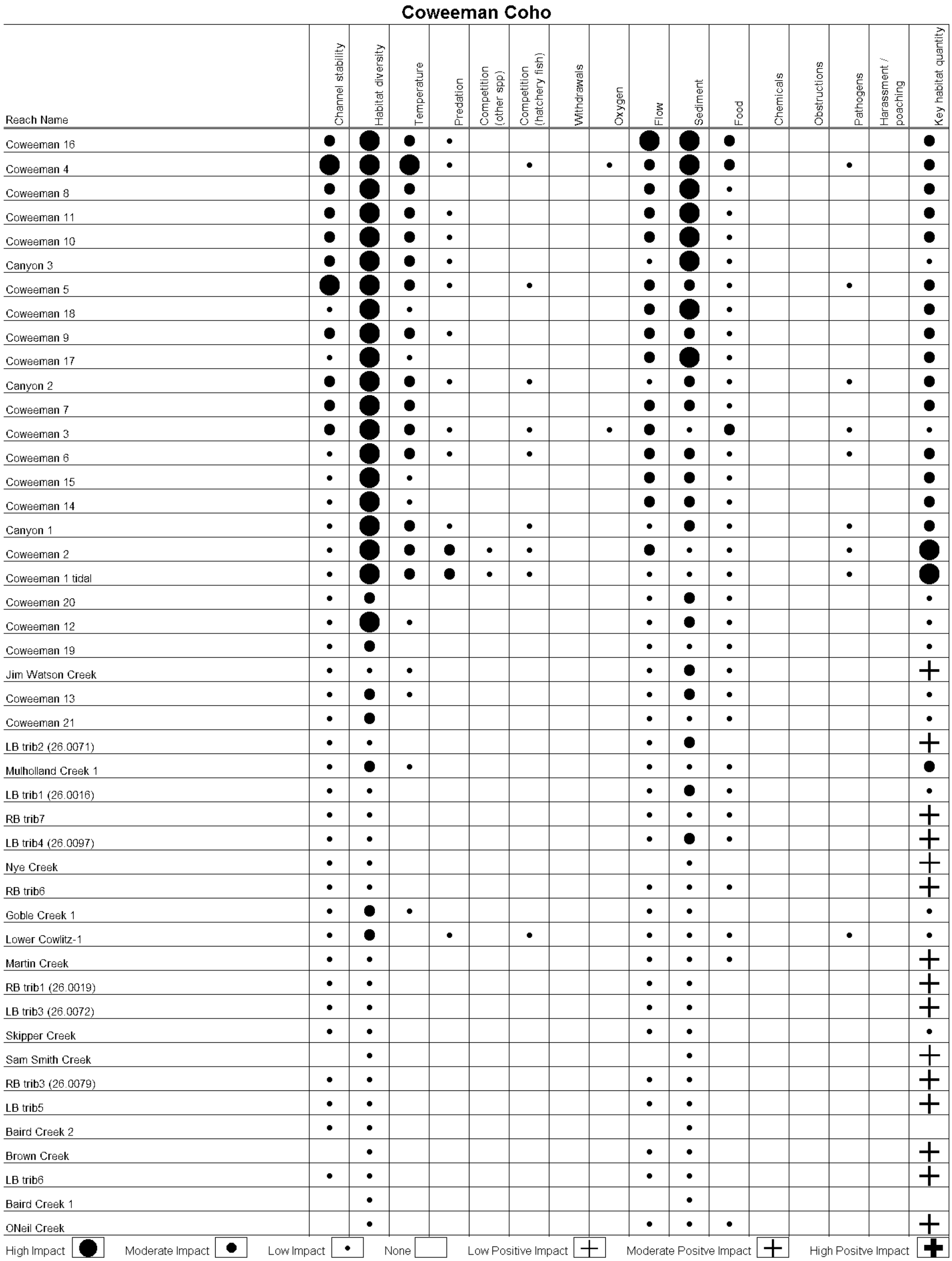


Figure 6-15. Coweeman basin coho habitat factor analysis diagram. Some low priority reaches are not included for display purposes

6.7 Integrated Watershed Assessment (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.

Based on their physiographic and hydrologic characteristics, subwatersheds in the Coweeman River drainage are primarily small to medium sized lowland areas composed of sedimentary/metamorphic geology and rain-dominated runoff characteristics. A significant portion (26%) of the Coweeman watershed consists of small, high elevation drainages where precipitation falls mainly as snow and the potential for erosion is low.

6.7.1 Results and Discussion

IWA metrics were calculated for all 18 subwatersheds in the Coweeman River watershed. Subwatershed, or local, level IWA metrics reflect the effects of local conditions on hydrologic, sediment, and riparian processes within individual subwatersheds. They do not consider the influence of subwatersheds located upstream. Watershed-level IWA metrics, determined separately for each subwatershed, reflect the combined effect of local conditions and upstream subwatersheds. IWA results for each subwatershed are presented in Table 6-2. A reference map showing the location of each subwatershed in the basin is presented in Figure 6-16. Maps of the distribution of local and watershed level IWA results are displayed in Figure 6-17.

Table 6-2. 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

Notes:

[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.

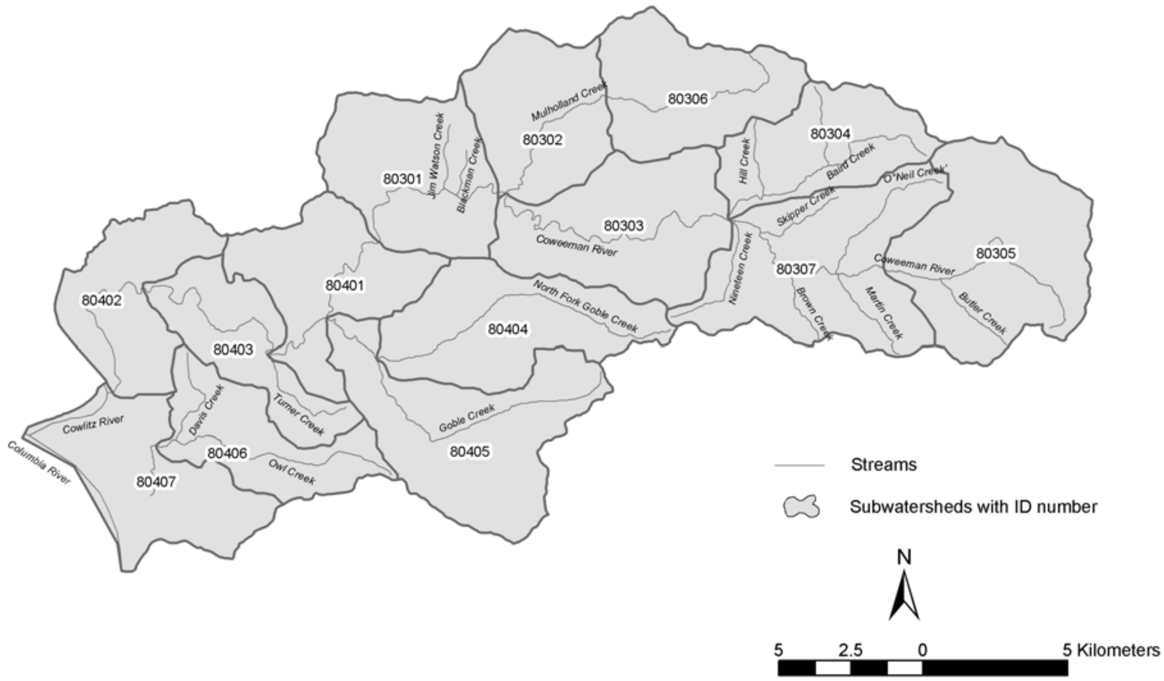


Figure 6-16. Map of the Coweeman basin showing the location of the IWA subwatersheds.

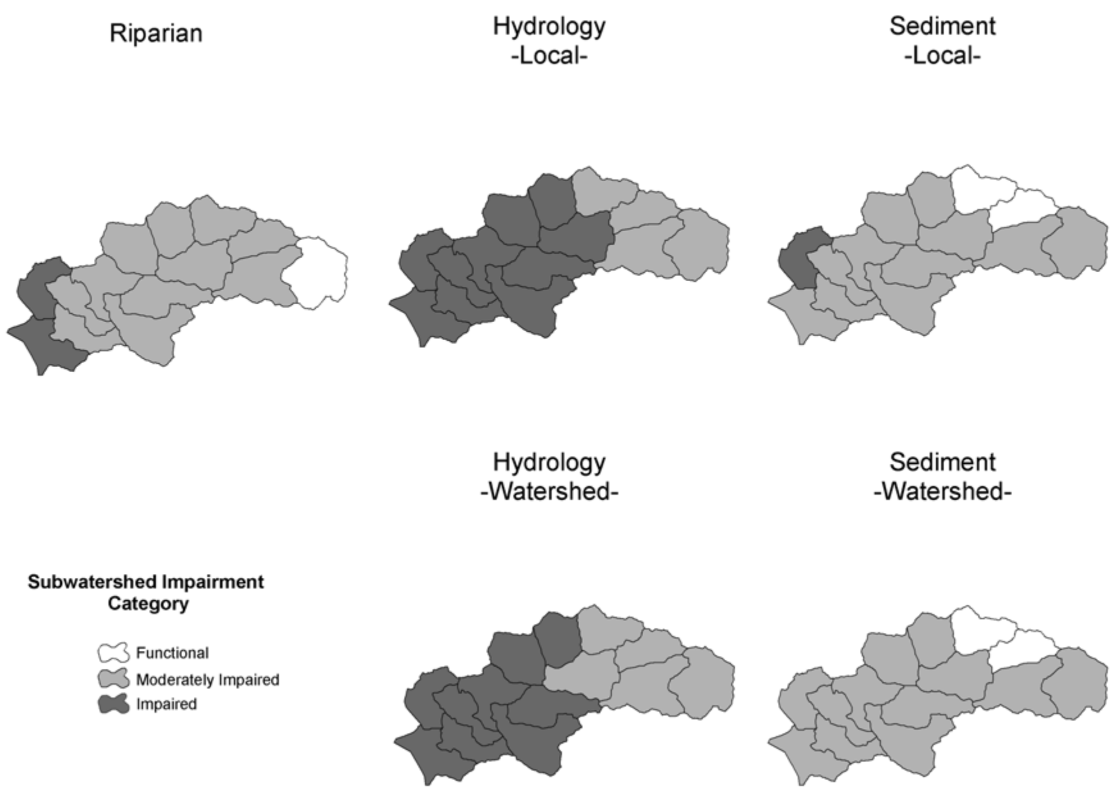


Figure 6-17. IWA subwatershed impairment ratings by category for the Coweeman basin

Based on their geologic, topographic and hydrologic characteristics, subwatersheds in the Coweeman can be stratified into two primary groups:

1. Small, higher elevation drainages where precipitation falls mainly as snow and the potential for erosion is low.
2. Small-to-medium size lower elevation drainages characterized by moderate aspects, erodable terrain and rain-dominated seasonal runoff patterns.

The overall impression afforded by the results of the IWA is one of moderate to severe disturbance of processes within subwatersheds in the Coweeman watershed. The preponderance of fully and moderately impaired hydrologic conditions suggests that hydrology may be a primary factor limiting habitat quality and fish population performance. Less-than-desirable sediment and riparian conditions are observed over most of the watershed. Degraded hydrologic and riparian conditions increase the probability that sediment processes will be adversely affected in drainages having highly erodable rock and soil types. These problems are ameliorated in low elevation, low-relief subwatersheds lying outside the rain-on-snow zone. The results of the IWA analysis for each process condition are described in more detail below.

6.7.1.1 Hydrology

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 (WDW 1990). Caldwell et al. (1999) reported suboptimal flows during the fall spawning period.

6.7.1.2 Sediment

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.

6.7.1.3 Riparian

fewer than 12% of the subwatersheds, at most, are functional in terms of their riparian 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.

6.7.2 Predicted Future Trends

6.7.2.1 Hydrology

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.

6.7.2.2 Sediment

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.

6.7.2.3 Riparian

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.

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