Final Assessment of NOAA Fisheries' Critical Habitat Analytical Review Team (CHART) For the Oregon Coast Coho Salmon Evolutionarily Significant Unit

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Prepared by NOAA Fisheries Protected Resources Division
1201 NE Lloyd Blvd., Suite 1100, Portland, Oregon 97232-1274

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EXECUTIVE SUMMARY

This report summarizes the results of the critical habitat analytical review team (CHART) charged with analyzing the best available data to assess biological information relevant to making a critical habitat designation for the Oregon Coast coho salmon Evolutionarily Significant Unit (ESU). The CHART reviewed information for 80 watersheds within the range of this ESU including the presence and distribution of essential habitat features in each watershed, potential management actions that may affect those features, and the conservation value of each watershed. This information will be used in conjunction with other agency analyses (e.g., economic analyses) to support NOAA Fisheries' final critical habitat designation for Oregon Coast coho salmon.

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1. BACKGROUND

Over the past several years, NOAA Fisheries has listed 27 distinct population segments, or evolutionarily significant units (ESU), of Pacific salmon and steelhead in Oregon, Washington, Idaho and California as threatened or endangered species under the U.S. Endangered Species Act (ESA). Collectively, these ESUs occupy thousands of miles of streams in watersheds covering more than 250 thousand square miles. In 2000, NOAA Fisheries designated critical habitat for 19 of the listed ESUs (65 FR 7764, February 16, 2000). These designations were challenged in court on a number of grounds. NOAA Fisheries entered into a consent decree resolving these claims and pursuant to court order the designations were vacated. Following remand, NOAA Fisheries received a letter from environmental groups providing 60-day notice of intent to sue for not having designations in place for these 19 ESUs and one additional ESU, Northern California Steelhead. The agency entered into a consent decree with the environmental groups establishing a schedule for completing new designations.

On December 14, 2004 the agency published a *Federal Register* Notice proposing designation of critical habitat for the Oregon Coast coho ESU and 12 other ESUs in Oregon, Washington, and Idaho covered by the consent decree (69 FR 74572). The proposed designation was based in part on analyses provided by the Oregon Coast critical habitat analytical review team (CHART). The CHART was charged with analyzing the best available data to assess biological information relevant to making a critical habitat designation for the Oregon Coast coho salmon ESU.

On January 19, 2006, NOAA Fisheries issued a final determination that listing the Oregon Coast coho ESU under the ESA was "not warranted" (71 FR 3033). In so doing the agency also withdrew the proposed critical habitat designation for this ESU. The decision not to list the Oregon Coast coho ESU was later challenged in *Trout Unlimited III v. Lohn*. On October 9, 2007, the U.S. District Court for the District of Oregon invalidated the January 2006 decision not to list Oregon Coast coho and ordered NOAA Fisheries to issue a new decision on listing consistent with the ESA. In November the court extended the date to February 2008.

As part of the effort to complete this final rulemaking the agency re-convened the Oregon Coast CHART to review information (including public comments on the 2004 proposed designation) for 80 watersheds within the range of the Oregon Coast coho salmon ESU. This review included assessing the presence and distribution of essential habitat features in each watershed, potential management actions that may affect those features, and the conservation value of each watershed. The resultant CHART findings will be used in conjunction with other agency analyses (e.g., economic analyses) to support NOAA Fisheries' final critical habitat designation for Oregon Coast coho salmon.

1.1 CRITICAL HABITAT UNDER THE ESA

The ESA defines critical habitat under section 3(5)(A) as follows:

> (i) the specific areas within the geographical area occupied by the species, at the time it is listed . . ., on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
>
> (ii) specific areas outside the geographical area occupied by the species at the time it is listed . . . upon a determination by the Secretary that such areas are essential for the conservation of the species.

Once critical habitat is designated, ESA Section 7 requires federal agencies to ensure that they do not fund, authorize, or carry out any actions that are likely to destroy or adversely modify that habitat. This requirement is in addition to the Section 7 requirement that federal agencies ensure that their actions do not jeopardize the continued existence of listed species.

A recent amendment to section 4(a) of the ESA precludes military land from designation, where that land is covered by an Integrated Natural Resource Management Plan that the Secretary has found in writing will benefit the listed species.

ESA Section 4(b)(2) requires NOAA Fisheries to designate critical habitat for threatened and endangered species "on the basis of the best scientific data available and after taking into consideration the economic impact, impact on national security, and any other relevant impact, of specifying any particular area as critical habitat." This section grants the Secretary [of Commerce] discretion to exclude any area from critical habitat if he determines "the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat." The Secretary's discretion is limited, as he may not exclude areas if it "will result in the extinction of the species."

1.2 SALMONID LIFE HISTORY

Pacific salmon and steelhead are anadromous fish, meaning adults migrate from the ocean to spawn in freshwater lakes and streams where their offspring hatch and rear prior to migrating back to the ocean to forage until maturity. The migration and spawning times vary considerably between and within species and populations (Groot and Margolis, 1991). At spawning, adults pair up to lay and fertilize thousands of eggs in freshwater gravel nests or "redds" excavated by females. Depending on lake/stream temperatures, eggs incubate for several weeks to months before hatching as "alevins" (a larval life stage dependent on food stored in a yolk sac). Following yolk sac absorption, alevins emerge from the gravel as young juveniles called "fry" and begin actively feeding. Depending on the species and location,

juveniles may spend from a few hours to a few years in freshwater areas before migrating to the ocean. The physiological and behavioral changes required for the transition to salt water result in a distinct "smolt" stage in most species. On their journey, juveniles must migrate downstream through every riverine and estuarine corridor between their natal lake or stream and the ocean. For example, smolts from Idaho will travel as far as 900 miles from their inland spawning grounds. En route to the ocean, the juveniles may spend from a few days to several weeks in the estuary, depending on the species. The highly productive estuarine environment is an important feeding and acclimation area for juveniles preparing to enter marine waters.

Juveniles and subadults typically spend from 1 to 5 years foraging over thousands of miles in the North Pacific Ocean before returning to spawn. Some species, such as coho and chinook salmon, have precocious life history types (primarily male fish) that mature and spawn after only several months in the ocean. Spawning migrations known as "runs" occur throughout the year, varying by species and location. Most adult fish return or "home" with great fidelity to spawn in their natal stream, although some do stray to non-natal streams. Salmon species die after spawning, while steelhead may return to the ocean and make repeat spawning migrations.

This complex life cycle gives rise to complex habitat needs, particularly during the freshwater phase (Spence et al. 1996). Spawning gravels must be a certain size and free of sediment to allow successful incubation of the eggs. Eggs also require cool, clean, and well-oxygenated waters for proper development. Juveniles need abundant food sources, including insects, crustaceans, and other small fish. They need places to hide from predators (mostly birds and bigger fish), such as under logs, root wads, and boulders in the stream, as well as beneath overhanging vegetation. They also need places to seek refuge from periodic high flows (side channels and off-channel areas) and from warm summer water temperatures (coldwater springs and deep pools). Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. Like juveniles, they also require cool water and places to rest and hide from predators. During all life stages, salmon and steelhead require cool water that is free of contaminants. They also need migratory corridors with adequate passage conditions (timing, water quality, and water quantity) to allow access to the various habitats required to complete their life cycle.

The homing fidelity of salmon and steelhead is reflected in the distribution of distinct, locally adapted populations among watersheds with differing environmental conditions and distinct habitat characteristics (Taylor 1991, Policansky and Magnuson 1998, McElhany et al. 2000). Spatially structured populations in which populations or subpopulations occupy habitat patches, connected by some low-to-moderate stray rates, are often generically referred to as "metapopulations" (Levins 1969). Low-to-moderate levels of straying result in regular genetic exchange among populations, creating genetic similarities among populations in adjacent watersheds (Quinn 1993, Utter et al. 1989, Ford 1998).

The overall health and likelihood of persistence of salmon and steelhead metapopulations are affected by the abundance, productivity, connectivity/spatial structure, and diversity of the component populations (see McElhaney et al. 2000). With respect to the habitat requirements of a healthy ESU, an ESU composed of many diverse populations distributed across a variety of well-connected habitats can better respond to environmental perturbations including catastrophic events (Schlosser and Angermeier 1995, Hanski and Gilpin 1997, Tilman and Lehman 1997, Cooper and Manger 1999). Additionally, well-connected habitats of different types are essential to the persistence of diverse, locally adapted salmonid metapopulations capable of exploiting a wide array of environments, as well as capable of responding to and surviving both short- and long-term environmental change (e.g., Groot and Margolis 1991, Wood 1995). Differences in local flow regime, temperature regime, geological, and ecoregion characteristics correlate strongly with ESU population structure (Ruckelshaus et al. 2001).

ESUs with fewer and less diverse habitat types and associated populations are more likely to become extinct due to catastrophic events. They also have a lower likelihood that the necessary phenotypic and genotypic diversity will exist to maintain future viability. ESUs with limited geographic range are similarly at increased extinction risk due to environmental variability and catastrophic events. ESUs with populations that are geographically distant from each other, or that are separated by severely degraded habitat, may lack the connectivity to function as metapopulations and are more likely to become extinct. ESUs with reduced local adaptation and limited life-history diversity are more likely to go extinct as the result of correlated environmental catastrophes or environmental change that occurs too rapidly for an evolutionary response. Assessing the conservation value of specific habitat areas to ESU viability involves evaluating the quantity and quality of habitat features (for example, spawning gravels, wood and water condition, side channels), the relationship of the area to other areas within the ESU, and the significance to the ESU of the population occupying that area.

1.3 GEOGRAPHICAL AREA OCCUPIED BY THE SPECIES AND SPECIFIC AREAS WITHIN THE GEOGRAPHICAL AREA

In past critical habitat designations, NOAA Fisheries concluded that the limited availability of species distribution data prevented mapping salmonid critical habitat at a scale finer than occupied river basins. While various efforts were underway to address these data limitations, the agency noted that “most have yet to be completed or fail to depict salmonid habitats in a consistent manner or at a fine geographic scale.” (65 FR 7764, February 16, 2000). Therefore, the 2000 designations indicated that the “geographical area occupied by the species” was best characterized by all accessible river reaches within the current range of the listed species.

For specific areas within that geographical area occupied by the species, NOAA Fisheries relied on the U.S. Geological Survey's (USGS) identification of subbasins, which was the finest scale mapped by USGS at that time. The subbasin boundaries are based on an area's topography and hydrography, and USGS has developed a uniform framework for mapping and cataloging drainage basins using a unique hydrologic unit code (HUC) identifier (Seaber et al. 1986). The HUCs contain separate two-digit identifier fields wherein HUC1 refers to a region comprising a relatively large drainage area (e.g., Region 17 for the entire Pacific Northwest), while subsequent fields identify smaller nested drainages. Under this convention, subbasins are commonly referred to as HUC4s. In its 2000 designations, then, NOAA Fisheries identified as critical habitat all areas accessible to listed salmon within an occupied HUC4.

Since the previous designations in 2000, two key efforts have significantly improved NOAA Fisheries' ability to identify freshwater and estuarine areas occupied by salmonids and to group the occupied stream reaches into finer scale "specific areas." The first key effort has allowed NOAA Fisheries to be more precise about the "geographical area occupied by the species." Federal, state, and tribal fishery biologists have made progress mapping species distribution at the level of stream reaches. The mapping includes areas where the species has been observed or where it is presumed to occur based on the professional judgment of biologists familiar with the watershed. Much of these data can now be accessed and analyzed using geographic information systems (GIS) to produce consistent and fine-scale maps. As a result, nearly all salmonid freshwater and estuarine habitats in Washington, Oregon, and Idaho are now mapped and available in GIS at a scale of 1:24,000. Previous distribution data were often compiled at a much coarser scale of 1:100,000 or greater. NOAA Fisheries made use of these finer-scale data for the current critical habitat designations and now believes that they enable a more accurate delineation of "geographical area occupied by the species" referred to in the ESA definition of critical habitat.

The second key effort has allowed NOAA Fisheries to identify "specific areas" (section 3(5)(a)) and "particular areas" (section 4(b)(2)) at a much finer scale. Since 2000, various federal agencies have identified HUC5 watersheds throughout the Pacific Northwest using the USGS mapping conventions referred to above. This information is now generally available from these agencies and via the internet (California Spatial Information Library 2004, Interior Columbia Basin Ecosystem Management Project 2003, Regional Ecosystem Office 2004). NOAA Fisheries used this information to organize critical habitat information systematically and at a scale that was relevant to the spatial distribution of salmon and steelhead. Organizing information at this scale is especially relevant to salmonids, since their innate homing ability allows them to return to particular reaches in the specific watersheds where they were born. Such site fidelity results in spatial aggregations of salmonid populations (and their constituent

spawning stocks) that generally correspond to the area encompassed by HUC4s or HUC5s (Washington Department of Fisheries et al. 1992, Kostow 1995, McElhany et al. 2000).

In addition, HUC5 watersheds are consistent with the scale of recovery efforts for West Coast salmon and steelhead. In its review of the long-term sustainability of Pacific Northwest salmonids, the National Research Council's (NRC) Committee on Protection and Management of Pacific Northwest Anadromous Salmonids concluded that "habitat protection must be coordinated at landscape scales appropriate to salmon life histories" and that social structures and institutions "must be able to operate at the scale of watersheds" (NRC 1996).

Watershed-level analyses are now common throughout the West Coast (Forest Ecosystem Management Assessment Team 1993, Montgomery et al. 1995, Spence et al. 1996). There are presently more than 400 watershed councils or groups in Washington, Oregon, and California alone (For the Sake of the Salmon 2004). Many of these groups operate at a geographic scale of one to several HUC5 watersheds and are integral parts of larger-scale salmon recovery strategies (Northwest Power Planning Council 1999, Oregon Plan for Salmon and Watersheds 2001, Puget Sound Shared Strategy 2002, CALFED Bay-Delta Program 2003). Concurrent with these efforts, NOAA Fisheries has developed various ESA guidance documents that underscore the link between salmon conservation and the recovery of watershed processes (NMFS 1996 and 1999). Aggregating stream reaches into HUC5 watersheds allowed the agency to delineate "specific areas" within or outside the geographical area occupied by the species at a scale that corresponds well to salmonid population structure and ecological processes.

Occupied estuarine and marine areas were also considered. In previous designations of salmonid critical habitat we did not designate marine areas outside of estuaries and Puget Sound. In the Pacific Ocean, we concluded that there may be essential habitat features, but they did not require special management considerations or protection. Since that time we have considered the statutory and regulatory direction, the best available scientific information, and related agency actions, such as the designation of Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act.

We now conclude that it is possible to delineate specific estuarine areas in Puget Sound and the Columbia River, as well as specific nearshore areas of Puget Sound that are occupied and contain essential habitat features that may require special management considerations or protection. Estuarine areas are crucial for juvenile salmonids given their multiple functions as areas for rearing/feeding, freshwater-saltwater acclimation, and migration (Simenstad et al. 1982, Marriott et al. 2002). In many areas, especially the Columbia River estuary, these habitats are occupied by multiple populations and ESUs. We are delineating occupied estuarine areas in similar terms to our past designations, as being defined by a line connecting the furthest land points at the estuary mouth.

Nearshore areas also provide important habitat for rearing/feeding and migrating salmonids, and in Puget Sound support multiple populations of Puget Sound Chinook and Hood Canal summer-run chum salmon (Bakkala 1970, Healey 1982, Simenstad et al. 1982, Bax 1983, Salo 1991 as cited in Johnson et al. 1997, Beamish et al. 1998, Pacific Fishery Management Council, 1999, WDFW and Point No Point Treaty Tribes (PNPTT), 2000; Battelle Marine Sciences Laboratory et al. 2001, Nightingale and Simenstad 2001, Ruckelshaus et al. 2001 and 2002, Williams and Thom 2001, Puget Sound Nearshore Ecosystem Restoration Program 2003; Williams et al. 2003, Brennan et al. 2004, Fresh et al. 2004, Washington State Conservation Commission 1999-1003). As noted in the previous rulemaking (65 FR 7764, February 16, 2000), the unique ecological setting of Puget Sound allowed us to focus on defining specific occupied marine areas. As with the freshwater areas described above, we identified 19 nearshore marine zones in Puget Sound based on water resource inventory areas defined by the state of Washington (Washington Department of Ecology 2004). In delineating these nearshore areas in Puget Sound, we focused on the area contiguous with the shoreline out to a depth no greater than 30 meters relative to mean lower low water. This nearshore area generally coincides with the maximum depth of the photic zone in Puget Sound and contains physical or biological features essential to the conservation of salmonids (Puget Sound Nearshore Ecosystem Restoration Program 2003, Williams et al. 2003).

We did not identify offshore marine areas of Puget Sound and the Pacific Ocean. For salmonids in offshore marine areas beyond the nearshore extent of the photic zone, it becomes more difficult to identify specific areas where essential habitat features that may require special management considerations can be found. We did identify certain prey species that are harvested commercially (e.g., Pacific herring) as physical or biological features essential to conservation that may require special management considerations or protection. However, because salmonids are opportunistic feeders we could not identify “specific areas” beyond the nearshore marine zone where these or other essential features are found within this vast geographic area occupied by Pacific salmon. Prey species move or drift great distances throughout the ocean and would be difficult to link to any “specific” areas (NMFS 2004).

1.4 UNOCCUPIED AREAS

ESA Section 3(5)(A)(ii) defines critical habitat to include “specific areas outside the geographical area occupied” if the areas are “essential for the conservation of the species.” NOAA Fisheries regulations at 50 CFR 424.12(e) emphasize that the agency “shall designate as critical habitat areas outside the geographical area presently occupied by a species only when a designation limited to its present range would be inadequate to ensure the conservation of the species.” The agency focused its attention on the species’ historical range when considering unoccupied areas since these logically would have been adequate to support the evolution and long-term maintenance of evolutionarily significant units. As with occupied areas, the agency

considered the stream segments within a HUC5 to best describe specific areas. While it is possible to identify which HUC5s represent geographical areas that were historically occupied with a high degree of certainty, this is not the case with specific stream segments. This is due, in part, to the emphasis on mapping currently occupied habitats and to the paucity of site-specific or systematic historical stream surveys.

1.5 "PHYSICAL OR BIOLOGICAL FEATURES ESSENTIAL TO THE CONSERVATION OF THE SPECIES" (PRIMARY CONSTITUENT ELEMENTS)

Agency regulations at 50 C.F.R. 424.12(b) interpret the statutory phrase "physical or biological features essential to the conservation of the species." The regulations state that these features include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing of offspring; and habitats that are protected from disturbance or are representative of the historical geographical and ecological distribution of a species. The regulations further direct us to "focus on the principal biological or physical constituent elements . . . that are essential to the conservation of the species, and specify that these elements shall be the "known primary constituent elements." The regulations identify primary constituent elements (PCE) as including, but not being limited to: "roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, host species or plant pollinator, geological formation, vegetation type, tide, and specific soil types."

NOAA Fisheries biologists developed a list of PCEs specific to salmon steelhead and relevant to determining whether occupied stream reaches within a watershed meet the ESA section (3)(5)(A) definition of "critical habitat," consistent with the implementing regulation at 50 CFR 424.12(b). Relying on the biology and life history of each species, we determined the physical or biological habitat features essential to their conservation. We identified these features in the ANPR (68 FR 55926, September 29, 2003) and subsequently, as a result of the initial CHART assessments, developed a revised set of PCEs described in the proposed rule (69 FR 74572, December 14, 2005). We received very few comments specifically addressing PCEs described in the proposed rule but have included clarifications (see below) regarding why each PCE is essential to the conservation of these ESUs.

The ESUs addressed in this rulemaking share many of the same rivers and estuaries and have similar life history characteristics and, therefore, many of the same physical and biological features are essential to their conservation. These features include sites essential to support one or more life stages of the ESU (sites for spawning, rearing, migration and foraging). These sites in turn contain physical or biological features essential to the conservation of the ESU (for example, spawning gravels, water quality and quantity, side channels, forage species). Specific

types of sites and the features associated with them (both of which are referred to as PCEs) include the following:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.

2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. These features are essential to conservation because without them juveniles cannot access and use the areas needed to forage, grow, and develop behaviors (e.g., predator avoidance, competition) that help ensure their survival.

3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival. These features are essential to conservation because without them juveniles cannot use the variety of habitats that allow them to avoid high flows, avoid predators, successfully compete, begin the behavioral and physiological changes needed for life in the ocean, and reach the ocean in a timely manner. Similarly, these features are essential for adults because they allow fish in a non-feeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores.

4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation. These features are essential to conservation because without them juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, these features are essential to the conservation of adults because they provide a final source of abundant forage that will provide the energy stores needed to make the physiological transition to fresh water, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas.

5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. As in the case with freshwater migration corridors and estuarine areas, nearshore marine features are essential to conservation because without them juveniles cannot successfully transition from natal streams to offshore marine areas. We have focused our designation on nearshore areas in Puget Sound because of its unique and relatively sheltered fjord-like setting (as opposed to the more open coastlines of Washington and Oregon).

6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. These features are essential for conservation because without them juveniles cannot forage and grow to adulthood.

1.6 SPECIAL MANAGEMENT CONSIDERATIONS OR PROTECTION

NOAA Fisheries' ESA regulations at 424.10(j) define "special management considerations or protection" to mean "any methods or procedures useful in protecting physical and biological features of the environment for the conservation of listed species." Based on discussions with NOAA Fisheries biologists in the Habitat Conservation Division (HCD) and the report by Spence et al. (1996), NOAA Fisheries identified a number of activities that may threaten the features, such that there would be any methods or procedures useful in protecting the features. The Spence et al. (1996) report contains a comprehensive review of factors limiting salmonid growth and production and relates them to specific human activities and useful management practices/actions. Major categories of habitat-related activities, identified in this report and through discussions with HCD biologists, include (1) forestry (2) grazing, (3) agriculture, (4) road building/maintenance, (5) channel modifications/diking, (6) urbanization, (7) sand and gravel mining, (8) mineral mining, (9) dams, (10) irrigation impoundments and withdrawals, (11) river, estuary, and ocean traffic, (12) wetland loss/removal, (13) beaver removal, and (14) exotic/invasive species introductions. In addition to these, the harvest of salmonid prey species (e.g., herring, anchovy, and sardines) may present another potential habitat-related activity (PFMC 1999). All of these activities have PCE-related impacts via their alteration of one or more of the following: stream hydrology, flow and water-level modifications, fish passage, geomorphology and sediment transport, temperature, dissolved oxygen, vegetation, soils, nutrients and chemicals, physical habitat structure, and stream/estuarine/marine biota and forage (Spence et al. 1996; PFMC 1999). The CHART identified and documented such activities for each area in tables contained in this report.

2. CRITICAL HABITAT ANALYTICAL REVIEW TEAM (CHART) ASSESSMENT FOR THE OREGON COAST COHO SALMON ESU

2.1 ESU DESCRIPTION & POPULATION STRUCTURE

The Oregon Coast coho salmon ESU was most recently defined as including "all naturally spawned populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco, as well as five artificial propagation programs: the North Umpqua River (ODFW stock #18), Cow Creek (ODFW stock #37), Coos Basin (ODFW stock #37), Coquille River (ODFW stock #44), and North Fork Nehalem River (ODFW stock #32) coho hatchery programs."[1] The geographical area inhabited by the ESU is described in the 1995 species status review as:

> *. . . an area with considerable physical diversity ranging from extensive sand dunes to rocky outcrops. With the exception of the Umpqua River, which extends through the Coast Range to drain the Cascade Mountains, rivers in this ESU have their headwaters in the Coast Range. These rivers have a single peak of flow in December or January and relatively low flow in late summer. Upwelling north of Cape Blanco is much less consistent and weaker than in areas south of Cape Blanco. Sitka spruce is the dominant coastal vegetation and extends to Alaska. Precipitation in coastal Oregon is higher than in southern Oregon/northern California but lower than on the Olympic Peninsula. (Weitkamp et al. 1995)*

Geographical isolation is an important factor in the evolution of separate populations within or between basins. The Oregon Coast coho ESU is, in general, composed of relatively small basins (the Umpqua basin, an exception to this general rule, is a relatively large basin characterized by diverse vegetation and geology). The distance between saltwater entry points of each basin may significantly affect the level of migration or connectivity among populations. Some populations may be significantly affected by migrants from larger or more productive

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[1] At the time of the 2004 proposed rule to list Oregon Coast coho as threatened, five artificial propagation programs were proposed to be listed as part of the ESU: the Cow Creek (ODFW stock #37), North Fork Nehalem River (ODFW stock #32), North Umpqua River (ODFW stock #18), Coos Basin (ODFW stock #37), and Coquille River (ODFW stock #44) coho hatchery programs. Informed by comments on the proposed rule received from ODFW, it was determined that the North Fork Nehalem River hatchery stock has diverged substantially from the ESU and is not part of the ESU. The North Umpqua River, Coos Basin, and Coquille River coho hatchery programs have been discontinued and the last year of returns for these programs was 2007. Given that these latter 3 programs no longer exist, they are not considered part of the Oregon Coast ESU. The final ESU determination for Oregon Coast coho includes only one hatchery stock: the Cow Creek coho hatchery stock. Fish distribution data was not expected to change as a result of changes in the listing status of these artificial propagation programs because the affected watersheds support both hatchery- and natural-origin coho salmon (StreamNet 2005, NMFS 2007c).

systems. When the CHART completed its initial assessment for this ESU the Oregon Workgroup of the Oregon-Northern California Coast Technical Recovery Team (TRT) had preliminarily identified 19 functionally and potentially independent populations, and 48 additional dependent populations (Lawson et al. 2004). Since that time this Workgroup of the TRT has revised its assessment and now identifies 21 independent populations and 35 dependent populations of Oregon Coast coho salmon (Lawson et al. 2007; see Figure 1). The independent populations include: the Necanicum River, Nehalem River, Tillamook Bay, Nestucca River, Salmon River, Siletz River, Yaquina River, Beaver Creek, Alsea River, Siuslaw River, Siltcoos River (lake), Tahkenitch Creek (lake), Lower Umpqua River, Middle Umpqua River, North Umpqua River, South Umpqua River, Tenmile Creek (lake), Coos Bay, Coquille River, Floras Creek, and Sixes River populations.

2.2 COHO SALMON LIFE HISTORY

Adult coho salmon begin migrating into coastal streams and rivers with the first freshets in the fall. Spawning begins in November, peaking in December or January, and many continue into March. Eggs hatch in the spring and fry grow rapidly to the parr stage by early summer or early fall. Parr then seek out areas protected from high flows and spend a second winter in freshwater before migrating to the ocean as smolts in March through June. Smolt outmigration timing and smolt size appear to respond to small-scale habitat variability, and have been shown to be affected by anthropogenic activities including: habitat degradation (Moring and Lantz 1975) and habitat restoration (Johnson et al. 1993, Rodgers et al. 1993). About twenty percent of males mature at age 2 and return to freshwater as “jacks” in the same year they entered the ocean as adults. Although the production of jacks is a heritable trait in coho salmon (Iwamoto et al. 1984), the proportion of jacks in a given coho salmon populations is strongly influenced by environmental factors (Silverstein and Hershberger 1992). The remainder of juveniles rear in the ocean for 18 months and return as 3-year-old adults in the fallowing fall. Habitat capacity for coho salmon on the Oregon Coast has significantly decreased from historical levels. During periods of poor ocean survival, high quality habitat is necessary to sustain coho populations (Nickelson and Lawson 1998). The following habitat features have been identified as important to the recovery of Oregon Coast coho salmon (IMST 2002): structure and function of lowland areas, wetland, floodplains, and riparian forests; the presence of large wood on beaches and stream banks, and in streams, channels, estuaries, and floodplains; water quality, including temperature; hydrologic function and flow regimes; connectivity of rivers with floodplain and off-channel habitats; and the presence of diverse native plant communities subject to natural disturbance regimes.

2.3 RECOVERY PLANNING STATUS

The CHART recognized that recovery planning will likely emphasize the need for a geographical distribution of viable populations across the range of the ESU (Ruckelshaus et al. 2002, McElhany et al. 2003). The TRT divided the ESU into five biogeographic strata because these units represent both biological diversity (genetic and ecological) and geographic variation. The TRT noted that, given the dominant influence of the ocean on the Oregon Coast climate, ecological conditions are relatively uniform throughout the ESU. The Umpqua River basin is an exception, with inland areas being drier and experiencing more extreme temperatures than the coastal areas. Ecological differences within the ESU relate to the effects of local topography on rainfall, and of local geology on vegetation composition and slope stability. The State of Oregon's Fish and Wildlife Commission adopted the Oregon Department of Fish and Wildlife's Oregon Coast Coho Conservation Plan in March 2007. The CHART considered the TRT products in rating each watershed. We anticipate that, as ESA recovery planning proceeds, we will have better information and may revise our recommendations regarding critical habitat designation.

2.4 CHART PROCESS OVERVIEW

In keeping with the process used in recent critical habitat designations (70 FR 52630, September 2, 2005), NOAA Fisheries convened an Oregon Coast coho salmon CHART to assist in the designation of critical habitat under the ESA. The CHART consisted of federal salmonid biologists and habitat specialists tasked with assessing biological information pertaining to areas under consideration for designation. The CHART explored a variety of data sources and used their best professional judgment, a geographic information system, and a computerized decision support system (DSS) to (1) verify the presence of PCEs within each occupied area, (2) verify the existence of activities that may affect the PCEs, and (3) rate the conservation value of watersheds and riverine corridors and determine if any unoccupied areas may be essential to conservation. The CHART has completed four phases of work associated with the critical habitat designation for Oregon Coast coho salmon.

2.4.1 CHART Phase 1

In the first phase, the CHART met to discuss the assignment and to identify the best scientific information available regarding Oregon Coast coho and the habitats supporting the ESU. This phase also involved developing a fuzzy logic-based DSS to analyze habitat, spawning, and other related data. Using the DSS allowed the CHART to apply a consistent, transparent, and repeatable ranking methodology across all watersheds evaluated. Appendix A provides an explanation of the data considered, their incorporation into the DSS, and outputs used by the CHART in later phases.

2.4.2 CHART Phase 2

After collecting and synthesizing the best available data, the CHART met during Phase 2 to review and discuss the information. In this phase the CHART verified the presence of the PCEs in each occupied watershed/area, identified management activities that may affect those PCEs, and reviewed outputs from the DSS. For each watershed, the CHART members assessed the best available fish distribution data and noted any discrepancies with their own knowledge of the area (which included documented sources of information). If discrepancies were found, they were flagged for follow-up and resolution with the appropriate state or federal fishery agency. The CHART then confirmed whether the occupied reaches/areas were likely to contain one or more of the specified PCEs. To aid in these assessments, the teams were provided with GIS data and maps displaying a variety of data layers including fish and PCE distributions, ESU population boundaries, stream hydrography and gradient, land use, land cover, and land ownership.

The CHART was also asked to determine whether, consistent with the regulatory definition of "special management considerations or protection" (50 C.F.R. 402.02 (j)), there were "any methods or procedures useful in protecting physical and biological features." The CHART was asked to determine whether there were actions occurring in occupied areas that may threaten the PCEs, such that there would be any methods or procedures useful in protecting the PCEs. CHART members drew upon their first-hand knowledge of the areas and the physical or biological features as well as their experience in section 7 consultations. The CHART identified and documented such activities for each area (see Table 1).

2.4.3 CHART Phase 3

In Phase 3, the CHART met to discuss the information generated in Phase 2, along with additional considerations and related assessments, to assign a high, medium, or low conservation value[2] to each watershed/area (the conservation value of a given HUC5 is the relative importance of the HUC5 to conservation of the ESU). Coho salmon in this ESU exhibit high genetic variability and form multiple, distinct population complexes (Weitkamp et al. 1995; Nickelson 2001, Lawson et al. 2007). Early in the CHART process, the team members resolved that the process should rate watersheds in the context of their surrounding landscape. The team felt that achieving conservation would require identifying critical habitat throughout the range of coho habitat use and worked to ensure the process did not focus exclusively on the most productive areas of the ESU to the detriment of potentially important habitat elsewhere. In addition, estuaries, lakes, and other off-

[2] In the Advance Notice of Proposed Rulemaking (68 FR 55926, September 29, 2003) we describe the conservation value of a site as depending on "(1) the importance of the populations associated with a site to the ESU conservation, and (2) the contribution of that site to the conservation of the population either through demonstrated or potential productivity of the area."

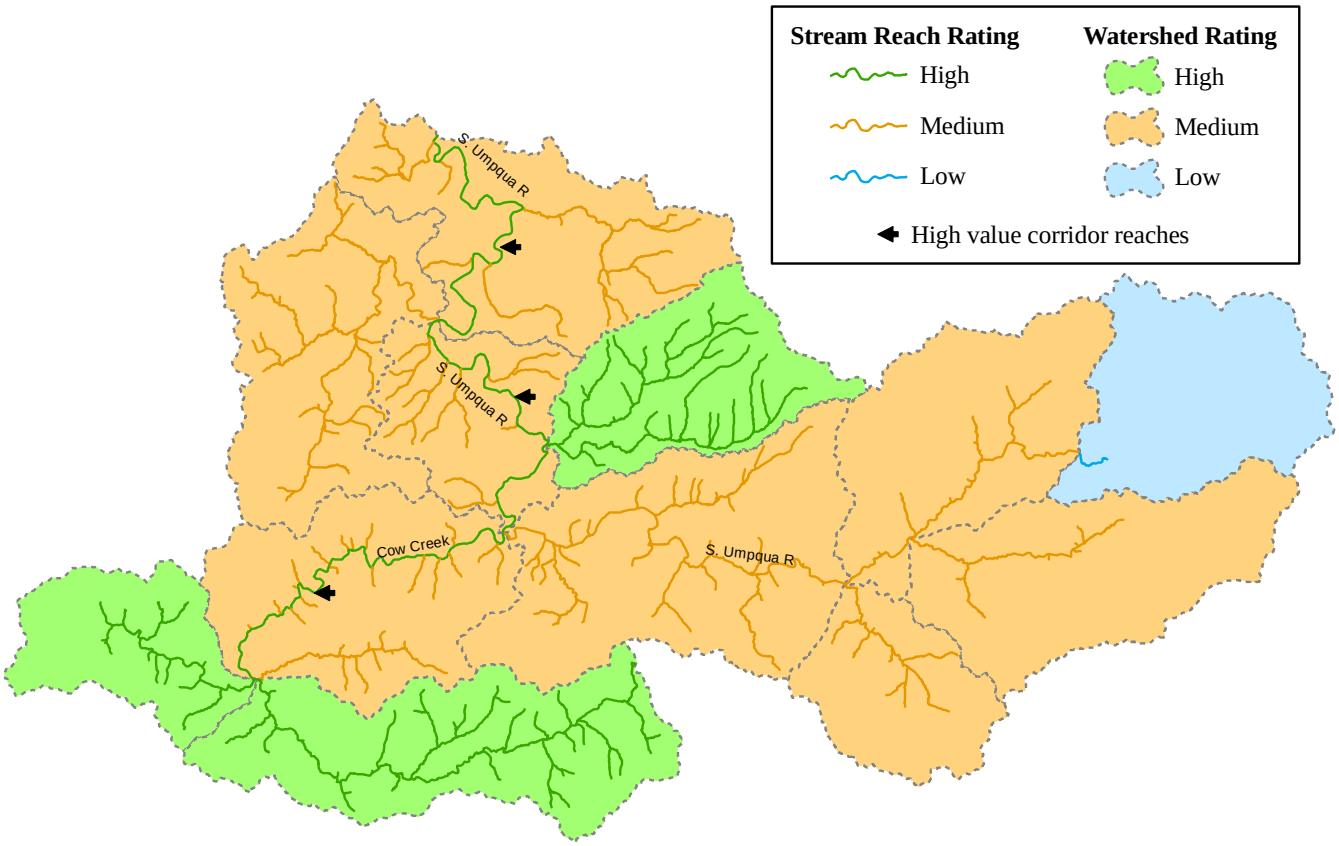
channel habitats received special attention from team members, as these areas have special value as habitat for coho salmon (Swain and Holtby 1989; Independent Multidisciplinary Science Team 2002). Throughout the rating process, team members identified these areas for special consideration and agreed to consider these areas as highly valuable to the ESU, where appropriate.

The additional considerations weighed by the CHART included the relationship of each HUC5 to other HUC5s in the ESU and the significance to the ESU of the population occupying each HUC5. As an example of the first additional consideration, a HUC5 with lower DSS outputs might receive a medium rating if it is in close proximity to several other HUC5s with higher DSS outputs, while another HUC5 with similarly low DSS outputs might receive a high rating if it is one of only a few HUC5s supporting a population. The second consideration involves population characteristics and is relevant because some populations have a higher conservation value to the ESU than others. Thus a HUC5 that received a modest DSS output might nevertheless be rated high if it supports a unique or significant population within the ESU. As an example of applying both the first and second considerations, connectivity of habitats is an important consideration for anadromous salmonids, which require access to the ocean as well as to a network of connected spawning habitats. In such cases a HUC5 might have medium-value tributary habitat but contain a high-value rearing and migration corridor because it is a rearing and migration corridor for fish from a high-valued spawning area. To accommodate this situation, we assigned separate conservation ratings where a HUC5 contains both tributary habitat and a migration corridor. We gave the migration corridor the same rating as the highest-rated HUC5 for which it serves as a migration corridor (see Figure 1).[3]

Essentially, the DSS scores provided important information about the value of each HUC5 in isolation, while the additional considerations allowed the CHART to evaluate the relative contribution of each HUC5 and come up with an overall rating. Other relevant assessments that, along with the DSS outputs, factored into the CHART's final watershed ratings included: (1) Tier 1 key watersheds identified in the Northwest Forest Plan (FEMAT, 1993); (2) coho core spawning reaches identified by the ODFW (ODFW, 2007) as part of the Coastal Salmon Restoration Initiative (now called "The Oregon Plan for Salmon and Watersheds"); (3) Aquatic Diversity Area designations of the American Fisheries Society (ORAFS, 1995.).

[3] The various west coast salmon and steelhead CHARTs discussed this concept at length and were unanimous in concluding that it was a logical conclusion for anadromous salmon and steelhead to assign a conservation value to a migration corridor based on the conservation value of the spawning areas to which it connects and the fish it serves. Moreover, it helped resolve a recurring issue for this and other ESUs with HUC5s having relatively low or limited value tributary spawning habitats but which had primary importance as a rearing/migration corridor for fish/habitats upstream. In this case, the HUC5 could be assigned a lower overall conservation value, but still contain a rearing/migration corridor with a higher conservation value.

Figure 1. Rating connectivity corridors. This example from the South Umpqua subbasin shows how rearing/migration corridors accrue the rating of the highest value watershed situated upstream.



Based on the CHART's overall assessment, high-value watersheds/areas were those deemed to have a high likelihood of promoting ESU conservation, while low-value watersheds/areas were expected to contribute relatively less to conservation. The DSS proved to be a useful tool for informing the rating of conservation value; in general, those watersheds and areas that received the highest DSS outputs also were deemed to have a high conservation value for the ESU, while the opposite was true for watersheds with the lowest DSS outputs.

The final step in Phase 3 involved asking the CHART to consider whether excluding from critical habitat designation particular areas with certain economic impacts (NMFS, 2007a) would significantly impede conservation. The CHART considered these areas both alone or in combination with other eligible areas. In making this determination, the CHART considered such factors as the role the particular area plays in the conservation of the population(s), the uniqueness or importance to the population(s), any recovery planning emphasis on the area, and similar considerations.

2.4.4 CHART Phase 4

In the fourth and final phase, the CHART re-convened in the Fall of 2007 to review comments received on the agency's proposed rule (69 FR 74572, December 14, 2004) as well as any new information they had identified that would assist in making final conclusions about areas under consideration as critical habitat. Comments reviewed included those submitted by the public as well as those solicited from peer reviewers with expertise regarding West Coast salmon and their habitats. The CHART evaluated this new information and then made necessary adjustments in their final conclusions for each ESU (see Table 4). The general types of changes made include: (1) adding or removing specific areas due to new information regarding species and PCE distribution; (2) revising the types of actions occurring in occupied areas that may threaten the PCEs; and (3) revising the conservation values of several watersheds.

During this phase the CHART was also asked to determine how well their conservation value ratings corresponded to the benefit of designation (i.e., as it pertains to the ESA's balancing of designation/exclusion benefits in section 4(b)(2)). We recognized that the "benefit of designation" needed to take into account not only the CHART's conservation ratings but also the likelihood of a section 7 consultation occurring in that area and the degree to which a consultation would yield conservation benefits for the species. To address this concern, we developed a profile for a watershed that would have "low leverage" in the context of section 7. The "low leverage" profile included watersheds with: less than 25 percent of the land area in federal ownership, no hydropower dams, and no consultations likely to occur on instream work (see Table 3). We chose these attributes because federal lands, dams and instream work all have a high likelihood of consultation and activities undergoing consultation have a potential to significantly affect the physical and biological features of salmon and steelhead habitat.

We then asked the CHART members to confirm whether they would conclude that the watersheds matching this profile did in fact have low leverage. To make this determination the CHART relied on the agency's recent consultation history (e.g., using data from the NOAA Fisheries Public Consultation Tracking System), detailed topographic maps and GIS data for each watershed, as well as their own knowledge of actions taking place in the watershed that may warrant ESA section 7 consultation. If the CHART affirmed that a watershed was likely to be "low leverage" we would have diminished the watershed's benefit of designation[4] for the purposes of conducting the ESA 4(b)(2) analysis.

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[4] The benefit of designation was diminished somewhat but not completely, since the educational benefits of designation would still be more important the higher the conservation value of an area, and since we cannot predict with complete accuracy all of the section 7 consultations that are likely to occur in a particular area.

As a final step, we also asked the CHART to determine if any low value watersheds not previously considered for exclusion might warrant exclusion due to low leverage. In such "low-value/low-leverage" cases we further reduced the economic threshold in the agency's ESA 4(b)(2) process to better address the few cases where the benefits of designation were clearly minimal (NMFS, 2005b).

As described in Table 3, none of the candidate watersheds for low leverage were determined to actually be low leverage, in particular due to the substantial number type of past (and potential) consultations in each watershed

Figure 2. Proposed historical populations in the Oregon Coast coho salmon ESU (from Lawson et al. 2007)

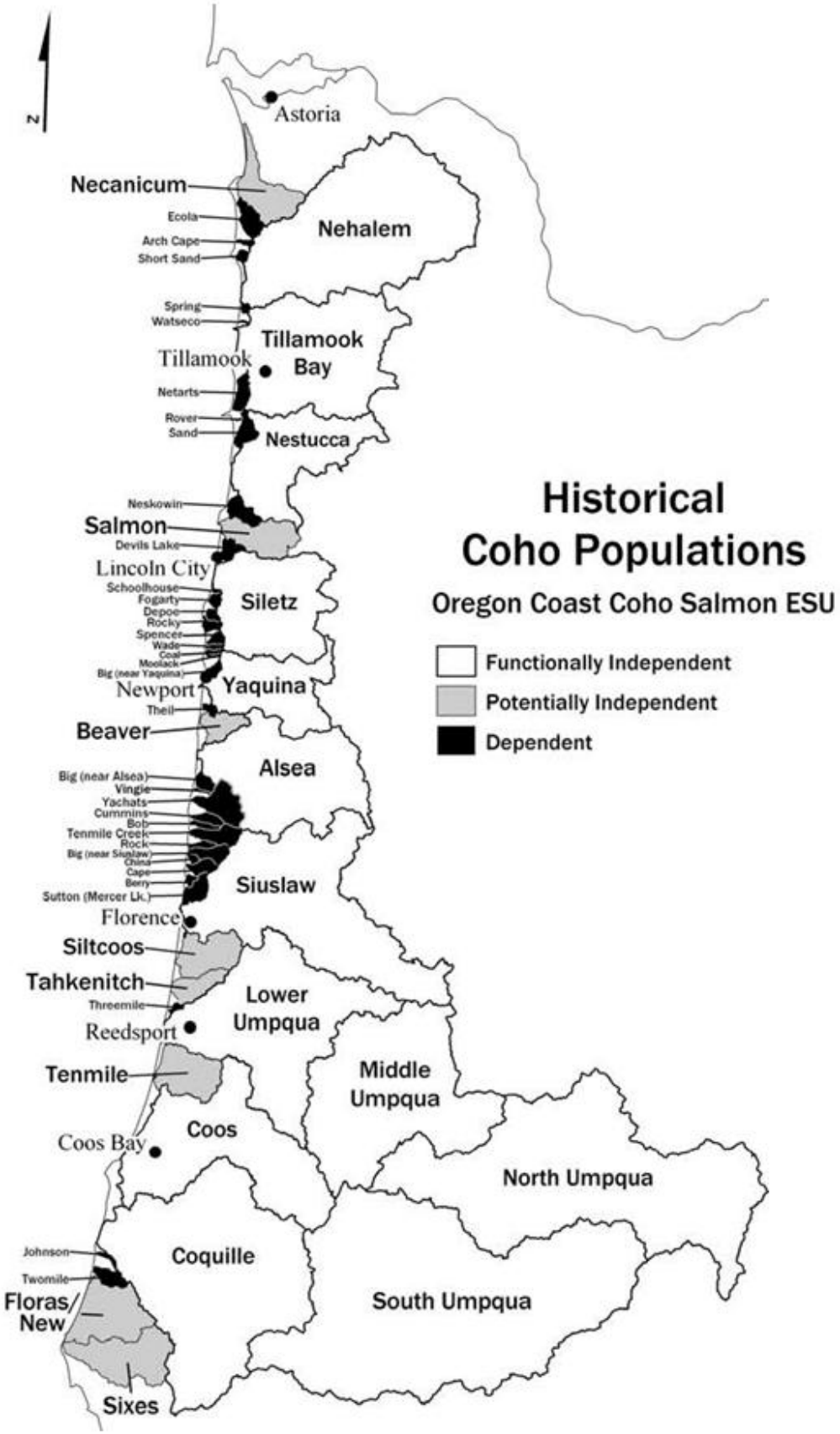


Table 1. Summary of Occupied Areas, PCEs and Management Activities Affecting Them, and CHART Ratings of Conservation Value for Watersheds Occupied by Oregon Coast Coho Salmon

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
NECANICUM	Necanicum River	1710020101	60.6	26.3		F, G, U - Loss of large woody debris (LWD) and forested land cover, impaired riparian vegetation, loss of habitat access (due to inadequate culverts), diking and floodplain removal, draining and filling of estuarine wetlands, low instream flows associated with municipal water withdrawals, sedimentation (mostly due to landslides associated with roadbuilding and forestry), and urban-related pollution. (Snyder *et al.* 2002)	Medium	
NEHALEM	Upper Nehalem River	1710020201	155.0	41.7		F, U - Loss of LWD and forest land cover, sedimentation (mostly related to forestry), impaired riparian vegetation, and elevated stream temperatures. (Johnson and Maser 1999)	High	
NEHALEM	Middle Nehalem River	1710020202	124.0	38.0		F, G - Loss of LWD and forest land cover, sedimentation (mostly related to forestry and roadbuilding), impaired riparian vegetation, and elevated stream temperatures. (Johnson and Maser 1999)	High	High
NEHALEM	Lower Nehalem River	1710020203	103.7	38.1	0.4	A, F - Loss of LWD and forest land cover, sedimentation (related to forestry and roadbuilding), stream channel modification (mostly for erosion control), and elevated stream temperatures. (Johnson and Maser 1999)	High	High
NEHALEM	Salmonberry River	1710020204	4.8	11.0		F - Sedimentation (related to forestry and roadbuilding) and loss of LWD and forest land cover. (Johnson and Maser 1999)	Low	
NEHALEM	North Fork Of Nehalem River	1710020205	53.7	25.9		A, F - Loss of LWD and forest land cover, impaired riparian vegetation, stream channel modification (mostly related to erosion control), ongoing water withdrawals (for municipal water supplies), and elevated stream temperatures (Johnson and Maser 1999)	High	
NEHALEM	Lower Nehalem River/Cook Creek	1710020206	45.0	31.5	4.2	A, F, U - Loss of LWD and forest land cover, impaired riparian vegetation (related to urbanization and agriculture), and sedimentation (related to forestry and roadbuilding) (Johnson and Maser 1999)	High	High

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
WILSON/ TRASK/ NESTUCCA	Little Nestucca River	1710020301	28.7	9.5		A, F, U - Loss of LWD and forested land cover, sedimentation (mostly due to landslides associated with roadbuilding), and altered nutrient cycling related to changes to riparian areas (USDA Forest Service 1998a)	Medium	
WILSON/ TRASK/ NESTUCCA	Nestucca River	1710020302	130.5	42.1	3.2	A, F - Loss of LWD and forested land cover, sedimentation (mostly due to landslides associated with roadbuilding and forestry), lowland channel entrenchment mostly associated with agriculture), and elevated stream temperatures (due to riparian vegetation removal for forestry, roadbuilding, and agriculture) (USDA Forest Service 1994a; Barczak 1998)	High	
WILSON/ TRASK/ NESTUCCA	Tillamook River	1710020303	34.6	21.6		F, G - Loss of LWD and forest land cover, elevated stream temperatures, sedimentation (related to forestry, roadbuilding, and grazing), agriculture-related pollution, floodplain diking and removal, wetland draining and filling, and modification or removal of estuarine habitat (Strittholt and Frost 1995; Tillamook Bay National Estuary Project 1998; Tillamook Bay National Estuary Project 1999)	High	
WILSON/ TRASK/ NESTUCCA	Trask River	1710020304	75.1	42.0		A, F, G, U - Loss of LWD and riparian vegetation, sedimentation (mostly due to erosion related to roadbuilding), stream flow modification (mostly due to forestry), agriculture- and urban-related pollution, diking and removal of floodplains, and low instream flows associated with municipal and agricultural water withdrawals (Follansbee *et al.* 1998a; Tillamook Bay National Estuary Project 1998; Hawksworth *et al.* 2003)	High	
WILSON/ TRASK/ NESTUCCA	Wilson River	1710020305	70.3	36.5		F, G, U - Wetland draining, diking, and filling (related to grazing and urban development), loss of LWD and forest land cover, elevated stream temperatures, and fish passage barriers (mainly inadequate culverts and tidegates) (Tillamook Bay National Estuary Project 1998; Tillamook Bay National Estuary Project 1999; Sullivan *et al.* 2001)	High	

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
WILSON/ TRASK/ NESTUCCA	Kilchis River	1710020306	29.5	13.5		F, G - Loss of LWD and forest land cover, impaired riparian vegetation (due to forestry and grazing), sedimentation (mostly due to landslides related to forestry and roadbuilding), wetland diking, draining, and filling, stream channelization and entrenchment, and altered steam substrate composition (Follansbee *et al.* 1998b; Tillamook Bay National Estuary Project 1998; Tillamook Bay National Estuary Project 1999)	High	
WILSON/ TRASK/ NESTUCCA	Miami River	1710020307	19.6	6.3		A, F, G, U - Loss of LWD and forest land cover, impaired riparian vegetation (due to grazing, agriculture, and development), filling, diking, and draining of wetlands, fish passage barriers (mostly due to inadequate culverts), and stream channelization and entrenchment (Tillamook Bay National Estuary Project 1998; Tillamook Bay National Estuary Project 1999; Snyder *et al.* 2001)	High	
WILSON/ TRASK/ NESTUCCA	Tillamook Bay	1710020308	4.4	21.8		A, F, G, R, U - Wetland diking, filling, and draining (related to grazing and agriculture), sedimentation (related to forestry, grazing, agriculture, and urbanization), estuary dredging (to support ocean traffic), loss of LWD and forest land cover, and stream channelization (Tillamook Bay National Estuary Project 1998; Tillamook Bay National Estuary Project 1999)	High	High
WILSON/ TRASK/ NESTUCCA	Spring Creek/Sand Lake/Neskowin Creek Frontal	1710020309	32.2	12.2		A, F - Loss of LWD and forested land cover, clearing of riparian areas for agricultural and residential use, and sedimentation (mostly due to landslides associated with roadbuilding) (Barczak 1998; SRI/SHAPIRO/AGCO 1998; Boateng & Associates *et al.* 1999; Follansbee *et al.* 1999)	Medium	
SILETZ/ YAQUINA	Upper Yaquina River	1710020401	60.5	24.5		A, F, G, U - Loss of LWD and forested land cover, diking and draining of wetlands (mostly for urban development, agriculture, and grazing), loss of riparian structure, floodplain removal, and sedimentation (Jones and Moore 2000)	High	
SILETZ/ YAQUINA	Big Elk Creek	1710020402	59.6	24.7		F, G - Loss of LWD and forest land cover, impaired riparian vegetation (related to grazing and forestry), elevated stream temperatures, floodplain removal, and sedimentation (mostly due to landslides related to forestry and erosion related to forestry and grazing) (USDA Forest Service 1995a; Jones and Moore 2000)	Medium	

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
SILETZ/ YAQUINA	Lower Yaquina River	1710020403	34.6	57.6		A, F, G, R, U - Loss of LWD and forested land cover, dredging and urbanization of lower estuary, and diking and draining of wetlands (mostly for urban development, agriculture, and grazing) (Brophy 1999; Jones and Moore 2000; Garono and Brophy 2001)	High	High
SILETZ/ YAQUINA	Middle Siletz River	1710020405	31.9	15.9		F, G - Sedimentation (mostly due to landslides related to forestry and roadbuilding), modified hydrology (increased peak flows related to forestry and roadbuilding), loss of LWD and forest land cover, and impaired riparian areas (Garono and Brophy 2001)	Medium	
SILETZ/ YAQUINA	Rock Creek/Siletz River	1710020406	26.0	5.3		F, G, S - Loss of LWD and forest land cover, sedimentation (from landslides related to quarries as well as roadbuilding- and grazing-related erosion), and channel entrenchment (possibly related to changes in hydrology related to forestry) (Garono and Brophy 1999)	Medium	
SILETZ/ YAQUINA	Lower Siletz River	1710020407	107.5	69.1		F, G, U - Sedimentation (mostly due to landslides related to forestry and roadbuilding), modified hydrology (increased peak flows related to forestry and roadbuilding), loss of LWD and forest land cover, and impaired riparian areas (USDA Forest Service and USDI 1996; Garono and Brophy 2001)	High	High
SILETZ/ YAQUINA	Salmon River/Siletz/ Yaquina Bay	1710020408	47.6	8.7		A, F - Loss of LWD and forest land cover, impaired riparian function, and sedimentation (mostly due to runoff from roads and landslides associated with forestry and roadbuilding) (Boateng & Associates *et al.* 1999)	Medium	
SILETZ/ YAQUINA	Devils Lake/Moolack Frontal	1710020409	28.5	10.4		F, G, U - Sedimentation (mostly due to landslides related to forestry and roadbuilding), modified hydrology (increased peak flows related to forestry and roadbuilding), loss of LWD and forest land cover, impaired riparian areas, urbanization- and forestry related pollution, loss of habitat access due to inadequate culverts and dams, and channel entrenchment (DEQ 2003d; DEQ 2003c; DEQ 2003b; DEQ 2003a; Trask and Higley 2003)	Medium	
ALSEA	Upper Alsea River	1710020501	45.7	12.7		F, S - Loss of LWD and forest cover, degraded riparian vegetation, sedimentation (mostly related to roadbuilding, also related to quarries), and altered hydrology (changes to peak flows related to roadbuilding and forestry) (USDI 1995d; USDI 1995f)	Medium	

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
ALSEA	Five Rivers/Lobster Creek	1710020502	101.3	22.3		F, S - Sedimentation (mostly due to landslides related to forestry and roadbuilding), loss of LWD and forest cover, impaired fish passage (due to inadequate road crossings), and elevated stream temperatures (related to loss of riparian vegetation) (USDI and USDA Forest Service 1997)	High	
ALSEA	Drift Creek	1710020503	47.2	16.9		F, S - Sedimentation (mostly due to landslides related to forestry and roadbuilding), loss of LWD and forest cover, and disturbance of riparian areas (USDA Forest Service and USDI 1997a)	High	
ALSEA	Lower Alsea River	1710020504	85.1	51.9		A, F, G, U - Loss of LWD and forest land cover, over-allocation of surface water (for irrigation and municipal uses), diking and filling of estuarine wetlands, loss of appropriate channel substrates (associated with modified hydrology related to roadbuilding and forestry), and impaired riparian vegetation (mostly due to modification associated with roadbuilding, forestry, agriculture/grazing, and residential development) (USDA Forest Service *et\ al.* 1999)	High	High
ALSEA	Beaver Creek/Waldport Bay	1710020505	25.4	16.9		A, F, U - Loss of LWD and forest land cover, stream channelization and entrenchment (generally due to agricultural use), impaired riparian vegetation, draining and degradation of wetlands, and modified estuary function (related to urbanization) (USDA Forest Service 2001a)	High	
ALSEA	Yachats River	1710020506	43.5	3.7		F, G, U - Loss of LWD, degraded riparian vegetation (related to forestry, roadbuilding, grazing, and residential development), over-allocated water use rights, and stream channelization and entrenchment (related to grazing and development) (USDA Forest Service 1997c)	Medium	
ALSEA	Cummins Creek/ Tenmile Creek/Mercer Lake Frontal	1710020507	64.4	12.3		F - Loss of LWD, sedimentation (related to forestry and roadbuilding), loss of habitat access due to inadequate culverts, and degraded riparian areas (USDA Forest Service 1995b; Andrus *et al.* 1996)	Medium	
ALSEA	Big Creek/Vingie Creek	1710020508	7.7	1.5		F - Loss of LWD, degraded riparian vegetation (related to forestry and roadbuilding), and loss of habitat access due to inadequate culverts (USDA Forest Service 1997c)	Low	

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
SIUSLAW	Upper Siuslaw River	1710020601	123.8	78.4	1.6	A, F - Loss of LWD and forest cover, elevated stream temperature, impaired riparian vegetation, and sedimentation (mostly due to landslides related to forestry and roadbuilding, also due to agriculture) (USDI 1995e; Ecotrust and Siuslaw Watershed Council 2002)	High	High
SIUSLAW	Wolf Creek	1710020602	40.1	17.0	0.5	F - Loss of LWD and forest cover and sedimentation (mostly due to landslides related to forestry and roadbuilding) (USDI 1995e; Ecotrust and Siuslaw Watershed Council 2002)	Medium	
SIUSLAW	Wildcat Creek	1710020603	47.6	4.8		F - Loss of LWD and forest cover and sedimentation (mostly due to landslides related to forestry and roadbuilding) (USDI 1995e; Ecotrust and Siuslaw Watershed Council 2002)	Medium	
SIUSLAW	Lake Creek	1710020604	67.4	30.3	2.1	A, F, G - Loss of LWD and forest cove, impaired riparian vegetation (due to forestry, grazing and agriculture), fish passage barriers (due to inadequate road crossings), and sedimentation (mostly due to landslides related to forestry) (USDI 1995e; USDI 1995b; Ecotrust and Siuslaw Watershed Council 2002)	High	High
SIUSLAW	Deadwood Creek	1710020605	65.4			F, G - Loss of LWD and forest cover, impaired riparian vegetation (due to forestry and grazing), elevated stream temperatures, and sedimentation (mostly due to landslides related to forestry and roadbuilding) (USDI 1995e; USDA Forest Service 1996; Ecotrust and Siuslaw Watershed Council 2002)	High	
SIUSLAW	Indian Creek/Lake Creek	1710020606	59.5			A, F - Loss of LWD and forest cover, impaired riparian vegetation (due to forestry and agriculture), elevated stream temperatures, and sedimentation (mostly due to landslides related to forestry and roadbuilding) (USDI 1995e; USDA Forest Service 1996; Ecotrust and Siuslaw Watershed Council 2002)	High	
SIUSLAW	North Fork Siuslaw River	1710020607	61.8	26.4		F, G, U - Loss of LWD and forest cover (related to forestry and land clearing for grazing and homebuilding), loss of spawning substrate (related to modified hydrology, possibly related to forestry), channel entrenchment (related to grazing activities), altered riparian vegetation, and sedimentation (mostly due to landslides related to forestry and roadbuilding) (USDA Forest Service 1994b; USDI 1995e; Ecotrust and Siuslaw Watershed Council 2002)	High	
SIUSLAW	Lower Siuslaw River	1710020608	78.2	69.2		F, G, U - Diking and levee construction on estuarine wetlands, restricted estuarine water and fish movement (due to tide gates), sedimentation (mostly due to landslides related to forestry and roadbuilding), impaired riparian vegetation (related to forestry and grazing), and loss of LWD and forest land cover (USDI 1995e; USDA Forest Service 1998b; Ecotrust and Siuslaw Watershed Council 2002)	High	High

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
SILTCOOS	Waohink River/ Siltcoos River/ Tahkenitch Lake Frontal	1710020701	50.6	87.0		F, G, U - Channelization, diking, and entrenchment of stream channels (mostly related to grazing), impaired riparian vegetation (due to grazing, forestry, and urbanization), sedimentation (due to forestry- and roadbuilding-related landslides and grazing-related erosion), modification of lake water levels and stream flows (related to urbanization and industrial water use), and impaired water quality (mostly due to algal blooms and pollution related to urbanization) (USDA Forest Service 1999a)	High	
NORTH UMPQUA	Boulder Creek	1710030106	0.9			F - Loss of LWD and forested land cover, sedimentation (mostly related to roadbuilding and landslides), increased peak flows associated with forestry, and loss of habitat access due to inadequate culverts (Stillwater Sciences Inc. 1998; USDA Forest Service 2001b; USDI 2001a)	Low	
NORTH UMPQUA	Middle North Umpqua	1710030107	39.7			F, H - Loss of LWD and forested land cover, removal of riparian vegetation, sedimentation (mostly due to landslides related to roadbuilding and forestry), and increased peak stream flows and stream temperatures (Stillwater Sciences Inc. 1998; USDA Forest Service 1999b; USDA Forest Service 2000)	Medium	Medium
NORTH UMPQUA	Steamboat Creek	1710030108	0.7			F - Loss of LWD and forested land cover, removal of riparian vegetation, sedimentation (mostly due to landslides related to roadbuilding and forestry), and increased peak stream flows and stream temperatures (Stillwater Sciences Inc. 1998; USDA Forest Service 1999b; USDA Forest Service 2000)	Low	
NORTH UMPQUA	Canton Creek	1710030109	1.3			F - Loss of LWD and forested land cover, removal of riparian vegetation, sedimentation (mostly due to landslides related to roadbuilding and forestry), and increased peak stream flows and stream temperatures (Stillwater Sciences Inc. 1998; USDA Forest Service 1999b; USDA Forest Service 2000)	Low	
NORTH UMPQUA	Rock Creek/North Umpqua River	1710030110	21.8	1.5		F - Loss of LWD and forested land cover, sedimentation (associated with roadbuilding and forestry-related landslides), loss of habitat access due to inadequate culverts, and stream flow modification related to roadbuilding (USDI 1996e; Stillwater Sciences Inc. 1998)	Medium	

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
NORTH UMPQUA	Little River	1710030111	35.0	7.1		F - Loss of LWD and forested land cover, sedimentation (due to accelerated erosion due to forestry and roadbuilding), impaired riparian vegetation, elevated stream temperatures, and elevated peak flows (USDA Forest Service and USDI 1995)	Medium	
NORTH UMPQUA	Lower North Umpqua River	1710030112	33.9	35.1		A, F, G, U - Loss of LWD and forested land cover, impaired riparian vegetation, loss of habitat access due to dams and inadequate culverts, stream channelization and riprapping, wetland draining and filling (for agriculture, grazing, and urbanization), sedimentation, and pollution associated with agriculture/grazing and urbanization (Geyer 2003b)	High	High
SOUTH UMPQUA	Upper South Umpqua River	1710030201	2.3	0.0		F - Loss of LWD, sedimentation, and changes to stream channel morphology and hydrology (Dose and Roper 1994; USDA Forest Service 1995c)	Low	
SOUTH UMPQUA	Jackson Creek	1710030202	9.6	11.4		F, G - Loss of LWD and forested land cover, sedimentation, floodplain removal (due to roadbuilding), stream channelization and riprapping, elevated peak flows and stream temperatures, impaired riparian vegetation (related to grazing and forestry), and loss of habitat access due to inadequate culverts (USDA Forest Service 1995c; Geyer 2003g)	Medium	
SOUTH UMPQUA	Middle South Umpqua River	1710030203	13.0	19.7		F - Sedimentation (related to erosion due to forestry), forestry-related pollution (associated with fertilizer or pesticide use), loss of habitat access (due to inadequate culverts), impaired riparian vegetation, and elevated stream temperature, and loss of LWD (DEQ 2003f; Geyer 2003g)	Medium	Medium
SOUTH UMPQUA	Elk Creek/South Umpqua	1710030204	24.1			F, G - Loss of habitat access (due to inadequate culverts), impaired riparian vegetation, and elevated stream temperature (DEQ 2003e; Geyer 2003g)	Medium	
SOUTH UMPQUA	South Umpqua River	1710030205	64.7	28.2		A, F, G, I, M - Loss of LWD and forest land cover, sedimentation (related to forestry, roadbuilding, and mining), impaired riparian vegetation (related to forestry, roadbuilding, agriculture, and grazing), wetland diking and damming, loss of habitat access due to inadequate culverts, Walker Dam, and Oshea Creek Dam, mining-related pollution, and low instream flows associated with irrigation withdrawals (USDI 1995a; USDI 1996c; USDI 1998a; Geyer 2003f)	Medium	Medium

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
SOUTH UMPQUA	Middle Cow Creek	1710030207	66.1	24.7	2.6	A, F, U - Loss of LWD and forest land cover, elevated stream temperatures related to removal of riparian vegetation (due to forestry and agriculture), sedimentation (mostly due to roadbuilding and forestry), wetland diking, draining, and filling (to support agriculture and urbanization), and fish passage barriers (mostly due to improper culverts) (USDI 1997b; USDI 1999b; Kincaid and Umpqua Basin Watershed Council 2002)	High	
SOUTH UMPQUA	West Fork Cow Creek	1710030208	31.3			F - Loss of LWD and forest land cover, increased stream temperature related to impaired riparian vegetation, and sedimentation (related to forestry and roadbuilding) (USDI 1997f; Geyer 2003h)	High	
SOUTH UMPQUA	Lower Cow Creek	1710030209	46.1	0.3	26.6	F, G - Loss of LWD and forested land cover, sedimentation (related to roadbuilding and forestry), elevated stream temperatures, loss of habitat access due to inadequate culverts, and increased peak flows (USDI 1997b)	Medium	High
SOUTH UMPQUA	Middle South Umpqua River	1710030210	42.4	0.0	21.8	A, F, G, S - Loss of LWD and forested land cover, impaired riparian vegetation (associated with forestry, agriculture, and grazing), loss of habitat access due to inadequate culverts, stream channel modification and sedimentation related to gravel mining and agriculture, stream channel downcutting due to grazing, and wetland diking, draining, and filling (USDI 1997b; USDI 1999c; Geyer 2003d)	Medium	High
SOUTH UMPQUA	Myrtle Creek	1710030211	87.5	1.8		A, F, G, I, U - Loss of LWD and forested land cover, wetland filling, diking, and draining, loss of habitat access due to inadequate culverts and irrigation dams, channelization and riprapping, sedimentation (related to roadbuilding and forestry), urban-related pollution, and low instream flows associated with irrigation and municipal use withdrawals (USDI 1997d; Geyer 2003e)	High	
SOUTH UMPQUA	Ollala Creek/Lookingglass	1710030212	55.2	21.6		F, G, I - Loss of LWD and forested land cover, sedimentation associated with forestry and roadbuilding, low instream flows associated with irrigation withdrawals, channel substrate erosion (due to increased peak flows associated with forestry and roadbuilding), stream channel entrenchment (mostly associated with grazing), loss of habitat access due to Berry Creek Dam, inadequate culverts, and irrigation dams, and impaired riparian vegetation (USDI 1998b; DeVore *et al.* 2003)	Medium	

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
SOUTH UMPQUA	Lower South Umpqua River	1710030213	60.5	1.7	24.9	A, F, G, U - Loss of LWD and forested land cover, sedimentation associated with forestry and roadbuilding, low instream flows associated with irrigation withdrawals, channel substrate erosion (due to increased peak flows associated with forestry, urbanization, and roadbuilding), stream channel entrenchment (mostly associated with grazing), loss of habitat access due to inadequate culverts and irrigation dams, impaired riparian vegetation, riprapping and channelization, agriculture- and urban-related pollution, diking and floodplain removal, and wetland filling and draining (USDI 2000b; Geyer 2003c)	Medium	High
UMPQUA	Upper Umpqua River	1710030301	108.2	0.0	57.4	A, F, G - Loss of LWD and forest land cover, sedimentation (related to forestry and erosion from grazing and agriculture), stream channelization and entrenchment (due to grazing and agriculture), fish passage barriers (mostly due to improper culverts), and impaired riparian vegetation (USDI 1997e)	Medium	High
UMPQUA	Calapooya Creek	1710030302	114.3	14.0	20.1	F, G, I, M, U - Loss of LWD and forested land cover, sedimentation (related to landslides associated with pasture lands, forestry, and roadbuilding), low stream flows associated with irrigation and domestic withdrawals, loss of habitat access due to irrigation dams and inadequate culverts, wetland drain and filling, diking and removal of floodplains, and mining- and urbanization-related pollution (USDI 1999a; Geyer 2003a)	High	
UMPQUA	Elk Creek	1710030303	170.5	4.3	26.0	A, F, G, I - Loss of LWD and forested land cover, sedimentation (related to forestry and roadbuilding), low stream flows associated with water withdrawals, elevated stream temperatures associated with loss of riparian vegetation, increased peak flows associated with forestry, and loss of habitat access due to dams and inadequate culverts (USDI 1996a; USDI 1996d)	High	
UMPQUA	Middle Umpqua River	1710030304	50.1	5.7	18.2	F, G - Loss of LWD, elevated stream temperatures, stream channelization, degradation of riparian habitat, and sedimentation (potentially related to forestry, roadbuilding, and grazing) (USDI 1997e; NMFS 1998)	High	High

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
UMPQUA	Lake Creek	1710030305	17.1	6.9	1.8	F - Sedimentation (due to landslides related to forestry and roadbuilding), impaired riparian vegetation, and loss of LWD and forested land cover (BioSystems *et al.* 2003)	Low	
UMPQUA	Upper Smith River	1710030306	175.0	1.5		F - Loss of LWD and forested land cover, sedimentation (related to landslides due to roadbuilding and forestry), high stream temperatures (related to impaired riparian vegetation), and loss of habitat access due to inadequate culverts (USDI 1995c)	High	
UMPQUA	Lower Smith River	1710030307	140.4	45.4	11.8	A, F, R - Loss of LWD and forest land cover, sedimentation (mostly due to landslides related to forestry and roadbuilding), modified stream flow patterns, diking and filling of wetlands, and river/estuary channel dredging (USDA Forest Service and USDI 1997b)	High	High
UMPQUA	Lower Umpqua River	1710030308	35.4	49.2		F, G, U - Loss of LWD and forest land cover, stream channelization and entrenchment (mostly associated with grazing), diking and filling of estuarine wetlands (related to grazing and urbanization), and sedimentation (related to landslides related to forestry and roadbuilding) (USDA Forest Service 1997a; BioSystems *et al.*2003)	High	High
COOS	South Fork Coos	1710030401	83.5	33.7		A, F, G - Sedimentation (due to agricultural/grazing-related erosion and landslides related to forestry and roadbuilding), diking and draining of wetlands for agriculture/grazing, loss of LWD and forest land cover, and stream channelization and entrenchment (USDI 2001b)	High	
COOS	Millicoma River	1710030402	78.3	20.3		F - Loss of LWD and forested land cover, sedimentation (related to roadbuilding), and elevated stream temperatures (BioSystems *et al.* 2003)	High	
COOS	Lakeside Frontal	1710030403	38.1	41.7		F, G, U - Loss of LWD and forested land cover, Sedimentation (related to forestry, roadbuilding, and grazing), stream channelization (for grazing and homebuilding), wetland draining and filling, floodplain removal, pollution associated with urbanization, and loss of habitat access due to inadequate culverts and dams (BioSystems *et al.* 2003; Tenmile Lakes Basin Partnership 2003)	High	
COOS	Coos Bay	1710030404	94.0	149.9	1.4	F, U - Loss of LWD and forested land cover, sedimentation (related to roadbuilding), loss of habitat access due to inadequate culverts, pollution and increased peak flows due to urbanization, stream channelization, and wetland filling and draining (Satre Associates PC *et al.* 2001; BioSystems *et al.* 2003)	High	High

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
COQUILLE	Lower South Fork Coquille	1710030501	45.2	8.5		A, F, I, M - Loss of LWD and forest land cover, sedimentation (mostly due to landslides related to forestry and roadbuilding, but also to erosion and streambed disturbance from mining activities), and elevated stream temperatures (related to reduced riparian vegetation and water withdrawals related to agriculture) (USDA Forest Service 1995d; USDI 1996b)	Low	
COQUILLE	Middle Fork Coquille	1710030502	65.6	16.1		A, F - Sedimentation (related to roadbuilding and forestry), loss of LWD and forest land cover, elevated stream temperatures, and impaired riparian vegetation (due to agriculture and forestry) (USDI 1997a; USDI 1999d)	Medium	
COQUILLE	Middle Main Coquille	1710030503	40.6	36.3		A, F, G - Sedimentation (mostly related to forestry and roadbuilding), impaired riparian vegetation, draining of wetlands (for grazing and agriculture), loss of LWD and forest land cover, stream channelization and entrenchment, and fish passage barriers (mostly due to improper culverts) (USDI 1997c)	High	High
COQUILLE	East Fork Coquille	1710030504	32.7	11.2		A, F, G, I - Sedimentation (mostly due to landslides related to forestry and roadbuilding), impaired riparian vegetation (related to forestry, agriculture, and grazing), loss of LWD and forest land cover, lowered summer stream flows (due to irrigation withdrawals), and channel downcutting (related to removal of riparian vegetation) (USDI 2000a)	High	
COQUILLE	North Fork Coquille	1710030505	99.3	37.7		A, F, U - Sedimentation (mostly due to landslides related to forestry, also to roadbuilding), loss of LWD and forest land cover, modifications to stream flow volume and timing, water withdrawals (for the city of Myrtle Point), and elevated stream temperatures (USDI 2002)	High	High
COQUILLE	Lower Coquille	1710030506	61.0	90.4		A, F - Loss of LWD and forested land cover, elevated stream temperatures, sedimentation (due to forestry and roadbuilding), loss of habitat access (due to inadequate culverts, tide gates, and dams), diking and draining wetlands, floodplain and riparian area removal, and destruction of estuarine habitat (Hampel 1999)	High	High
SIXES	Sixes River	1710030603	32.9	25.5		A, F, G - Loss of LWD and forested land cover, sedimentation (related to landslides due to forestry and roadbuilding), loss of habitat access due to inadequate culverts, wetland filling and draining (mostly for agriculture and grazing), stream channelization, and high stream temperatures (USDA Forest Service 1997b; Maguire *et al.* 2001b)	Medium	

Subbasin	Watershed	HUC5 Code	Spawning/ Rearing PCEs (mi)	Rearing/ Migration PCEs (mi)	Presence/ Migration Only PCEs (mi)*	Key Management Activities** and Issues	CHART Rating of HUC5 Conservation Value	CHART Rating of Corridor Conservation Value*
SIXES	New River Frontal	1710030604	60.5	30.0		A, F, G, I, S - Loss of LWD and forest land cover, sedimentation (related to forestry, roadbuilding, and rock mining), impaired riparian vegetation (due to forestry, grazing, and agriculture), stream channelization and entrenchment (due to grazing and agriculture), water withdrawals (mostly related to agriculture and irrigation), and wetland diking and draining (Maguire *et al.* 2001a)	High	

* Some streams classified as "Presence/Migration Only PCEs" may also include rearing or spawning PCEs, but the GIS data are still undergoing review to confirm species use type.
** This list is not exhaustive. It is intended to highlight key management activities affecting PCEs in each watershed. Activities identified are based on the general categories described by Spence et al. (1996) and summarized previously in the "Special Management Considerations or Protection" section of this report. Coding is as follows: F= forestry, G = grazing, A = agriculture, C = channel modifications/diking, R = road building/maintenance, U = urbanization, S = sand and gravel mining, M = mineral mining, D = hydroelectric dams, I = irrigation impoundments and withdrawals, T = river, estuary, and ocean traffic, W = wetland loss/removal, B = beaver removal, X = exotic/invasive species introductions, H = forage fish/species harvest. Primary sources for this information were the CHART and reports cited in the References and Sources of Information.

Table 2. CHART Conclusions Regarding ESA Section 7 Leverage

The following table identifies those watersheds that met the following possible "low leverage" profile identified by NOAA Fisheries habitat biologists:

- less than 25 percent of the land area in federal ownership
- no hydropower dams, and
- no consultations likely to occur regarding instream work.

We chose these attributes because federal lands, dams and instream work all have a high likelihood of consultation, and activities undergoing consultation have a potential to significantly affect the physical and biological features of salmon and steelhead habitat. Where federal lands are involved any activity occurring there must undergo a section 7 consultation if it may affect the species or the designated critical habitat. Salmon and steelhead habitat can be significantly affected by many activities occurring on federal lands, including grazing, timber harvest, roadbuilding, and mining. Dams generally are either federally operated or federally permitted by the U.S. Army Corps of Engineers or by the Federal Energy Regulatory Commission, triggering section 7 consultation. Dam operation can significantly affect salmon and steelhead in many ways, including by impeding passage, inundating habitat and changing flow and temperature regimes. Instream work generally requires a permit from the Corps. Instream work can significantly affect salmon and steelhead habitat in a number of ways, including by reducing channel complexity, increasing flows, diminishing connectivity between the stream channel and floodplain, and increasing sediment. Other types of activities also impact salmon and steelhead habitat, but their potential leverage was not deemed as predictable as those used in the above low leverage profile.

In addition to watersheds matching this profile, the CHART also reviewed all watersheds identified as low conservation value, but not exceeding a $91,556 economic threshold, to determine if they were low leverage and should be considered for exclusion. The basis for the threshold used is described in the agency's 4(b)(2) report (NMFS, 2007a), and the data used to query these parameters were the same as those reported in NOAA Fisheries' final economic analysis (NMFS, 2007b). The table below also includes the CHART's assessment as to whether the watershed was in fact likely to be "low leverage," and if so, the CHART's conclusion as to whether excluding a "low leverage" watershed would significantly impede the conservation of the ESU.

Five HUC5 watersheds within the range of the Oregon Coast coho salmon ESU met the criteria for possible low leverage. However, after discussions with the CHART during its final meeting in the Fall of 2007 and a subsequent discussion with the NOAA Fisheries' consultation biologists, it was concluded that none of the watersheds would be considered low leverage, especially in light of the substantial number type of past (and potential) consultations related to transportation systems and maintenance in each watershed.

Watershed Name	Watershed Code	Conservation Value Rating		Likely to be Low Leverage ?	Would Exclusion Significantly Impede Conservation?	Comments
		Benefit of designating watershed	Benefit of designating connectivity corridor			
Necanicum River	1710020101	Medium		No	na	CHART concluded that consultations were likely to yield significant leverage in this HUC5, noting that the Public Consultation Tracking System (PCTS)* contains numerous ESA consultations or conferences here since 1997 associated with the following activities: Fill; Road Construction/Maintenance; Pipeline Construction/Repair; Pollutant Discharge; Rip-rap; Waste Management; Culvert; Fish Passage/Trapping; Right-of-Way; Bridge Repair/Construction; Pilings; Stormwater Drainage; Erosion Control; Bank Stabilization; & Excavation/Mining. The CHART underscored this by noting that leverage associated with road construction and maintenance is evidenced by the fact that the Necanicum River flows through the cities of Seaside and Gearhart, Highway 26 parallels and crosses nearly the entire length of the Necanicum River, and Highway 101 crosses over Necanicum tributaries as well as several occupied independent streams in this HUC5.
Salmonberry River**	1710020204	Low		No	na	CHART concluded that consultations were likely to yield significant leverage in this HUC5, noting that the Lower Nehalem highway bridge is located at the mouth of the Salmonberry and the recent December 2007 floods caused extensive damage to it and the Port of Tillamook railroad line which runs the entire length of the Salmonberry River. Very recent discussions with the U.S. Army Corps of Engineers and NMFS biologists confirmed that there would be potentially significant leverage in this HUC5 as NMFS and the COE prepare to engage in consultation to address the flood damage and possible railroad bed/track re-alignment. Likely consultation-related activities include: Fill; Road Construction/Maintenance; Pipeline Construction/Repair; Rip-rap; Culvert;

Watershed Name	Watershed Code	Conservation Value Rating		Likely to be Low Leverage ?	Would Exclusion Significantly Impede Conservation?	Comments
		Benefit of designating watershed	Benefit of designating connectivity corridor			
						Bridge Repair/Construction; Erosion Control; & Bank Stabilization.
Middle South Umpqua River	1710030210	Medium	High	No	na	CHART concluded that consultations were likely to yield significant leverage in this HUC5, noting that the PCTS contains numerous ESA consultations or conferences here since 1997 associated with the following activities: Timber Sale - Thinning; Timber Harvest/Sales; Habitat Restoration/Improvement; Road Construction/Maintenance; Bridge Repair/Construction; Rip-rap; Bank Stabilization; Erosion Control; Culvert; Fill. Some were associated with tributaries. The CHART underscored this by noting that leverage associated with road construction and maintenance is evidenced by the fact that Interstate 5 and Highway 99 parallel and cross over the South Umpqua River as well as occupied reaches of smaller tributaries.
Lower South Umpqua River	1710030213	Medium	High	No	na	CHART concluded that consultations were likely to yield significant leverage in this HUC5, noting that the PCTS contains numerous ESA consultations or conferences here since 1999 associated with the following activities: Stormwater Drainage; Wetland Modification; Road Construction/Maintenance; Prescribed Burn; Rip-rap; Culvert; Pipeline Construction/Repair; and Cable installation/maintenance. The CHART underscored this by noting that leverage associated with road construction and maintenance is evidenced by the fact that the South Umpqua River flows through the city of Roseburg and Interstate 5 and Highway 99 parallel and cross over the South Umpqua River as well as occupied reaches of smaller tributaries.
Elk Creek	1710030303	High		No	na	CHART concluded that consultations were likely to yield significant leverage in this HUC5, noting that the PCTS contains numerous ESA consultations or conferences here since 1995 associated with the following activities: Timber Harvest/Sales; Timber Sale - Thinning; Timber Sale - Green; Road Use Permit; Road Construction/Maintenance; Trail and Campground Maintenance; Grazing; Culvert; Rip-rap; Erosion Control; Excavation/Mining; Fill; Bridge Repair/Construction; Bank Stabilization; and Fish Passage/Trapping. The CHART underscored this by noting that leverage associated with road construction and maintenance is evidenced by the fact that Elk Creek flows

Watershed Name	Watershed Code	Conservation Value Rating		Likely to be Low Leverage ?	Would Exclusion Significantly Impede Conservation?	Comments
		Benefit of designating watershed	Benefit of designating connectivity corridor			
						through the city of Drain and it as well as numerous occupied tributaries are paralleled or crossed by Interstate 5 and Highways 38 and 99.

* PCTS queries were made in December 2007 at: http://seahorse.nmfs.noaa.gov/pcts/

** This watershed was subjected to a lower $1,000 threshold (described in the 4(b)(2) report, NMFS 2007a) because it was under consideration as a potentially “very low” conservation value HUC5. However, for the reasons given above, it was determined to actually have significant potential for leverage.

Table 3. Final CHART Conclusions Regarding Areas Under Consideration for Exclusion from Critical Habitat

The CHART considered whether excluding from critical habitat designation particular areas with certain economic impacts would significantly impede conservation. The CHART considered these areas both alone or in combination with other eligible areas. In making this determination, the CHART considered such factors as the role the particular area plays in the conservation of the population(s), the uniqueness or importance to the population(s), any recovery planning emphasis on the area, and similar considerations. The CHART's final conclusions, summarized below for those watersheds considered eligible for exclusion due to economic impacts, were obtained via discussions with each CHART during meetings conducted in the Fall of 2007.

		Conservation Value Rating			
Watershed Name	**Watershed Code**	**Benefit of designating watershed**	**Benefit of designating connectivity corridor***	**Would Exclusion Significantly Impede Conservation?**	**Comments**
Upper Alsea River	1710020501	M		Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that the NW Forest Plan identified a Tier 1 key watershed in this HUC5, ODFW has identified core areas for coho in this HUC5, and the presence of large and contiguous reaches of high intrinsic potential that comprise 50% of the occupied areas in this HUC5.
Cummins Creek/Tenmile Creek/Mercer Lake Frontal	1710020507	M		Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that the NW Forest Plan identified approximately half of this HUC5 as a Tier 1 key watershed and most of this HUC5 has been classified as an Aquatic Diversity Area by the Oregon Chapter of the American Fisheries Society. This area is also the focus of important habitat restoration work.

		Conservation Value Rating			
Watershed Name	**Watershed Code**	**Benefit of designating watershed**	**Benefit of designating connectivity corridor***	**Would Exclusion Significantly Impede Conservation?**	**Comments**
Middle North Umpqua	1710030107	M	M	Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that the upper Umpqua River is ecologically unique and is the only Cascade drainage within the range of this ESU. The CHART also noted that this watershed contains important summer rearing (cold water) habitat for coho salmon, the NW Forest Plan identified three Tier 1 key watersheds in this HUC5, upper portions of it have been classified as Aquatic Diversity Areas by the Oregon Chapter of the American Fisheries Society . Also, the exclusion of adjacent low conservation watersheds increases the significance of excluding this particular HUC5.
Steamboat Creek	1710030108	L		No	Based on exclusion of entire watershed.
Canton Creek	1710030109	L		No	Based on exclusion of entire watershed.
Little River	1710030111	M		Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that the upper Umpqua River is ecologically unique and is the only Cascade drainage within the range of this ESU. The CHART also noted that this watershed contains the majority of tributary spawning habitat for the North Umpqua coho population and the exclusion of adjacent low conservation watersheds increases the significance of excluding this particular HUC5.
Upper South Umpqua River	1710030201	L		No	Based on exclusion of entire watershed.

		Conservation Value Rating			
Watershed Name	**Watershed Code**	**Benefit of designating watershed**	**Benefit of designating connectivity corridor***	**Would Exclusion Significantly Impede Conservation?**	**Comments**
Jackson Creek	1710030202	M		Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that the upper Umpqua River is ecologically unique and is the only Cascade drainage within the range of this ESU. Given its location this HUC5 is important for maintaining diversity of the South Umpqua population (historically a productive population) and the Umpqua major population group as a whole. The CHART also noted that this HUC5 is part of one of the largest Tier 1 key watersheds identified in the NW Forest Plan and that upper portions of it have been classified as Aquatic Diversity Areas by the Oregon Chapter of the American Fisheries Society . Also, the exclusion of an upstream low conservation watershed increases the significance of excluding this particular HUC5.
Middle South Umpqua River	1710030203	M	M	Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that the upper Umpqua River is ecologically unique and is the only Cascade drainage within the range of this ESU. Given its location this HUC5 is important for maintaining diversity of the South Umpqua population (historically a productive population) and the Umpqua major population group as a whole. The CHART also noted that this HUC5 is part of one of the largest Tier 1 key watersheds identified in the NW Forest Plan and that upper portions of it have been classified as Aquatic Diversity Areas by the Oregon Chapter of the American Fisheries Society . Also, the exclusion of an upstream low conservation watershed increases the significance of excluding this particular HUC5.

		Conservation Value Rating			
Watershed Name	**Watershed Code**	**Benefit of designating watershed**	**Benefit of designating connectivity corridor***	**Would Exclusion Significantly Impede Conservation?**	**Comments**
Elk Creek/ South Umpqua	1710030204	M		Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that the upper Umpqua River is ecologically unique and is the only Cascade drainage within the range of this ESU. Given its location this HUC5 is important for maintaining diversity of the South Umpqua population (historically a productive population) and the Umpqua major population group as a whole. The CHART also noted that this HUC5 is part of one of the largest Tier 1 key watersheds identified in the NW Forest Plan and that the exclusion of an upstream low conservation watershed increases the significance of excluding this particular HUC5.
South Umpqua River	1710030205	M	M	Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that the upper Umpqua River is ecologically unique and is the only Cascade drainage within the range of this ESU. Given its location this HUC5 is important for maintaining diversity of the South Umpqua population (historically a productive population) and the Umpqua major population group as a whole. The CHART also noted that this HUC5 is part of one of the largest Tier 1 key watersheds identified in the NW Forest Plan and that the exclusion of an upstream low conservation watershed increases the significance of excluding this particular HUC5.
Ollala Creek/ Lookingglass	1710030212	M		Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that this HUC5 is important for maintaining diversity of the South Umpqua population (historically a productive population) and the Umpqua major population group as a whole. The CHART also noted that this HUC5 has large and contiguous reaches of high intrinsic potential and that the exclusion of an upstream low conservation watershed increases the significance of excluding this particular HUC5.

		Conservation Value Rating			
Watershed Name	**Watershed Code**	**Benefit of designating watershed**	**Benefit of designating connectivity corridor***	**Would Exclusion Significantly Impede Conservation?**	**Comments**
Lower South Umpqua River	1710030213	M	H	Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that this HUC5 is important for maintaining diversity of the South Umpqua population (historically a productive population) and the Umpqua major population group as a whole. The CHART also noted that this HUC5 has large and contiguous reaches of high intrinsic potential and that the exclusion of an upstream low conservation watershed increases the significance of excluding this particular HUC5.
Upper Umpqua River	1710030301	M	H	Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that this HUC5 is important for maintaining diversity of the Umpqua major population group as a whole. The CHART also noted that this HUC5 contains important rearing habitat for three Umpqua populations (South, North and Middle Umpqua) and that the exclusion of upstream low conservation watersheds increases the significance of excluding this particular HUC5.
Lake Creek	1710030305	L		No	Based on exclusion of entire watershed.
Lower South Fork Coquille	1710030501	L		No	Based on exclusion of entire watershed.
Middle Fork Coquille	1710030502	M		Yes	CHART concluded that excluding this watershed would significantly impede conservation, noting that this HUC5 has a relatively high juvenile occupancy rate for the Coquille population, approximately 2/3 of the occupied reaches have been identified by ODFW as core areas for coho, and that the exclusion of an adjacent low conservation watershed increases the significance of excluding this particular HUC5.

* Blanks for the conservation value of connectivity corridors indicate that a watershed does not include a rearing and migration corridor serving occupied watersheds upstream (i.e., there are no occupied upstream watersheds).

Table 4. Summary of Comments and Changes to the Initial CHART Assessment for Oregon Coast Coho Salmon ESU

The following table summarizes the comments received on the initial CHART assessment and the changes made for specific watersheds. Key changes included: (1) Elevating the conservation value rating for five watersheds in the Umpqua River basin as a result of recent population identification and viability work by the Technical Recovery Team (TRT) (Lawson et al., 2007; Wainwright et al., 2007) that further subdivides this basin into four (versus two) independent populations; (2) changing the delineation of occupied habitat areas in several watersheds based on comments and field surveys by the U.S. Bureau of Land Management (BLM), Oregon Department of Fish and Wildlife (ODFW), and NOAA Fisheries staff indicating that the original coho distribution maps/data were in error; (3) removing Josephine and Jackson counties from the relevant critical habitat table in agency regulations because these counties overlap slightly with upland areas in watersheds occupied by Oregon Coast coho salmon but they do not contain stream reaches designated as critical habitat for this ESU; and (4) as a result of revised economic data for this ESU and our final 4(b)(2) assessment, we are no longer excluding habitat areas in three watersheds that were previously proposed for designation.

Subbasin	Watershed code	Watershed name	Summary of Comments and Changes
NEHALEM	1710020206	Lower Nehalem River/Cook Creek	*NOAA Fisheries GIS staff noted an error in the original GIS data for Neahkahnie Creek.* Response: Added 1.3 miles (2.1 km) of occupied habitat areas in Neahkahnie Creek based on recent habitat access improvements confirmed by ODFW.
WILSON/ TRASK/ NESTUCCA	1710020302	Nestucca River	*BLM comments noted coho distribution errors associated with the upper Nestucca River.* Response: Added 4.2 miles (6.8 km) of occupied habitat areas in the upper Nestucca River (downstream of McGuire Dam) and Walker Creek, and removed 3 miles (4.8 km) of unoccupied stream reaches above a falls in Elk Creek based on comments from the BLM and feedback from ODFW.

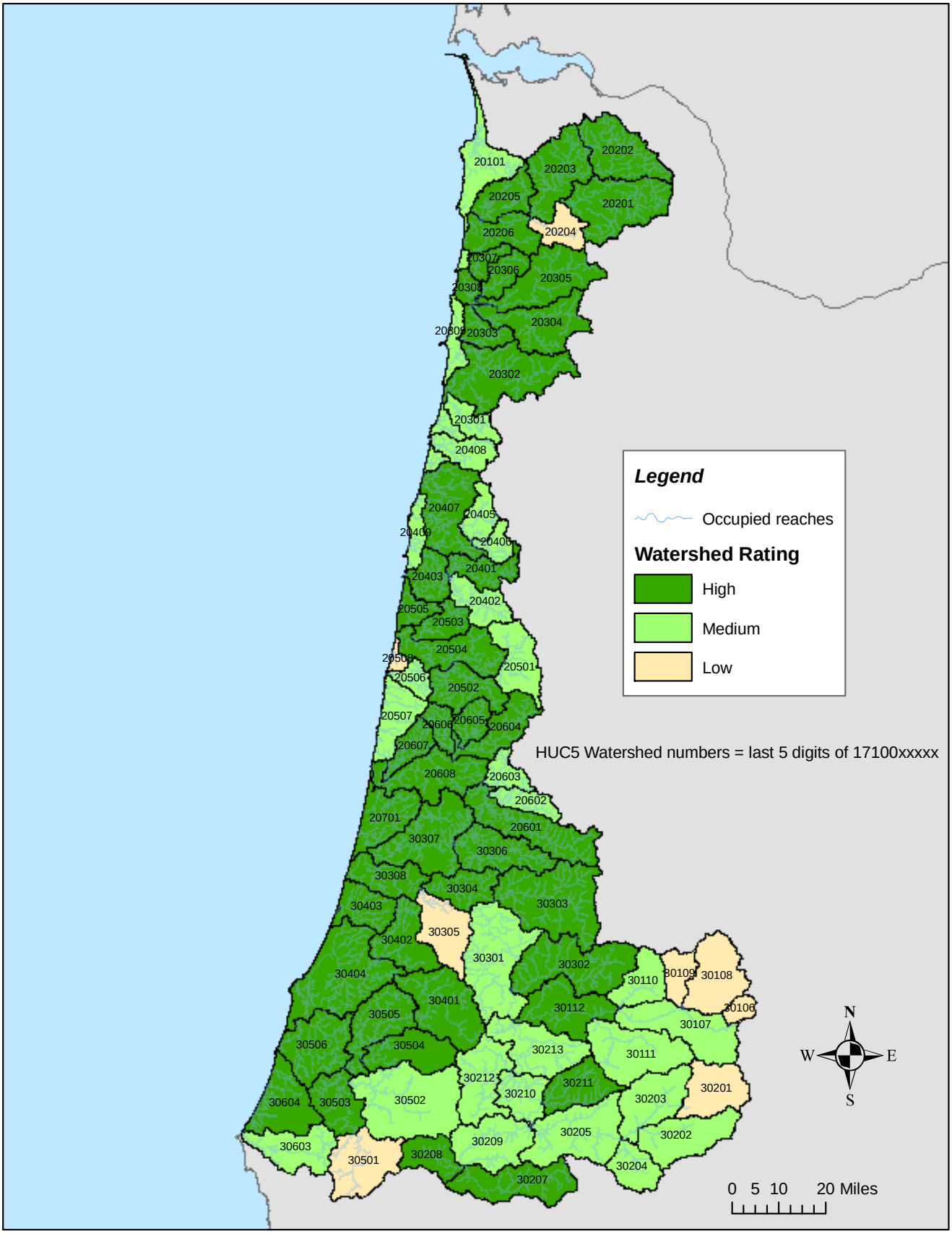
Subbasin	Watershed code	Watershed name	Summary of Comments and Changes
SILETZ/YAQUINA	1710020409	Devils Lake/Moolack Frontal	*Two commenters questioned the "medium" conservation-value rating assigned by the CHART to the habitat area for Devils Lake coho. These areas are within a larger Devils Lake/Moolack Frontal watershed. The commenters cited recent genetic data establishing that coho from Rock Creek/Devils Lake are genetically distinct from other populations in the ESU. The commenters believed that the coho in Devils Lake possess a unique and distinct genetic heritage warranting a "high" conservation value rating.* Response: No changes made. The CHART considered these comments along with recent population identification work (Lawson et al., 2007) and genetic analyses by Johnson and Banks (2007). The team maintained that the Devils Lake/Moolack Frontal watershed (which contains Devils Lake) was still of medium conservation value, noting that Devil's Lake coho are one of ten small and dependent populations in this watershed and appear to most closely related to coho in the nearby Siletz River. The team acknowledged that Devils Lake was the most productive of these ten populations but that the overall watershed did not warrant a high conservation value relative to other adjacent watersheds with more extensive habitat areas and functionally independent populations (e.g., the Siletz River and Yaquina River watersheds). Regardless, Devils Lake and all other habitat areas in this watershed are designated as critical habitat for Oregon Coast coho salmon.
NORTH UMPQUA	1710030106	Boulder Creek	Habitat areas in this watershed (originally proposed for exclusion) are no longer eligible for exclusion from designation due to economic impacts.

Subbasin	Watershed code	Watershed name	Summary of Comments and Changes
NORTH UMPQUA	1710030110	Rock Creek/North Umpqua River	*BLM comments noted coho distribution errors associated with four tributaries to Rock Creek.* Response: Added 1.8 miles (2.9 km) of occupied habitat areas in Miller Creek, Woodstock Creek, Conley Creek and an unnamed creek near Kelly Creek based on comments from the BLM and feedback from ODFW.
SOUTH UMPQUA	1710030202	Jackson Creek	The CHART elevated this HUC5's conservation value from Low to Medium due to recent TRT population and viability analyses (Lawson et al. 2007, Wainwright et al. 2007) that now identify four functionally independent populations and related biological recovery criteria in the Umpqua River basin. HUC5 no longer excluded from designation.
SOUTH UMPQUA	1710030204	Elk Creek/South Umpqua	The CHART elevated this HUC5's conservation value from Low to Medium due to recent TRT population and viability analyses (Lawson et al. 2007, Wainwright et al. 2007) that now identify four functionally independent populations and related biological recovery criteria in the Umpqua River basin. HUC5 no longer excluded from designation.
SOUTH UMPQUA	1710030205	South Umpqua River	*BLM comments noted coho distribution errors associated with two tributaries to the South Umpqua River.* Response: Removed 2 miles (3.2 km) of unoccupied stream reaches in Lavadoure Creek and East Fork Poole Creek based on comments from the BLM and feedback from ODFW.

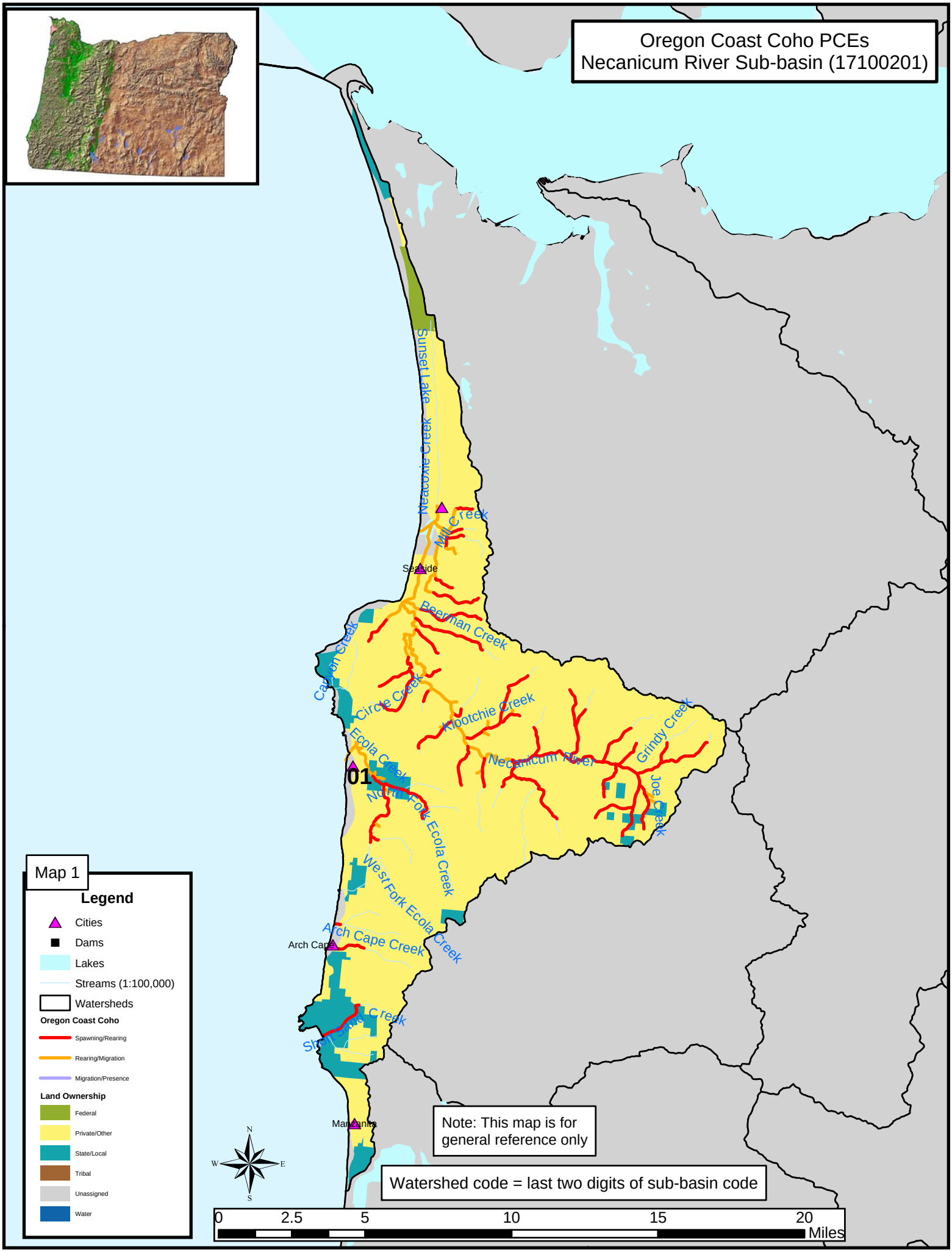
Subbasin	Watershed code	Watershed name	Summary of Comments and Changes
SOUTH UMPQUA	1710030207	Middle Cow Creek	The CHART elevated this HUC5's conservation value from Low to Medium due to recent TRT population and viability analyses (Lawson et al. 2007, Wainwright et al. 2007) that now identify four functionally independent populations and related biological recovery criteria in the Umpqua River basin.
SOUTH UMPQUA	1710030209	Lower Cow Creek	*BLM comments noted coho distribution errors associated with a tributary to Cow Creek.* Response: Removed 3 miles (4.8 km) of unoccupied stream reaches in Buck Creek based on comments from the BLM and feedback from ODFW.
SOUTH UMPQUA	1710030211	Myrtle Creek	The CHART elevated this HUC5's conservation value from Medium to High due to recent TRT population and viability analyses (Lawson et al. 2007, Wainwright et al. 2007) that now identify four functionally independent populations and related biological recovery criteria in the Umpqua River basin. HUC5 no longer excluded from designation.
UMPQUA	1710030301	Upper Umpqua River	*BLM comments noted coho distribution errors associated with two tributaries to the upper Umpqua River.* Response: Removed 2 miles (3.2 km) of unoccupied stream reaches in Bottle Creek and Porter Creek based on comments from the BLM and feedback from ODFW.

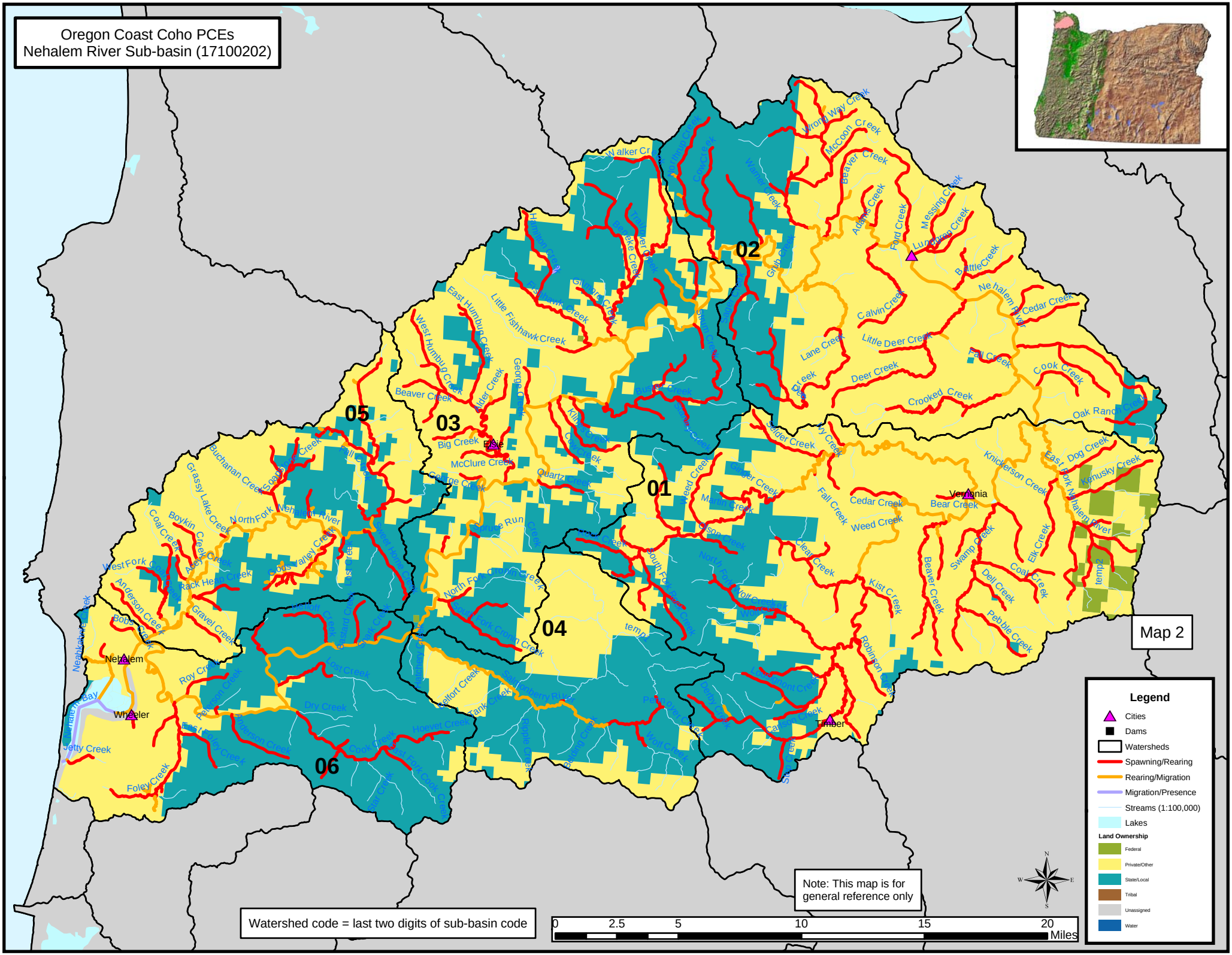
Subbasin	Watershed code	Watershed name	Summary of Comments and Changes
UMPQUA	1710030303	Elk Creek	*BLM comments noted coho distribution errors associated with a tributary to Elk Creek.* Response: Removed 1 mile (1.6 km) of unoccupied stream reaches in Brush Creek and Blue Hole Creek based on comments from the BLM and feedback from ODFW. Also, the CHART elevated this HUC5's conservation value from Medium to High due to recent TRT population and viability analyses (Lawson et al. 2007, Wainwright et al. 2007) that now identify four functionally independent populations and related biological recovery criteria in the Umpqua River basin. HUC5 no longer excluded from designation.
UMPQUA	1710030304	Middle Umpqua River	*BLM comments noted coho distribution errors associated with a tributary to the Umpqua River.* Response: Removed 1.5 miles (2.4 km) of unoccupied stream reaches in Mill Creek based on comments from the BLM and feedback from ODFW.
UMPQUA	1710030305	Lake Creek	*BLM comments noted coho distribution errors associated with the area near Otter Creek Falls.* Response: Removed 5.3 miles (8.5 km) of unoccupied stream reaches in Camp Creek based on comments from the BLM and feedback from ODFW.
COQUILLE	1710030504	East Fork Coquille	*BLM comments noted coho distribution errors associated with a tributary to the East Fork Coquille River.* Response: Removed 1.5 miles (2.4 km) of unoccupied stream reaches in Weekly Creek based on comments from the BLM and feedback from ODFW.

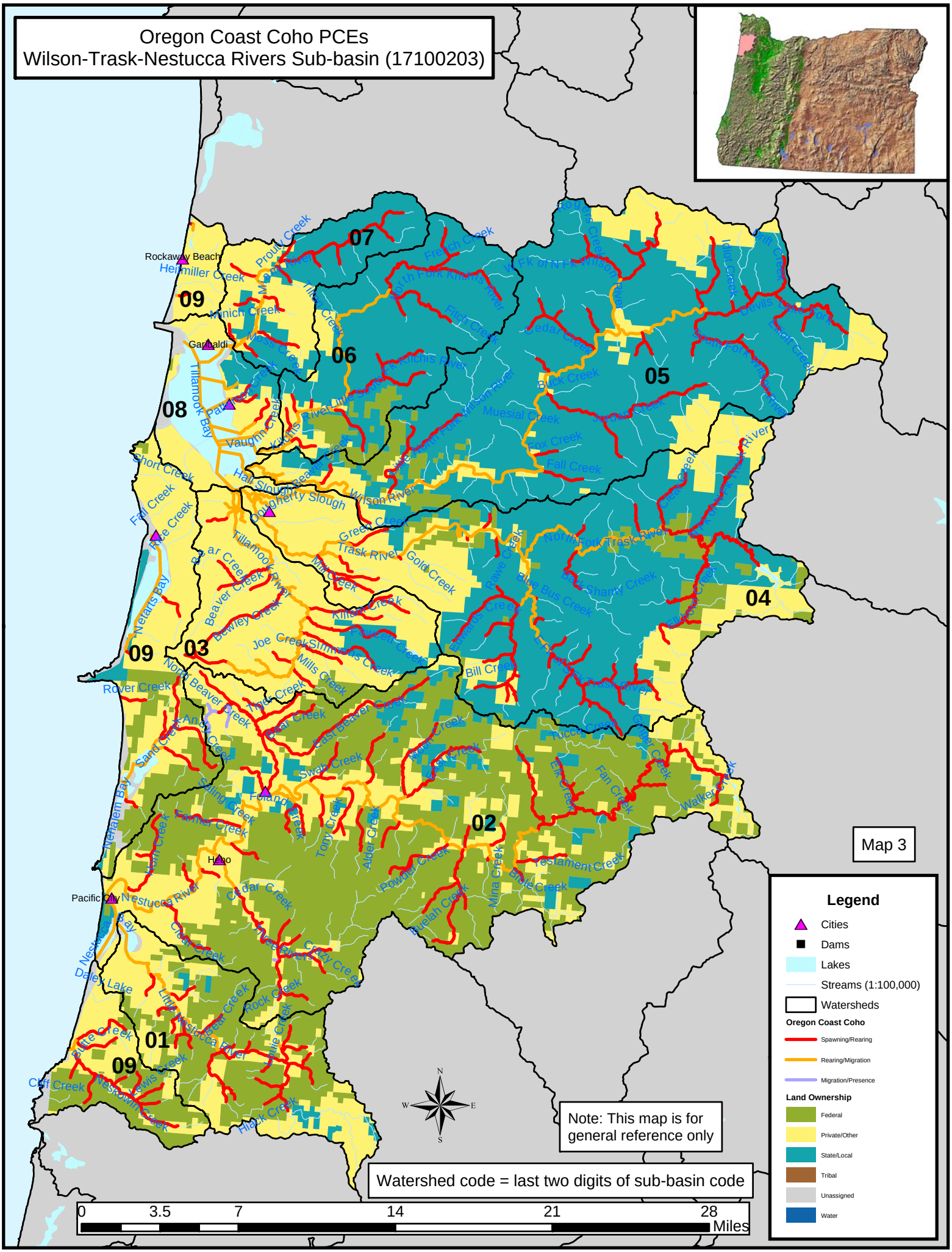
Figure 3. Final CHART Ratings of Conservation Value for Habitat Areas in HUC5 Watersheds Occupied by the Oregon Coast Coho Salmon ESU



Maps 1 through 13. Occupied Habitat Areas Considered for Critical Habitat Designation for the Oregon Coast Coho ESU


Oregon Coast Coho PCEs
Necanicum River Sub-basin (17100201)
Sunset Lake
Neacoxie Creek
Mill Creek
Seaside
Beerman Creek
Circle Creek
Ecola Creek
Klootchie Creek
Necanicum River
Grindy Creek
Joe Creek
01
North Fork Ecola Creek
West Fork Ecola Creek
Arch Cape Creek
Arch Cape
Shingle Creek
Manzanita
Map 1
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
Note: This map is for general reference only
Watershed code = last two digits of sub-basin code
N
S
E
W
0
2.5
5
10
15
20
Miles


Oregon Coast Coho PCEs
Nehalem River Sub-basin (17100202)
Map 2
01
02
03
04
05
06
Nehalem
Wheeler
Timber
Vernonia
Elsie
Legend
Cities
Dams
Watersheds
Spawning/Rearing
Rearing/Migration
Migration/Presence
Streams (1:100,000)
Lakes
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
Note: This map is for general reference only
Watershed code = last two digits of sub-basin code
0 2.5 5 10 15 20 Miles


Oregon Coast Coho PCEs
Wilson-Trask-Nestucca Rivers Sub-basin (17100203)
Map 3
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
Note: This map is for general reference only
Watershed code = last two digits of sub-basin code
0 3.5 7 14 21 28 Miles
N
S
E
W
Rockaway Beach
Garibaldi
Pacific City
Hebo
Tillamook Bay
Nestucca Bay
Netarts Bay
Nehalem Bay
Daley Lake
01
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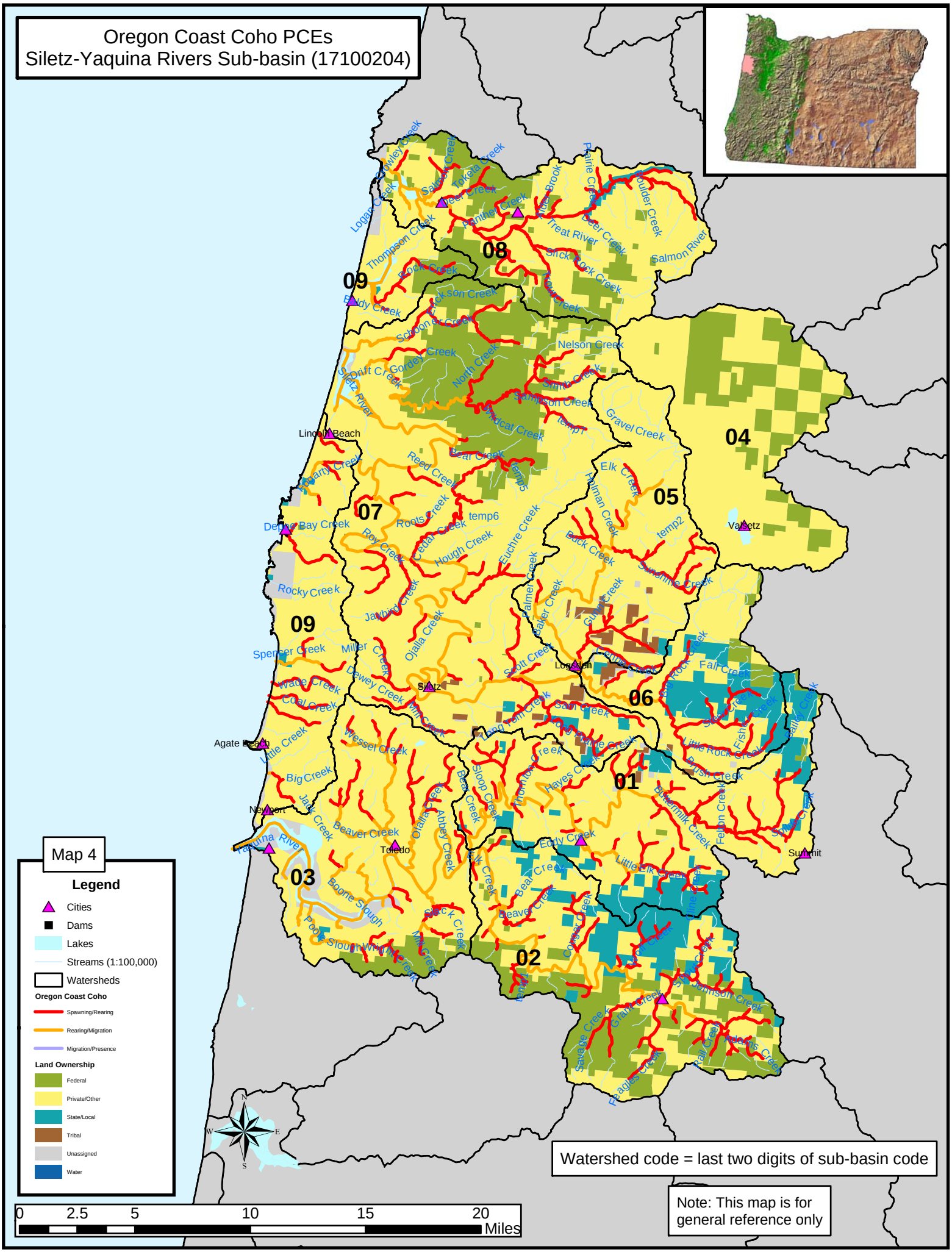
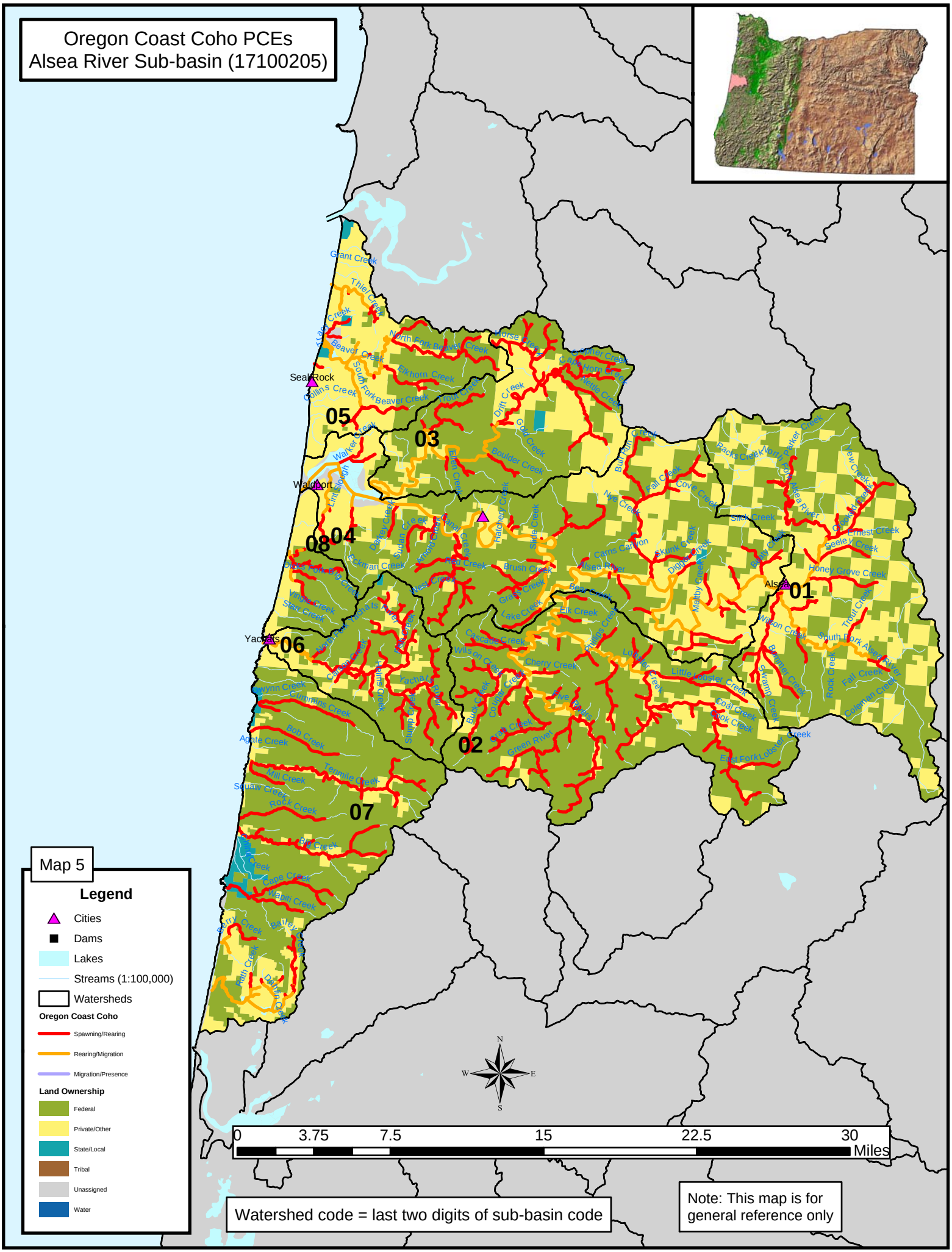
03
04
05
06
07
08
09
09
09


Oregon Coast Coho PCEs
Siletz-Yaquina Rivers Sub-basin (17100204)
Map 4
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
Watershed code = last two digits of sub-basin code
Note: This map is for general reference only
0 2.5 5 10 15 20 Miles
01
02
03
04
05
06
07
08
09
09
Lincoln Beach
Depoe Bay
Newport
Agate Beach
Toledo
Siletz
Logsden
Valsetz
Summit
Salmon River
Siletz River
Yaquina River
Nelson Creek
Gravel Creek
Elk Creek
Euchre Creek
Hough Creek
Roots Creek
Rocky Creek
Big Creek
Beaver Creek
Boone Slough
Fall Creek
Little Rock Creek
Little Elk Creek
Savage Creek
Johnson Creek
Beaver Creek
Eddy Creek
Sloop Creek
Bear Creek
Elk Creek
Abbey Creek
Wessel Creek
Jack Creek
Coal Creek
Wade Creek
Spencer Creek
Miller Creek
Dawley Creek
Jarbing Creek
Ojalla Creek
Scott Creek
Palmer Creek
Walker Creek
Gulnare Creek
Buck Creek
Sunshine Creek
Pulman Creek
Temp1
Temp2
Temp5
Temp6
Bear Creek
Reed Creek
Roy Creek
Cedar Creek
North Creek
Thompson Creek
Cooper Creek
Schooner Creek
Gorden Creek
Drift Creek
Bayley Creek
Logan Creek
Toketa Creek
Panther Creek
Prairie Creek
Boulder Creek
Treat River
Slick Rock Creek
Tony Creek
Smith Creek
Johnson Creek
Critical Creek
Rocky Creek
Fish Creek
Bushmilk Creek
Felton Creek
Little Rock Creek
Marsh Creek
Hayes Creek
Thornton Creek
Long Tom Creek
Sam Creek
Little Creek
Big Creek
Jack Creek
Beaver Creek
Boone Slough
Prosper Slough
Wright Creek
Mill Creek
Black Creek
Gorman Creek
Beaver Creek
Savage Creek
Johnson Creek
Eagles Creek
Bear Creek
Roberts Creek
N
S
E
W


Oregon Coast Coho PCEs
Alsea River Sub-basin (17100205)
Map 5
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
Seal Rock
Waldport
Yachats
Alsea
01
02
03
04
05
06
07
08
N
S
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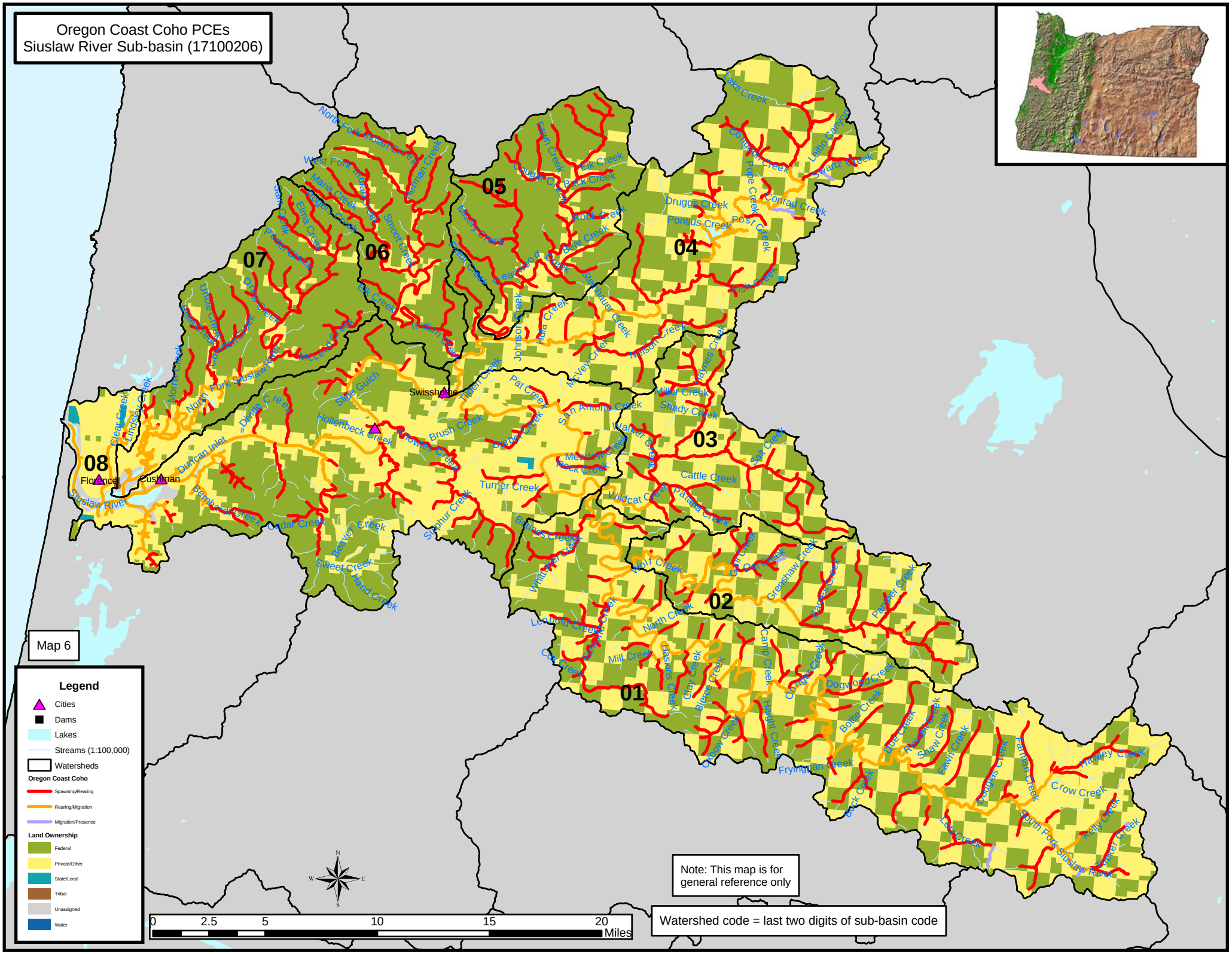
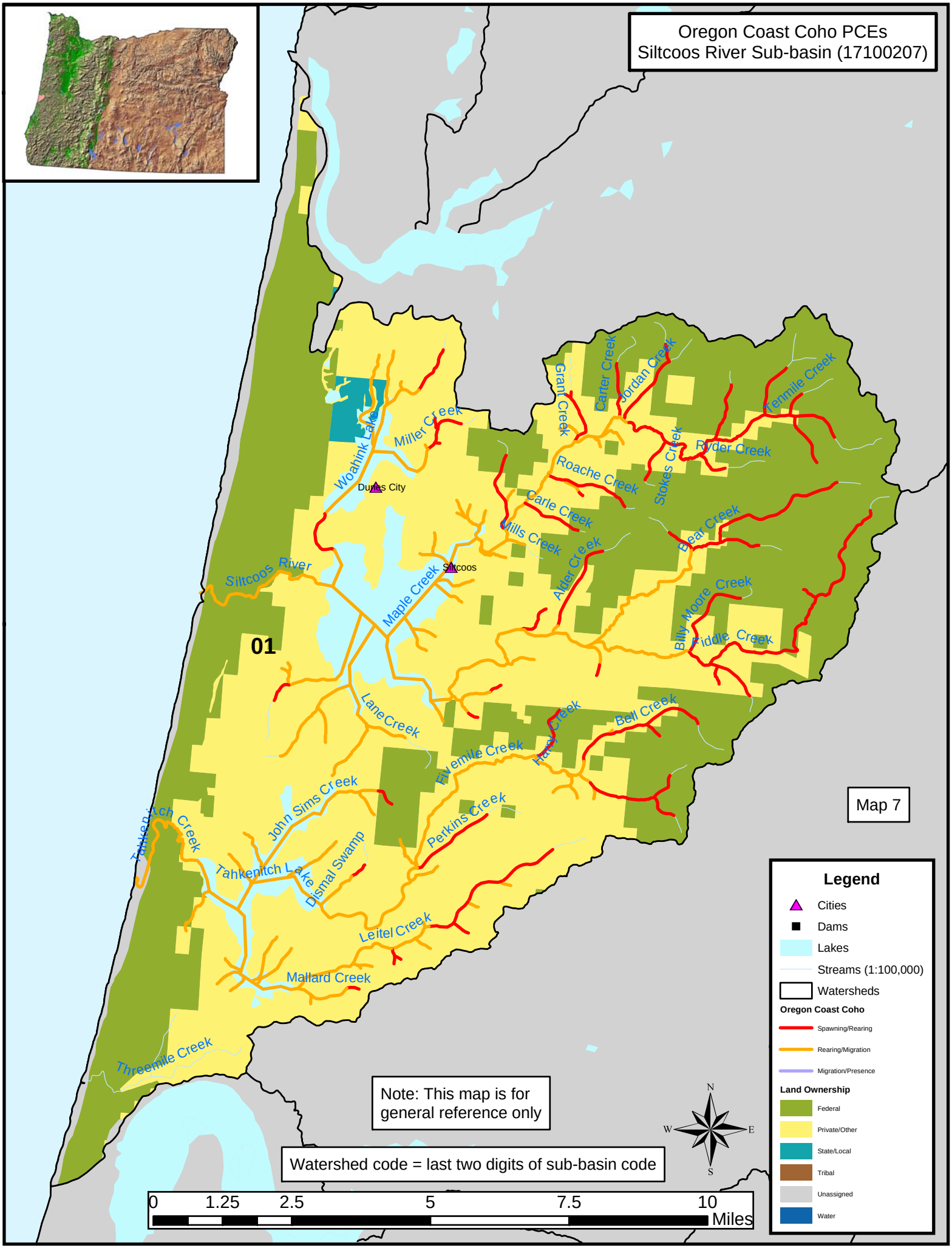
W
0
3.75
7.5
15
22.5
30
Miles
Watershed code = last two digits of sub-basin code
Note: This map is for general reference only


Oregon Coast Coho PCEs
Siuslaw River Sub-basin (17100206)
Map 6
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
01
02
03
04
05
06
07
08
Swisshome
Florence
Cushman
Siuslaw River
Note: This map is for general reference only
Watershed code = last two digits of sub-basin code
0 2.5 5 10 15 20 Miles


Oregon Coast Coho PCEs
Siltcoos River Sub-basin (17100207)
Map 7
01
Dunes City
Siltcoos
Woahink Lake
Miller Creek
Siltcoos River
Maple Creek
Lane Creek
John Sims Creek
Tahkenitch Creek
Tahkenitch Lake
Dismal Swamp
Threemile Creek
Mallard Creek
Leitel Creek
Perkins Creek
Fivemile Creek
Hare Creek
Bell Creek
Billy Moore Creek
Fiddle Creek
Bear Creek
Alder Creek
Mills Creek
Carle Creek
Roache Creek
Grant Creek
Carter Creek
Jordan Creek
Stokes Creek
Ryder Creek
Tenmile Creek
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
Note: This map is for general reference only
Watershed code = last two digits of sub-basin code
N
W
E
S
0
1.25
2.5
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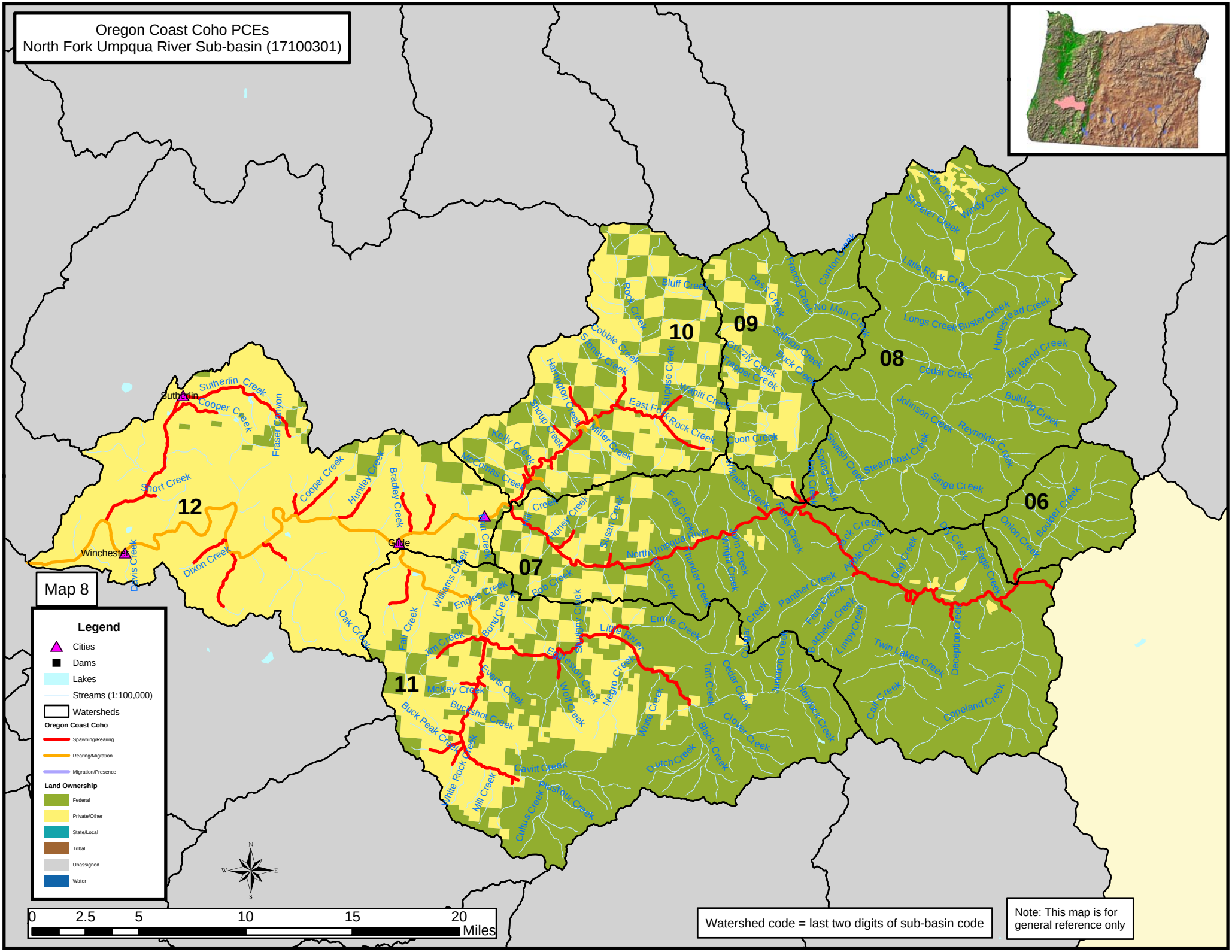
Miles


Oregon Coast Coho PCEs
North Fork Umpqua River Sub-basin (17100301)
Map 8
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
0 2.5 5 10 15 20 Miles
Watershed code = last two digits of sub-basin code
Note: This map is for general reference only
12
11
10
09
08
07
06
Sutherlin
Winchester
Glide
Sutherlin Creek
Cooper Creek
Fraser Canyon
Short Creek
Davis Creek
Dixon Creek
Huntley Creek
Bradley Creek
Oak Creek
Fall Creek
Williams Creek
Engles Creek
Bond Creek
McKay Creek
Buckshot Creek
Buck Peak Creek
White Rock Creek
Mill Creek
Cavitt Creek
Cultus Creek
Fivemile Creek
Wolf Creek
Negro Creek
Little River
Emile Creek
Dutch Creek
White Creek
Black Creek
Tait Creek
Cedar Creek
Clover Creek
Hancock Creek
Hemlock Creek
Panther Creek
Twin Creek
Lindsay Creek
Twin Lakes Creek
Oak Creek
Copeland Creek
Deception Creek
Dog Creek
Apple Creek
Rock Creek
Elgin Creek
Onion Creek
Boulder Creek
Steamboat Creek
Singe Creek
Reynolds Creek
Johnson Creek
Bulldog Creek
Big Bend Creek
Homestead Creek
Buster Creek
Longs Creek
Cedar Creek
Little Rock Creek
Fraser Creek
Lindy Creek
Canton Creek
No Man Creek
Pass Creek
Salmon Creek
Buck Creek
Grizzly Creek
Trapper Creek
Coon Creek
Wapiti Creek
Sardine Creek
East Fork Rock Creek
Bluff Creek
Rock Creek
Cobble Creek
Sidney Creek
Hardington Creek
Shoup Creek
Miller Creek
Kelly Creek
McComas Creek
Mill Creek
Honey Creek
Susan Creek
North Umpqua River
Fall Creek
Thunder Creek
Fox Creek
Williams Creek
Spring Creek
Swash Creek
Fisher Creek
Mill Creek
Bob Creek
Susan Creek
Williams Creek
Emile Creek
Little River
Negro Creek
Wolf Creek
Fivemile Creek
Cultus Creek
Cavitt Creek
Mill Creek
White Rock Creek
Buck Peak Creek
Buckshot Creek
McKay Creek
Evans Creek
Fall Creek
Williams Creek
Engles Creek
Bond Creek
Oak Creek
Dixon Creek
Davis Creek
Short Creek
Cooper Creek
Sutherlin Creek
Fraser Canyon
Huntley Creek
Bradley Creek
Cavitt Creek
Fivemile Creek
Cultus Creek
Dutch Creek
White Creek
Black Creek
Tait Creek
Cedar Creek
Clover Creek
Hancock Creek
Hemlock Creek
Panther Creek
Twin Creek
Lindsay Creek
Twin Lakes Creek
Oak Creek
Copeland Creek
Deception Creek
Dog Creek
Apple Creek
Rock Creek
Elgin Creek
Onion Creek
Boulder Creek
Steamboat Creek
Singe Creek
Reynolds Creek
Johnson Creek
Bulldog Creek
Big Bend Creek
Homestead Creek
Buster Creek
Longs Creek
Cedar Creek
Little Rock Creek
Fraser Creek
Lindy Creek
Canton Creek
No Man Creek
Pass Creek
Salmon Creek
Buck Creek
Grizzly Creek
Trapper Creek
Coon Creek
Wapiti Creek
Sardine Creek
East Fork Rock Creek
Bluff Creek
Rock Creek
Cobble Creek
Sidney Creek
Hardington Creek
Shoup Creek
Miller Creek
Kelly Creek
McComas Creek
Mill Creek
Honey Creek
Susan Creek
North Umpqua River
Fall Creek
Thunder Creek
Fox Creek
Williams Creek
Spring Creek
Swash Creek
Fisher Creek
Mill Creek
Bob Creek
Susan Creek
Williams Creek
Emile Creek
Little River
Negro Creek
Wolf Creek
Fivemile Creek
Cultus Creek
Cavitt Creek
Mill Creek
White Rock Creek
Buck Peak Creek
Buckshot Creek
McKay Creek
Evans Creek
Fall Creek
Williams Creek
Engles Creek
Bond Creek
Oak Creek
Dixon Creek
Davis Creek
Short Creek
Cooper Creek
Sutherlin Creek
Fraser Canyon
Huntley Creek
Bradley Creek
Sutherlin
Winchester
Glide
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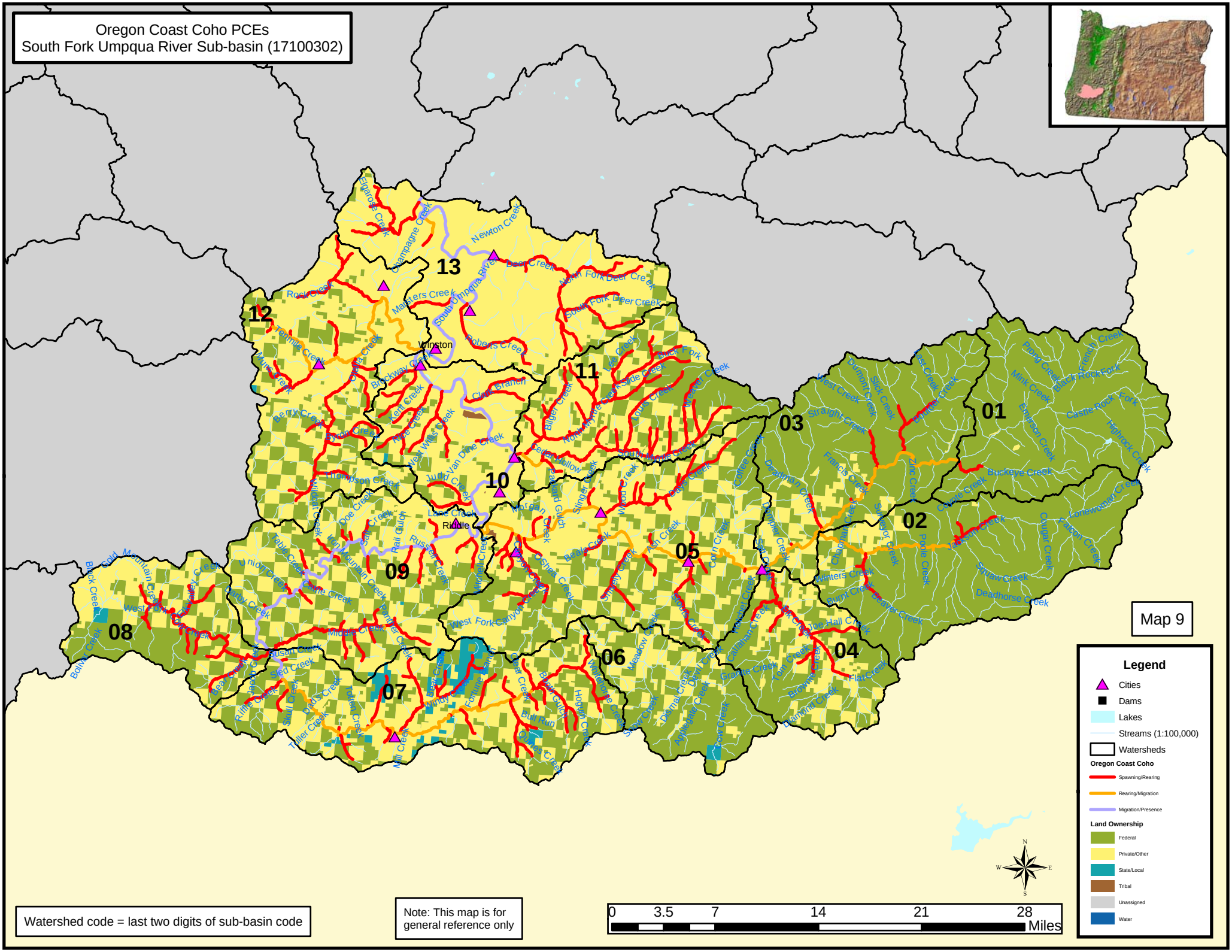
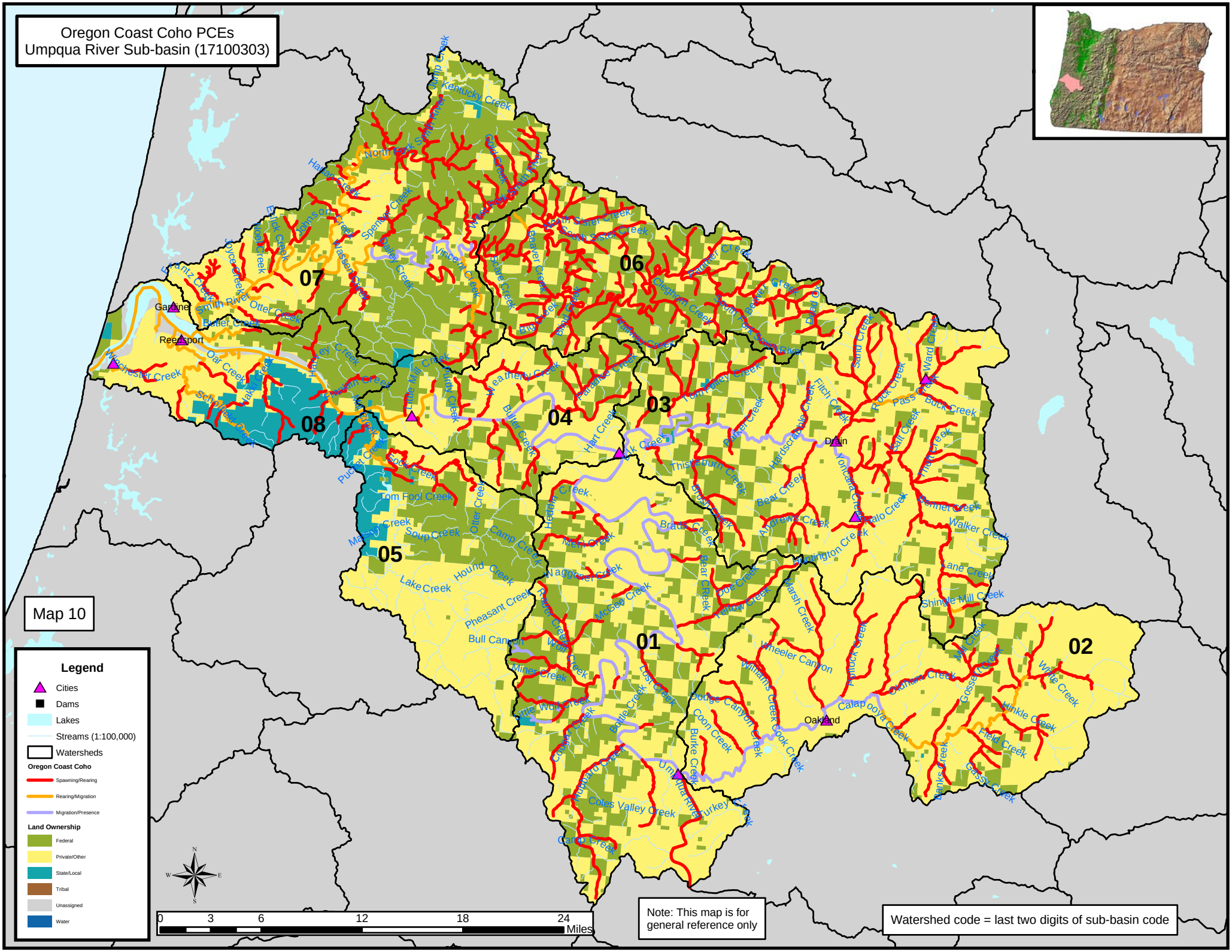
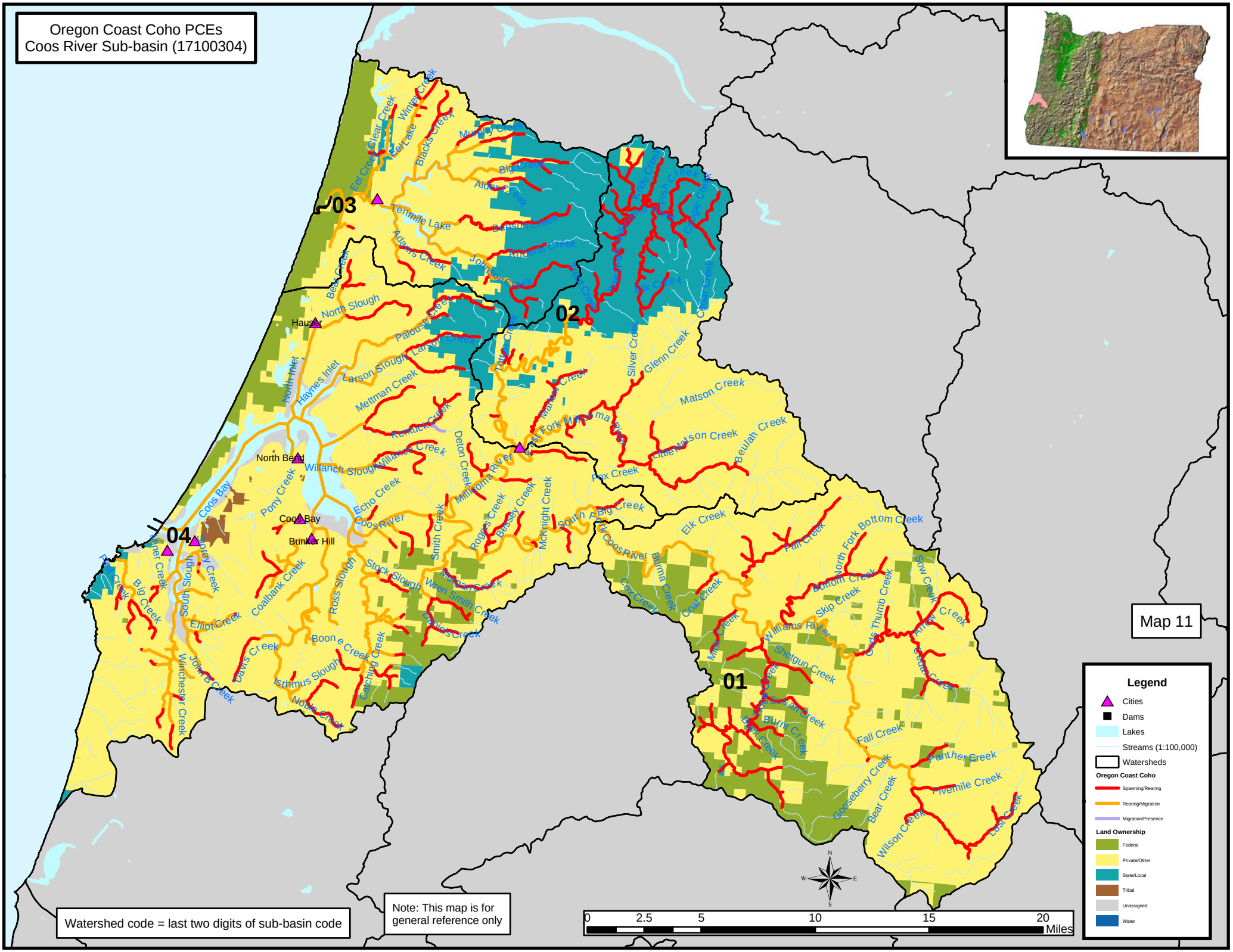
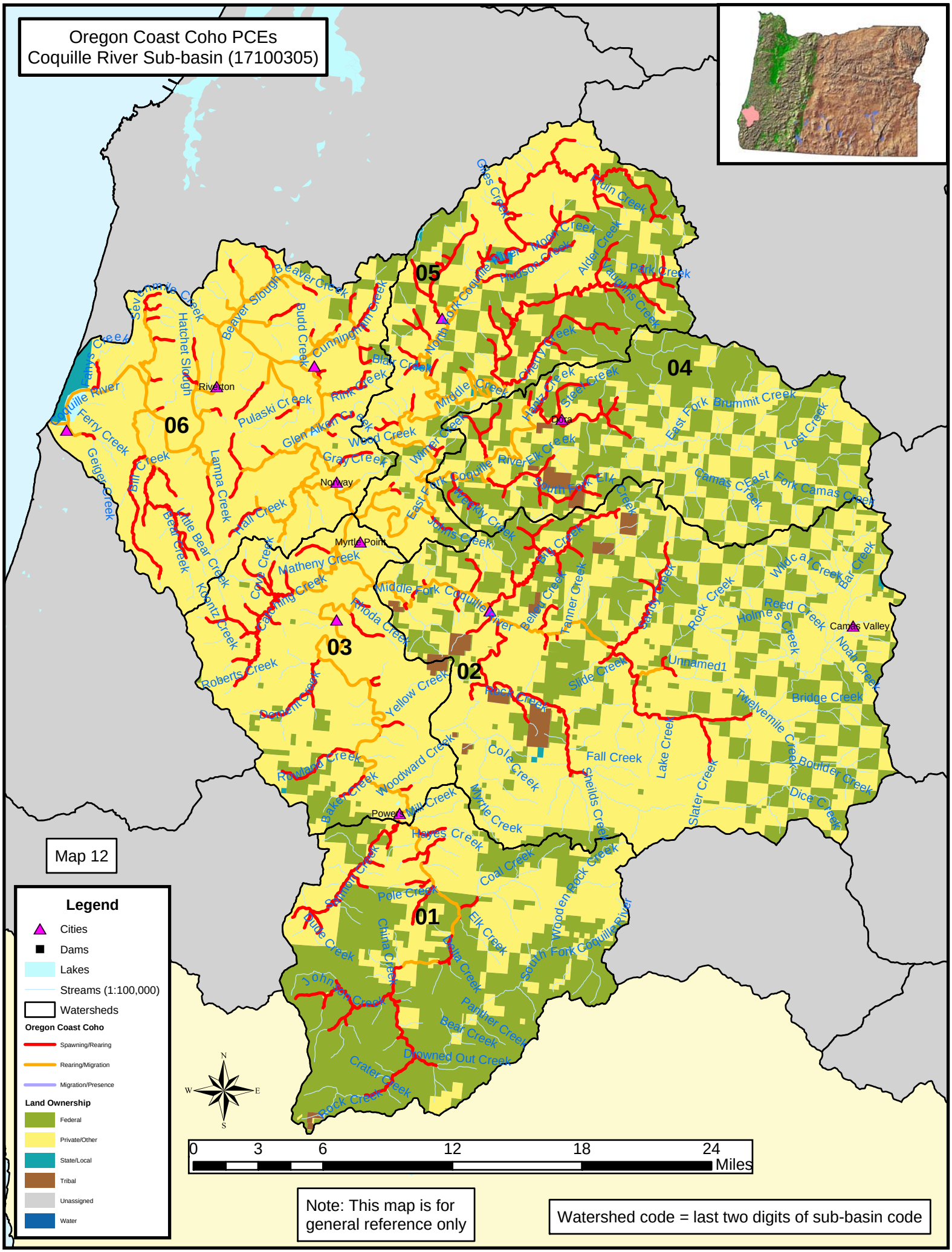
E
W


Oregon Coast Coho PCEs
South Fork Umpqua River Sub-basin (17100302)
Map 9
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
Watershed code = last two digits of sub-basin code
Note: This map is for general reference only
0 3.5 7 14 21 28 Miles
N
S
E
W
Winston
Riddle
01
02
03
04
05
06
07
08
09
10
11
12
13


Oregon Coast Coho PCEs
Umpqua River Sub-basin (17100303)
Map 10
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
0 3 6 12 18 24 Miles
Note: This map is for general reference only
Watershed code = last two digits of sub-basin code
01
02
03
04
05
06
07
08
Gardiner
Reedsport
Drain
Oakland

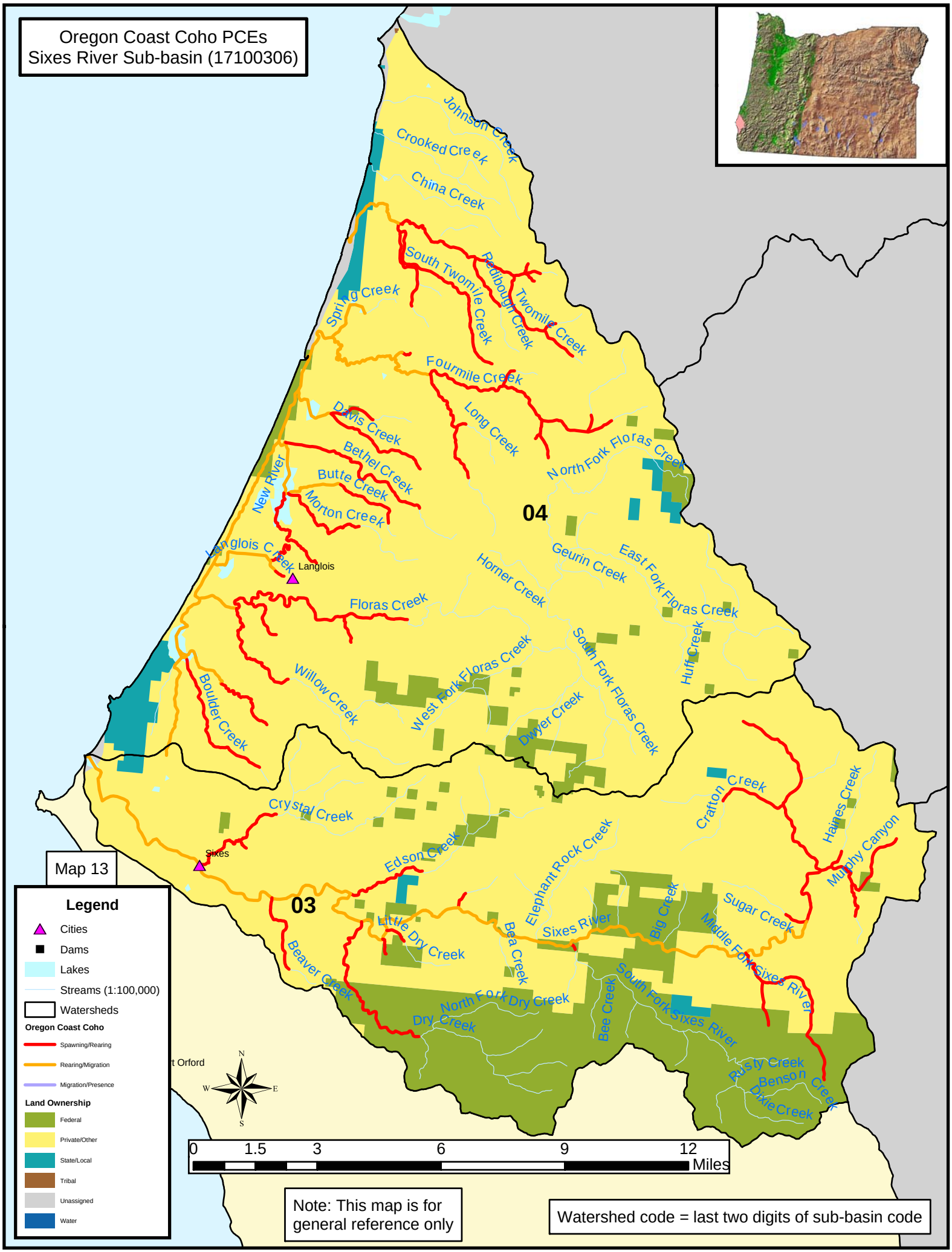

Oregon Coast Coho PCEs
Coos River Sub-basin (17100304)
03
02
01
04
Hauser
North Bend
Coos Bay
Bunker Hill
Temmile Lake
Eel Creek
Clear Creek
Eel Lake
Winter Creek
Blacks Creek
Big Creek
Alder Creek
Beaver Creek
Adams Creek
John Creek
Bear Creek
North Slough
Paloux Creek
Larson Slough
Largy Creek
Mettman Creek
Haynes Inlet
North Inlet
Kentuck Creek
Willanch Creek
Willanch Slough
Detton Creek
Millicoma River
East Fork Millicoma River
Silver Creek
Glenn Creek
Cedar Creek
Matson Creek
Little Matson Creek
Beulah Creek
Fox Creek
Echo Creek
Coos River
Pony Creek
Coos Bay
Smith Creek
Rogers Creek
Bessey Creek
Mcknight Creek
South Fork Big Creek
Elk Creek
Fall Creek
North Fork Bottom Creek
Bottom Creek
Skip Creek
Cecils Thumb Creek
Slow Creek
Andy Creek
Cedar Creek
Stock Slough
Wren Smith Creek
Ross Slough
Coalbank Creek
Elliot Creek
Big Creek
Winter Creek
Joe Ben Creek
Davis Creek
Isthmus Slough
Noble Creek
Boon a Creek
Catching Creek
Winchester Creek
John B Creek
Burma Creek
Cox Creek
Cow Creek
Mill Creek
Williams River
Shotgun Creek
Burnt Creek
Fall Creek
Panther Creek
Fivemile Creek
Gooseberry Creek
Bear Creek
Wilson Creek
Lost Creek
Map 11
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
Watershed code = last two digits of sub-basin code
Note: This map is for general reference only
0 2.5 5 10 15 20 Miles
N
S
E
W



Map 12

Note: This map is for general reference only

Watershed code = last two digits of sub-basin code


Oregon Coast Coho PCEs
Sixes River Sub-basin (17100306)
Johnson Creek
Crooked Creek
China Creek
South Twomile Creek
Redbough Creek
Twomile Creek
Spring Creek
Fourmile Creek
Long Creek
Davis Creek
Bethel Creek
Butte Creek
Morton Creek
New River
North Fork Floras Creek
04
Langlois Creek
Langlois
Geurin Creek
East Fork Floras Creek
Horner Creek
Floras Creek
South Fork Floras Creek
Huff Creek
West Fork Floras Creek
Willow Creek
Boulder Creek
Dwyer Creek
Crystal Creek
Crafton Creek
Haines Creek
Sixes
Edson Creek
Elephant Rock Creek
Murphy Canyon
03
Sugar Creek
Little Dry Creek
Sixes River
Big Creek
Bea Creek
Middle Fork Sixes River
Beaver Creek
North Fork Dry Creek
Dry Creek
Bee Creek
South Fork Sixes River
Rusty Creek
Benson Creek
Dixie Creek
Map 13
Legend
Cities
Dams
Lakes
Streams (1:100,000)
Watersheds
Oregon Coast Coho
Spawning/Rearing
Rearing/Migration
Migration/Presence
Land Ownership
Federal
Private/Other
State/Local
Tribal
Unassigned
Water
N
W
E
S
0
1.5
3
6
9
12
Miles
Note: This map is for general reference only
Watershed code = last two digits of sub-basin code

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4. APPENDIX A: DESCRIPTION OF THE DECISION SUPPORT SYSTEM (DSS) USED BY THE OREGON COAST CHART

Introduction

During the development of a critical habitat designation for the Oregon Coast coho salmon ESU the CHART was asked by policy makers to develop criteria for evaluating and rating the conservation value of HUC5 watersheds within the ESU's range. The usual approach to developing such criteria has been to combine modeled goals with expert opinion assessments of the status of populations and their habitats in relation to these goals. This development process can be difficult to document and apply consistently over many populations. The CHART chose to use a combination of aids to assist in this development, including data analysis, computer models, and expert opinion integrated onto a decision support system (DSS). The DSS assists in ensuring that expert opinion will be well documented, repeatable, and transparent. Results from the DSS can provide guidance to policy makers in evaluating which areas warrant designation or exclusion as critical habitat under the ESA. This appendix provides an overview of DSS development for this effort and key sources of information used by the CHART.

Software Packages

Four software packages were used in developing the DSS: ArcGIS 8.3 from Environmental Systems Research Institute, Inc., Access 2002 from Microsoft, Netweaver Developer 16.2.3 from Rules of Thumb, Inc., and Ecosystem Management Decision Support 3.0.2 (EMDS) from the U.S. Forest Service. ArcGIS is a Geographical Information Systems (GIS) software suite providing the ability to analyze and manage spatial data. Access is a relational database management system used for tabular data management and analysis. Netweaver is a fuzzy logic-based development system used for building the logical structure of the DSS. EMDS integrates the logic structure from Netweaver into the ArcGIS environment and evaluates GIS data via the DSS.

Data Analyzed

The DSS evaluated data on the extent of coho distribution, spawner escapement, stream habitat conditions, and geomorphic suitability. CHART members collaborated to develop methods of aggregating each dataset fifth-field watersheds. The team designed the aggregation functions to highlight differences and relationships between watersheds. This allowed the results to be consistent with the intent of the DSS to inform the team's recommendations. Coho distribution is available from the Oregon Department of Fish and Wildlife as a vector digital

dataset. ODFW developed this dataset with the assistance of their district biologists throughout the state. It is digitized on the Pacific Northwest Reach File 1:100,000 scale stream network managed by Streamnet (2005), and includes information on how coho are known, or believed, to be using the areas of distribution. The DSS evaluates the proportion of digitized streams being used by coho salmon as an indicator of how widely distributed coho salmon are throughout each watershed. Coho spawner survey data is also available from ODFW. The DSS incorporates random coho spawn survey data from 1990 through 2002. When the CHART chose to include this data, they designed the DSS to highlight the differences between those watersheds that were consistently more productive than others. To do so, the DSS evaluates how the average annual spawner density of each watershed compares to the rest of the ESU within each year.

Aquatic habitat support for various life history stages is evaluated in the DSS with stream survey data provided by ODFW and USFS. The DSS evaluated support for spawning, winter rearing, and summer rearing by applying fuzzy logic curves to several measured parameters. These included average density of large woody debris, average residual pool depth, and availability of spawning gravel.

The CLAMS project at Oregon State University's Forestry Science Laboratory provided a measure of geomorphic suitability for supporting coho salmon in their Intrinsic Potential (IP) dataset for the Oregon Coast. IP is a computer-modeled expression of the suitability of the gradient, confinement, and flow characteristics of stream reaches for the rearing and migration of coho salmon. The CHART developed an IP index that expresses the relative amount and suitability of habitat in each watershed, as expressed by the IP dataset. This dataset serves both as an indicator of potential of areas to support the restoration of coho salmon populations and an indicator of the potential availability of habitat components in non-surveyed areas of each watershed.

Decision Support System Structure

The DSS uses a network of data nodes and operators to evaluate each watershed, resulting in a final score that reflects the various inputs. It consists of three major evaluation networks: biological features, habitat rating, and restoration potential (Figure 1). The three networks are combined with an AND operator, with the biological features network assigned twice the weight of the other networks. After the AND operator is applied, the system checks for coho use in each watershed, assigning a final truth value of -1 to watersheds outside the coho distribution.

The CHART chose to assign additional weight to the biological features network because they felt the fish were the most important indicator of which areas are essential to the ESU's survival. This additional weight is not enough to cause the biological features to override the other network results in all cases, but does reflect the expert decision making process.

Biological Features Network

The Biological Features topic of the Oregon Coast CHART knowledge base was intended to evaluate how well each watershed satisfies the condition that it contains biological features that require special management considerations. This evaluation considers habitat utilization, productivity, and the presence of unique population characteristics. Utilization and productivity are expressed as truth values, derived with a fuzzy logic curve, and aggregated with an AND operator. The output of this AND operator is compared to the truth value of the uniqueness component with an OR operator (Figure 2).

Utilization

Utilization is expressed as the proportion of stream length in the watershed that is identified as having current coho salmon use. The source data for stream length is the 1:100,000 scale PNW Reach File maintained by Streamnet (reference i). The source data for the coho distribution is the Oregon Department of Fish and Wildlife's 1:100,000 scale coho distribution layer version 11 (reference ii). We calculated the proportion of utilization by summing the total length of current, nondisputed coho distribution features (using the spawning & rearing and rearing & migration use types) in each watershed and dividing the result by the total length of Streamnet stream features.

The coho distribution features are a subset of the Streamnet stream features, allowing direct calculation of the proportion of stream length being used by coho. The 1:100,000 scale Streamnet streams layer is a wide-area coverage that should have consistent density across the area of interest. Watershed utilization proportions range from 0.0 (watersheds with no documented coho use) to over 0.9 (Figure 3). We inserted these data into the knowledge base input layer and built a use proportion curve with a truth value of -1 at 0.0 and truth value of 1 at utilization of 1.0 (Figure 4). There are clear spatial patterns of utilization proportion, with concentrations in the Nehalem, Siuslaw, Lower Umpqua, and Coos River basins (Figure 5).

Productivity

The model evaluates productivity based on a spawner density index that indicates areas with consistently higher than average spawner abundance, as measured by ODFW's random spawn surveys (reference iii). We calculated spawner density for each spawn survey by dividing the area under the curve (AUC) by the total survey length. We averaged the resulting AUC per mile (weighted by survey length) for each watershed within each spawning year. We then computed the average AUC per mile and standard deviation for the entire ESU within each year (based on the watershed averages). Within each spawning year, we calculated the standard deviations from the ESU mean for each watershed. Finally, we averaged the standard deviations

for each ESU across all spawning years. The result of these calculations provided an indicator of which watersheds were consistently above or below the average spawner density, while compensating for year-to-year differences in return size. Clear spatial patterns emerged from spawning concentration index calculation (Figure 6). The mid-south coast area, particularly the lake systems, showed consistent and considerable densities greater than the ESU mean. The consistently highly productive systems also strongly influence the index distribution (Figure 7). Most watersheds tend to be somewhat below the ESU mean, but not substantially. We assigned a truth value to each watershed according to the curve shown in Figure 8, with the system assigning false (-1) at an IP index of -0.5 or lower and true (1) at an IP index of 0.5 or higher.

Intrinsic Potential

Intrinsic potential (IP) is a computer-modeled evaluation of the potential for the physical landscape to support populations of coho salmon. IP is expressed for each evaluated stream reach as a score between 0 and 1, indicating no potential for support to full potential, respectively. Each reach also has length and width data. Reaches with gradient above 7 percent are considered outside the range of potential for coho use, as are those reaches above 7 percent or greater gradient reaches and natural barriers. Coverage for the entire Oregon Coast ESU was provided by the Coastal Landscape Analysis and Modeling Study (CLAMS) (reference iv).

Intrinsic potential is an indicator of freshwater habitat only. Estuaries are not modeled in the calculation of the underlying streams, so must be considered separately. The major lake systems are assigned an IP of either 1 or 0 (reference v), and area calculated from a separate ArcInfo coverage (reference vi). Reaches with IP assigned do account for historically impassable, natural barriers to coho salmon. Dams and other human-induced blockages are not considered, nor are fishways that provide access to historically unavailable habitat reflected by the IP model (reference vii). The IP index of each watershed in this system is calculated by multiplying the IP value of each reach in the watershed by its area, then taking the sum of all reaches in the watershed and dividing by watershed area. The resulting index indicates the relative abundance of high quality reaches in each watershed while controlling for watershed size, resulting in the spatial distribution seen in Figure 9. One drawback to this index is the absence of estuarine areas from the IP dataset, leading to artificially depressed scores for the small, coastal watersheds that are dominated by estuaries. The Tillamook Bay watershed is an one such watershed.

Overall, the IP index values for all watersheds are distributed as shown in (Figure 10). We assigned a truth value to each watershed according to the curve shown in Figure 11, with the system assigning false (-1) at an IP index of 0 and true (1) at an IP index of approximately 0.01. These truth values reflect the high variability of IP of stream reaches distributed across the ESU.

Habitat Rating

Habitat rating is expressed as a truth value for the proposition that the streams in a watershed, on average, contain high levels of desirable habitat components relative to other watersheds in the ESU. Rather than directly evaluating the habitat conditions in each watershed against a set of benchmarks, this rating evaluates where each watershed ranks in the distribution of all watersheds for each habitat component. This avoids inappropriate application of reach-level benchmarks to watershed average conditions. It also allows the system to express a wide range of values that reflect the current conditions of habitat available to coho in the ESU.

The habitat rating truth value is the result of an AND operation on the truth values of three habitat rating networks: spawning habitat, summer rearing habitat, and winter rearing habitat. Each network uses area-weighted averages of stream habitat parameters from the habitat inventories for each watershed.

We used ODFW's basin-wide aquatic habitat inventories for watersheds in the ESU from 1990 through 2002 (reference viii). As needed, we supplemented this data with USFS level 2 stream survey data from the Siuslaw, Siskiyou, and Umpqua National Forest (reference ix). Differences in the ODFW and USFS survey protocols, particularly in the evaluation and tabulation of large woody debris, require different evaluation criteria for each agency's stream survey data. The Habitat Rating network is designed to evaluate which agency had more data available (Figure 12) and choose the appropriate network (Figure 13). Of the 82 watersheds in the ESU, 10 had more USFS data than ODFW, and 4 had no survey data available (Figure 14).

Gradient Index

The gradient index is an expression of the relative availability of stream reaches with a gradient appropriate for spawning and winter rearing. We calculate the gradient index from the modeled streams used for the calculation of the intrinsic potential values. For each watershed, we find the total length of all reaches with a mean gradient between 1 and 3 percent, then divide by watershed area. The resulting gradient index is nearly normally distributed, as seen in Figure 15. The curve for assigning truth values to the gradient index, shown in Figure 16, will return a false (-1) value at 0 and true (1) at about 0.00058. Figure 17 shows the spatial distribution of gradient index values.

Spawning Habitat

The Spawning Habitat topic receives a truth value from the AND operator combining truth values from the average percentage of gravel in riffles and the gradient index (Figure 18). Gravel is defined as particles between 2 and 64 mm in diameter in both ODFW (reference x) and USFS (reference xi) data, and we considered only the percentage of the substrate in riffles which was composed of gravel. Figure 19 shows the distribution of gravel in riffles, with a mean

around 38 percent. Gravel is given a truth value based on the curve in Figure 20, and the gradient index is given the value based on the curve in Figure 16. The final truth values for spawning habitat (for ODFW data only) are shown on the map in Figure 21.

Summer Habitat

The Summer Habitat topic receives a truth value from the AND operator combining truth values from the average residual pool depth and the number of pieces of large woody debris (LWD) per 100 meters of stream surveyed (Figure 22). Each is given a truth value based on a curve with a score of 0 evaluating to false (-1) and the maximum value for that parameter (among all watersheds) evaluating to true (1). The CHART selected LWD per 100 meters as an analytical component because of the cumulative impact of all LWD, regardless of size, on the availability of summer rearing habitat. The ODFW survey data includes all LWD with a diameter of 15 cm or greater and length of 3 m or more (reference viii). USFS survey data (for forests west of the High Cascades) only includes LWD greater than 12 inches (30.5 cm) in diameter and 25 ft (7.6 m) long (reference ix). Using the ODFW survey dataset, watersheds average around 11 pieces per 100 meters (Figure 23). The curve for LWD, shown in Figure 24, will return false (-1) at 0 pieces per 100 m and return true (1) at about 30.14 pieces per 100 m. Average residual pool depth averages 0.7 m across all watersheds and is distributed as shown in Figure 25. The curve for residual pool depth will return false (-1) at 0.3 m (the minimum measured) and return true (1) at 1.7 m, as shown in Figure 26.

The final truth values from the ODFW summer habitat network are displayed in Figure 27. All watersheds scored below zero, indicating only poor to moderate support for the presence of both high LWD and residual pool depth. A few watersheds have accumulations of both parameters and received truth values as high as -0.069.

Winter Habitat

The Winter Habitat topic receives a truth value from an AND operator combining truth values from the gradient index with an OR operator combining the average number of key pieces of large woody debris per 100 meters of stream surveyed, and average percentage of reach area that is in sheltered pools (Figure 28). The gradient index is given the value based on the curve in Figure 15.

This network uses an OR operator to pass the higher truth value from evaluating the number of pieces of key LWD per 100 m and the percent of stream area in sheltered pools. The CHART believed these two factors provide similar functions in winter survival and should be evaluated based on which is more prevalent.

The CHART selected key pieces of LWD per 100 m for evaluation as winter habitat because of the strong relationship between very large LWD and appropriate winter rearing for

juvenile coho. ODFW's key pieces of LWD measure is roughly equivalent to the USFS medium and large LWD measures combined, with minimum sizes of 0.6 m diameter and 10 m long versus 24 inches (0.61 m) diameter and 35 ft. (10.7 m) long, respectively. Most watersheds contain few key pieces of large wood, as indicated in Figure 29. The truth value for key pieces of wood is assigned based on the curve shown in Figure 30, with false (-1) at 0 pieces per 100 m and true (1) at 1.72 pieces per 100 m.

Sheltered pools are defined as backwaters, eddies, isolated pools, alcoves, beaver dams, and pools on secondary channels. The average percentage of surveyed stream area in sheltered pools for each watershed varies from 0 to 58 percent, shown in Figure 31. The result for each watershed is given a truth value based on the curve shown in Figure 32, returning false (-1) at 0 percent and true (1) at 58 percent.

The resulting truth values, shown on the map in Figure 33, are mostly below zero. The lowest truth value is -0.995 and the highest is 0.864. Sixty-two of the sixty-nine watersheds received a winter habitat truth value below zero, indicating poor to moderate support for the proposition that these watersheds have accumulations of all factors for winter habitat.

Combined Habitat Rating

Combining the results of the ODFW and USFS habitat rating networks (Figures 34 and 35) produces an overall habitat rating for most watersheds (Figure 36). All watersheds (among those with enough data to be rated) received a combined truth value below zero, as shown in . However, there is variation between watersheds throughout the ESU, shown in Figure 37. A key underlying factor in the combined habitat rating is the way the decision support system evaluate the habitat data. In order for a watershed to score well in the combined habitat rating, it must be among the best watersheds for all habitat rating parameters. This condition is not present in any of the rated watersheds, leading to the overall very poor scores seen in the rating. If we were to evaluate the combined habitat rating using a series of OR nodes instead of AND nodes, the final scores would probably be much higher. However, the team expressed a desire to identify those watersheds with the best of all conditions. Evaluating all the habitat parameters in a single evaluation node (i.e., discarding the individual habitat type ratings) would identify those watersheds with the highest levels of combined habitat parameters, but would not lend any insight to which watersheds have best support for each life history stage.

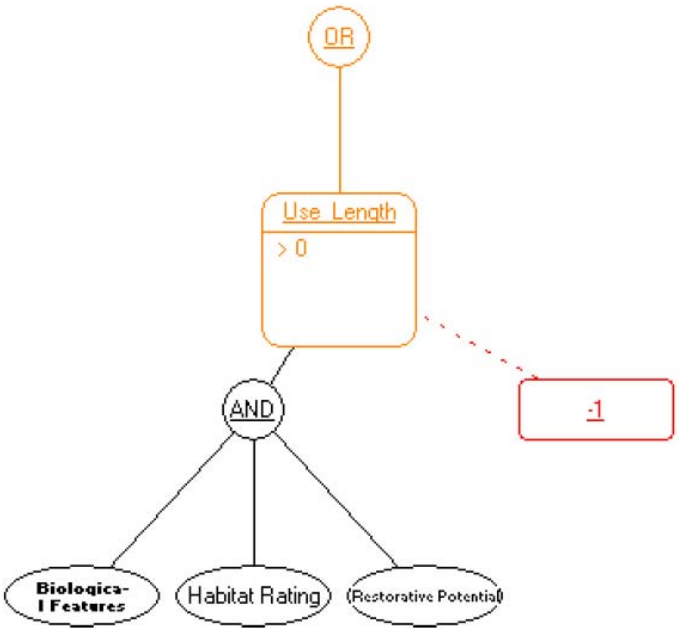

Figure 1. The top levels of the DSS test for coho distribution within each watershed and combine the scores of the lower networks.

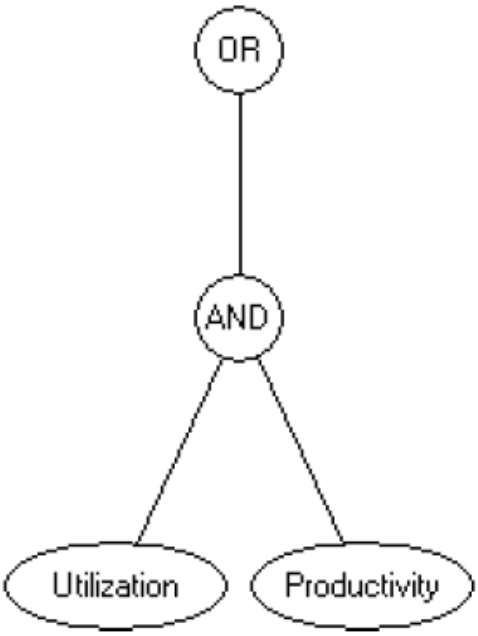

Figure 2. The truth values for Utilization and Productivity are aggregated with the AND operator, then compared with the Uniqueness truth value with an OR operator.

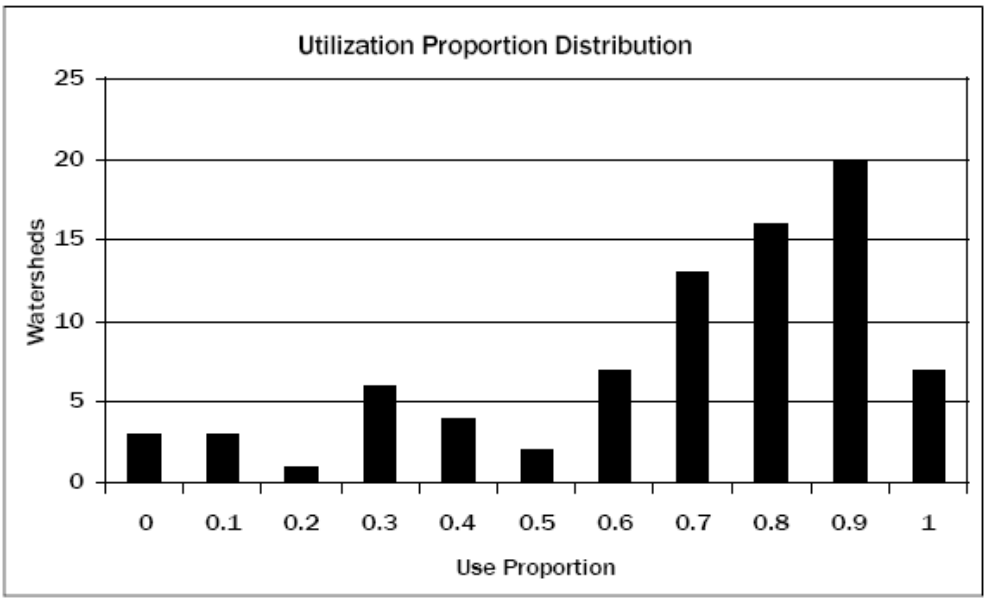

Figure 3. The proportion of coho utilization ranges from 0 to over 0.9, with the majority above 0.5.

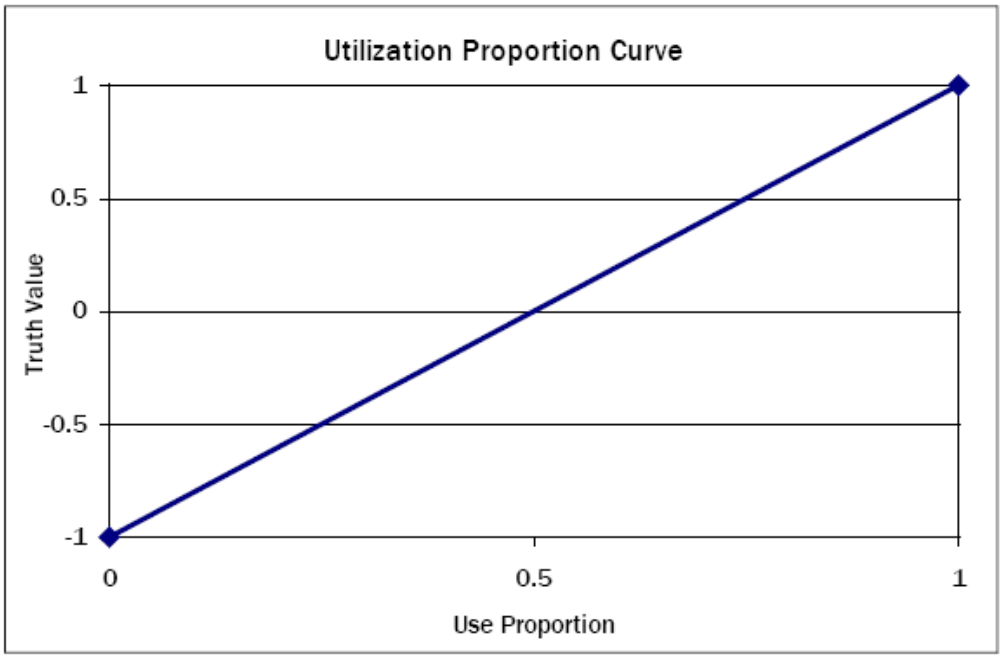

Figure 4. The utilization proportion curve is defined with truth value -1 at 0.0 utilization and 1 at 1.0 utilization.

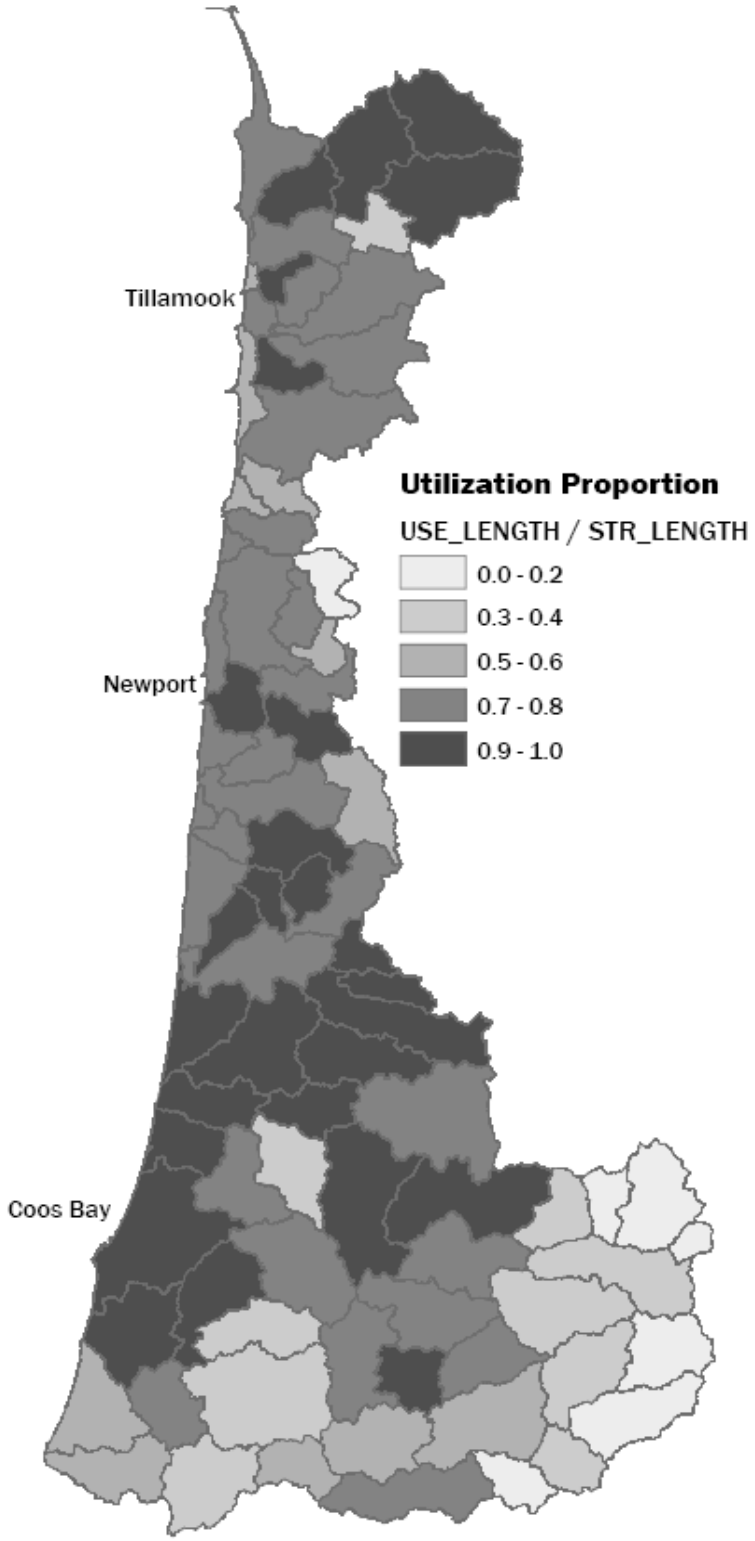

Figure 5. This map illustrates the spatial distribution of utilization proportion values throughout the Oregon coast coho ESU.

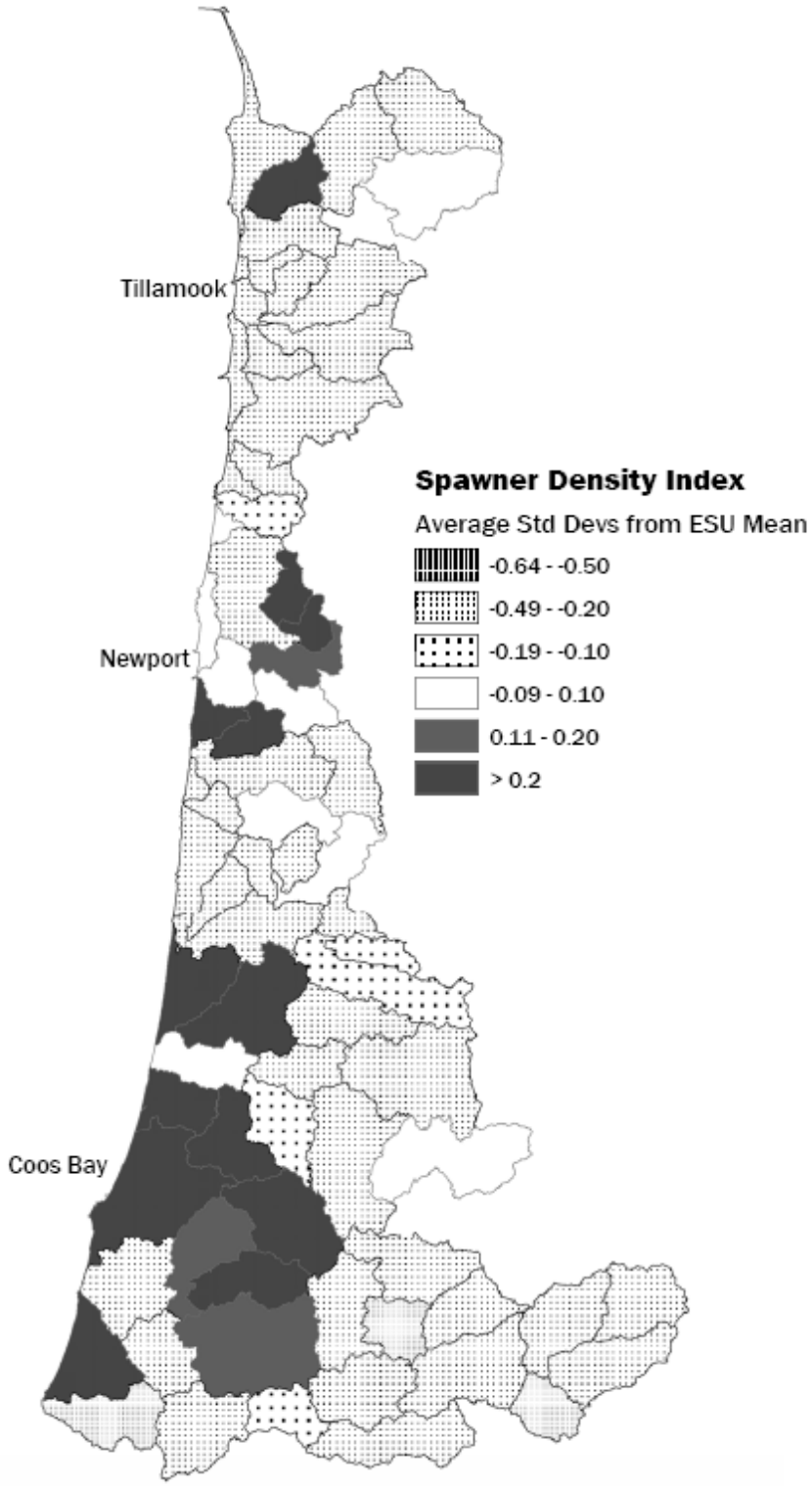

Figure 6. This map illustrates the areas with consistently above or below average spawning densities.

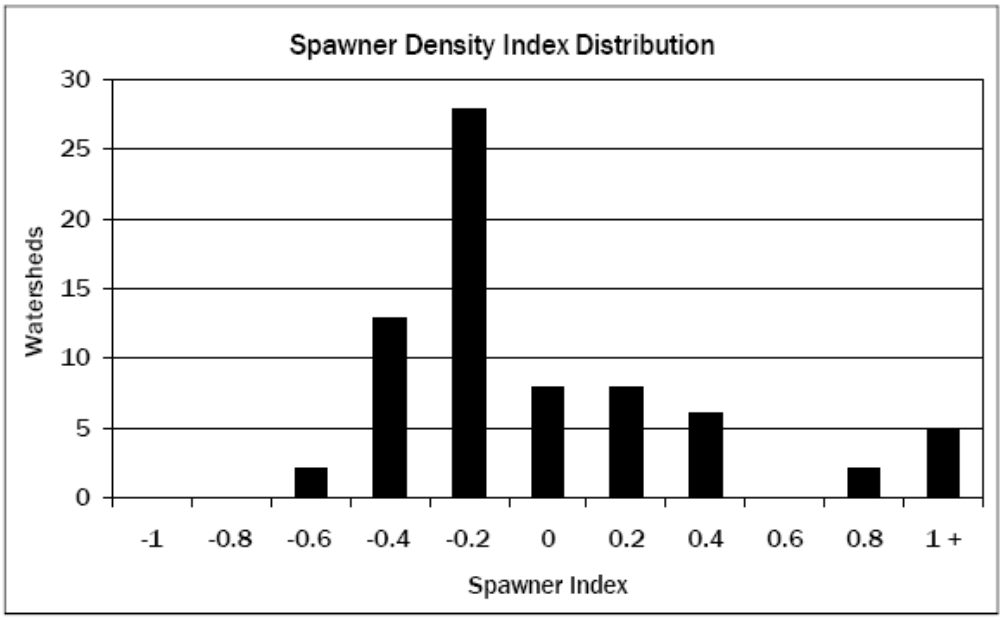

Figure 7. The spawner density index distribution reflects the large impact of a few highly productive systems on the mean spawner abundance.

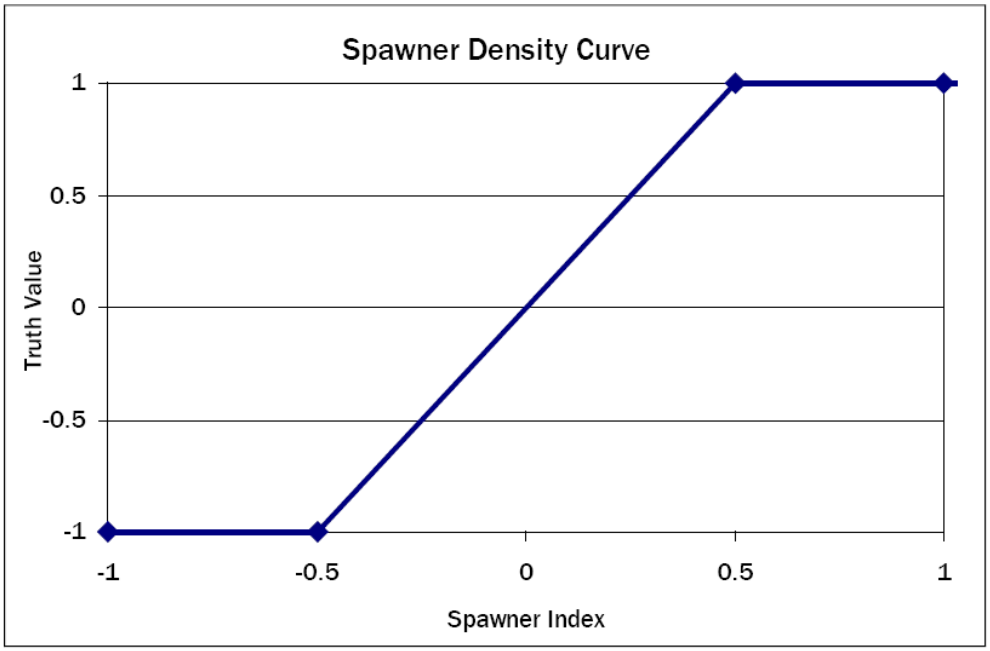

Figure 8. The spawner density index curve returns false (-1) for values below -0.5 and true (1) for values above 0.5.

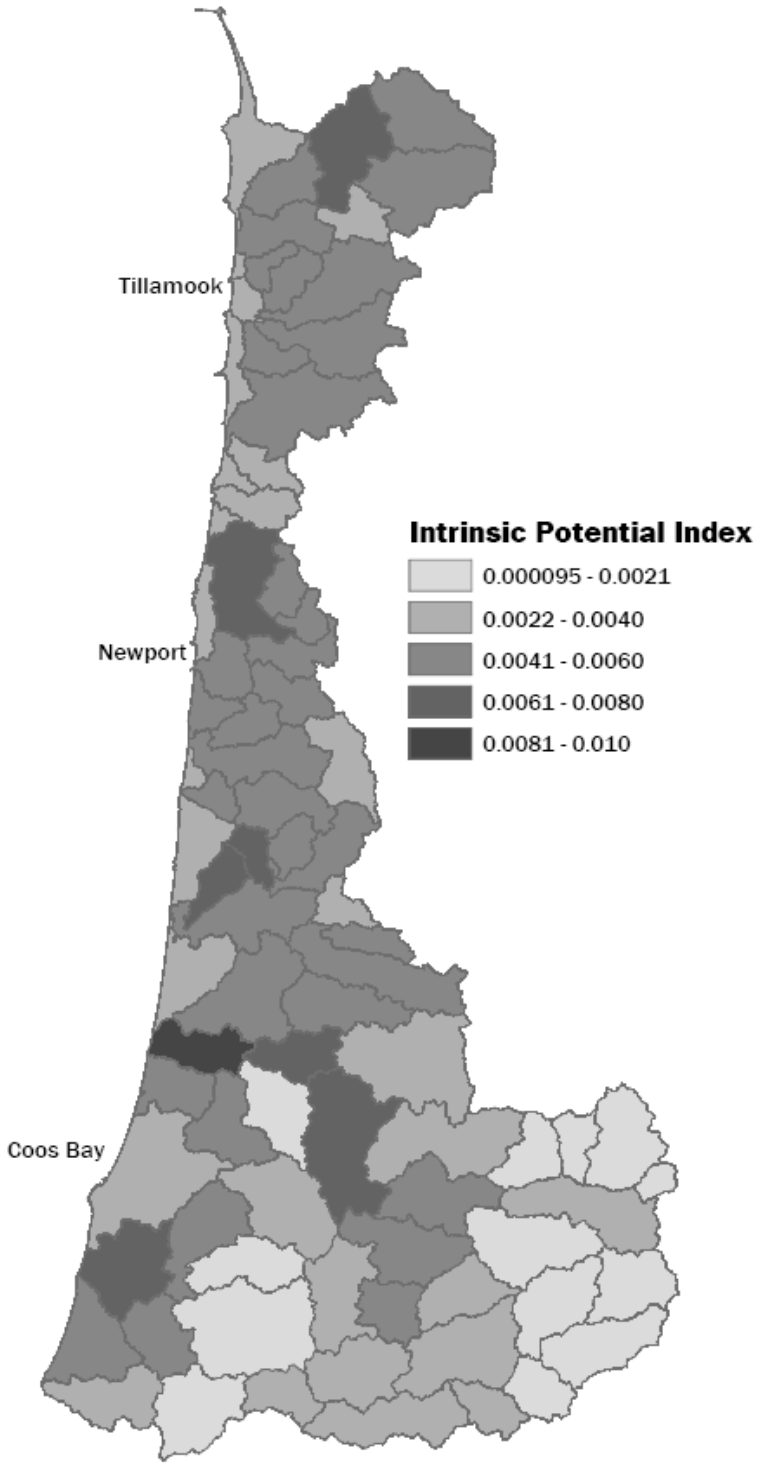

Figure 9. The intrinsic potential index is distributed across the landscape with higher values in areas with large, low gradient, unconfined stream reaches. Lake areas are not taken into consideration in this map.

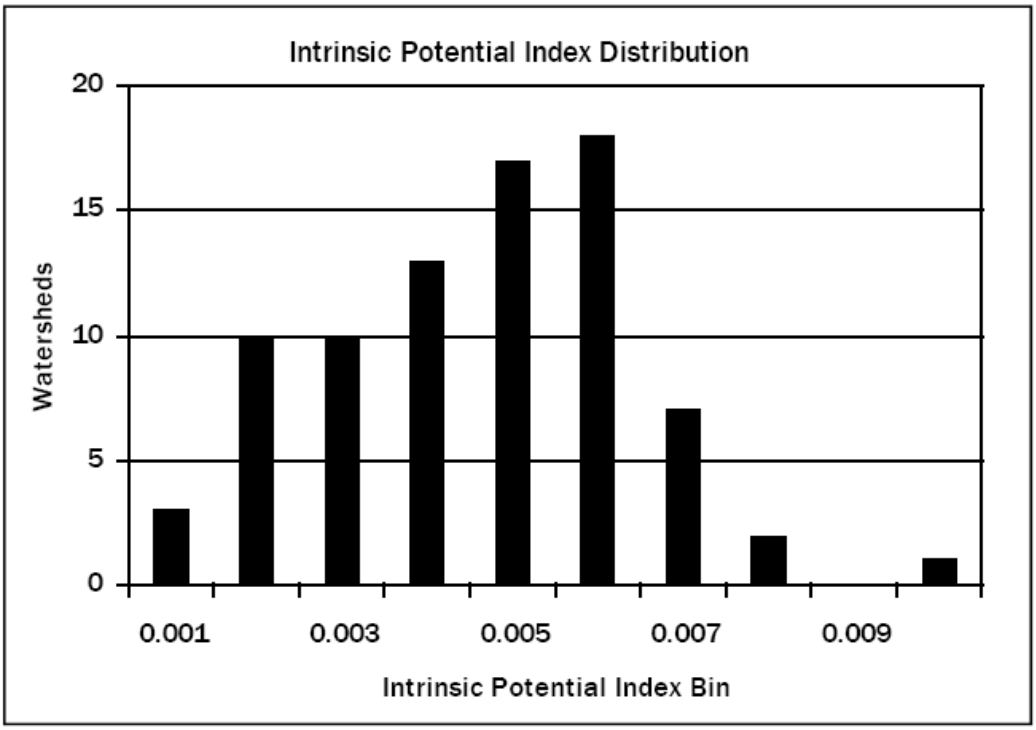

Figure 10. The intrinsic potential index distribution reflects the high abundance of mid-potential streams in most watersheds.

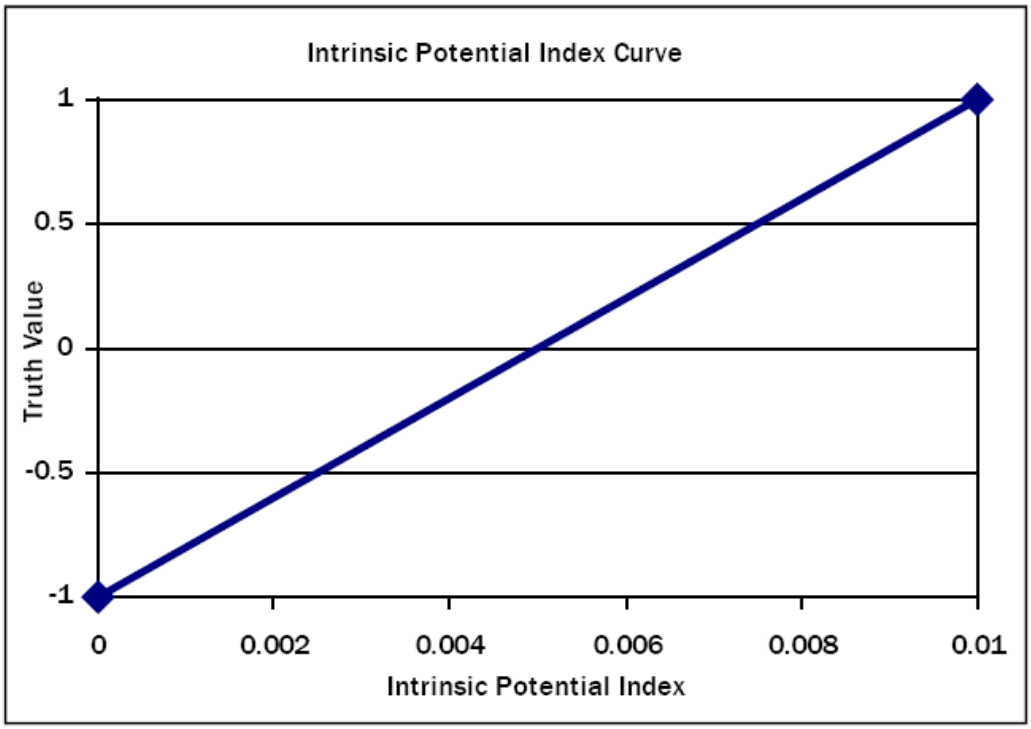

Figure 11. The intrinsic potential curve is false (-1) at 0 and true (1) at about 0.01

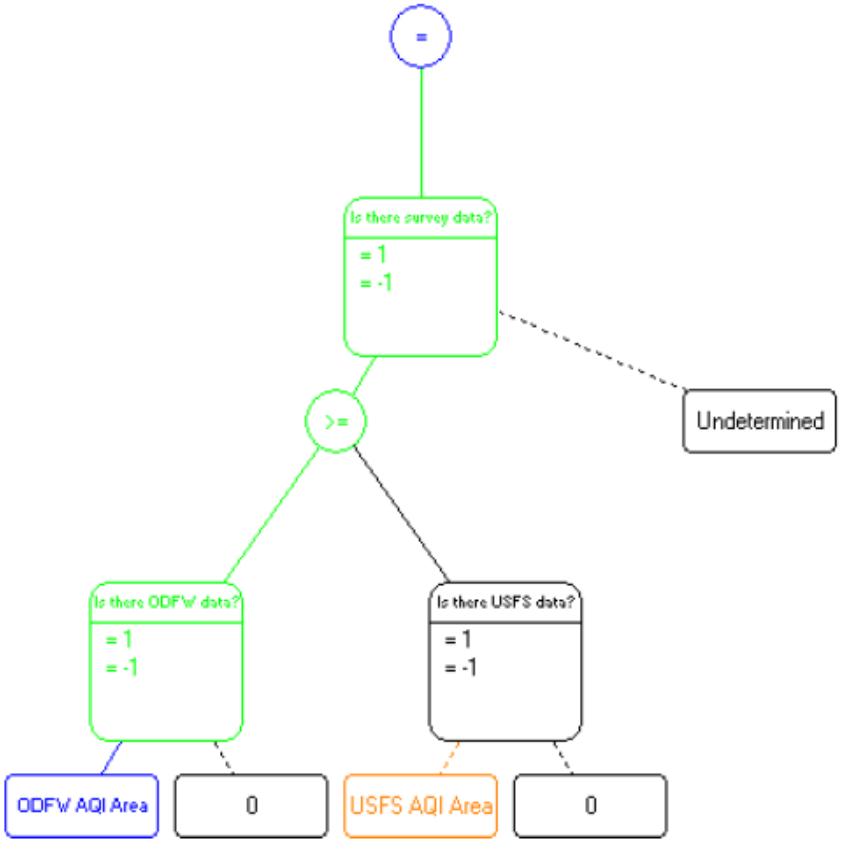

Figure 12. The "Is there more ODFW AQI area or USFS" data switch first tests if any survey data exists, then compares each agency's survey area to the other.

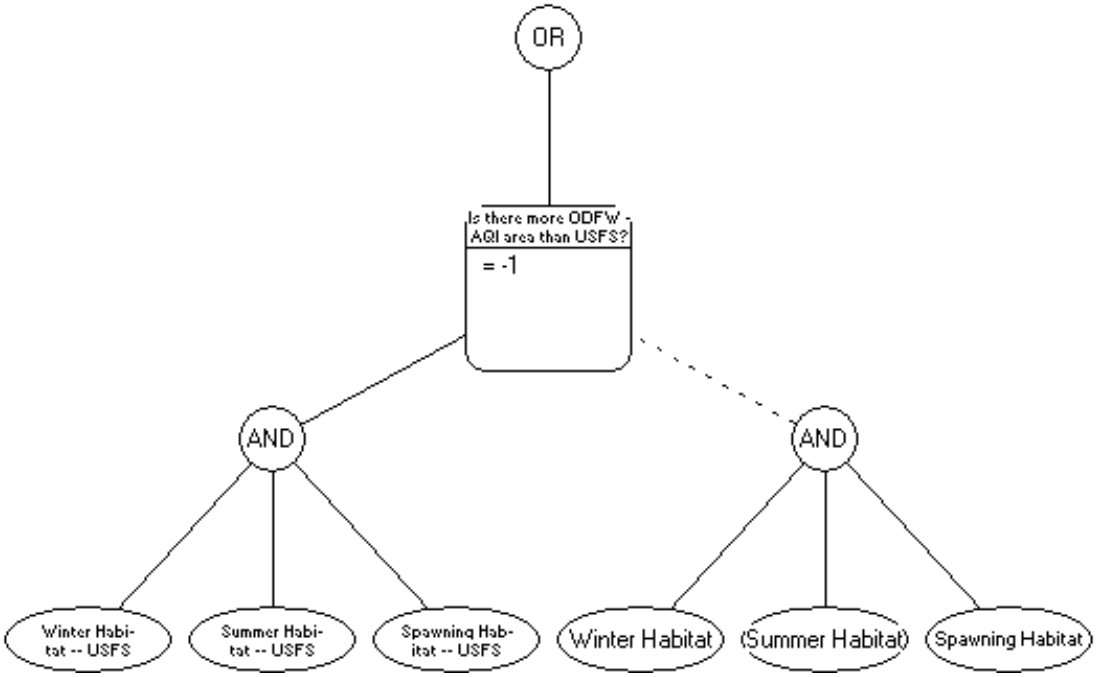

Figure 13. The Habitat Rating network evaluates ODFW and USFS stream survey data separately, depending on which group of data has a greater area surveyed.

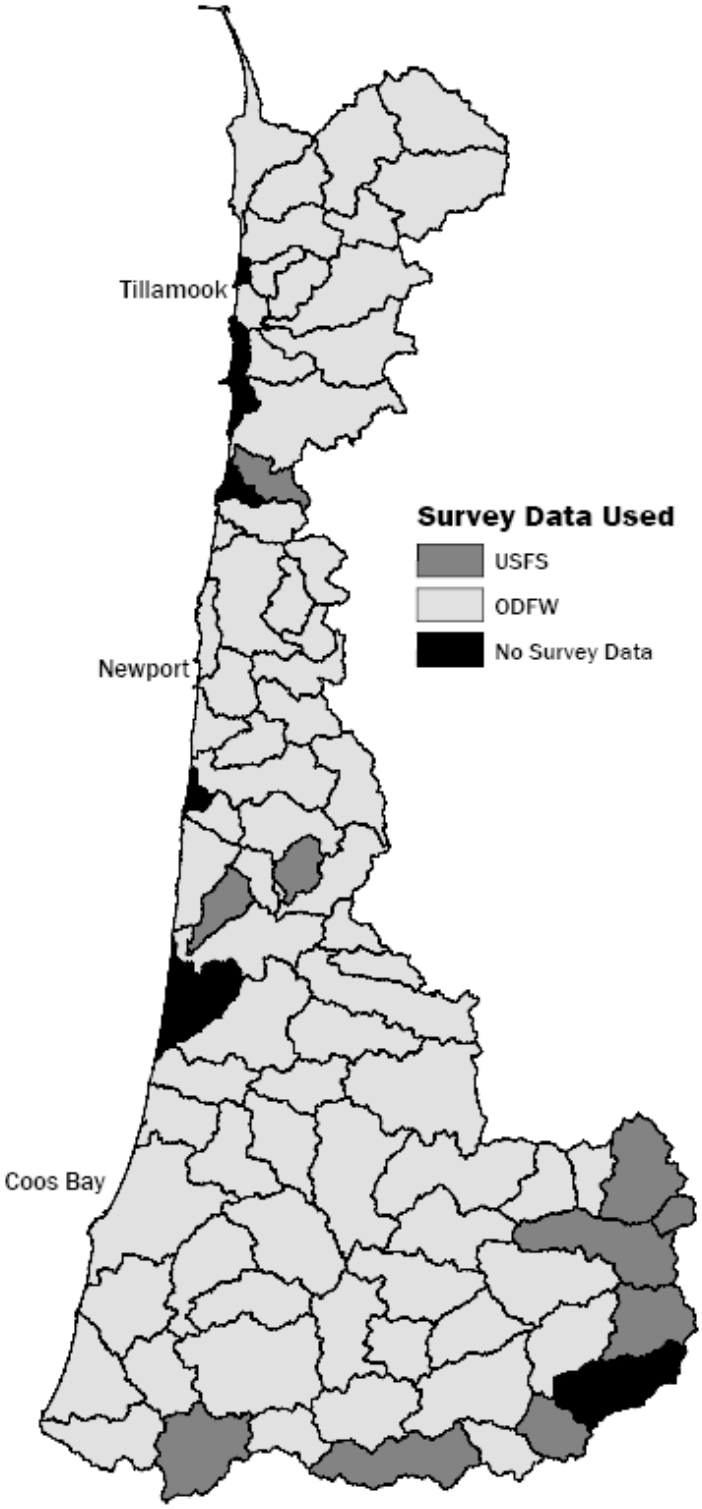

Figure 14. Only four watersheds have neither USFS nor ODFW stream survey data. For other watersheds, the system chose the data with the greatest survey area in the watershed.

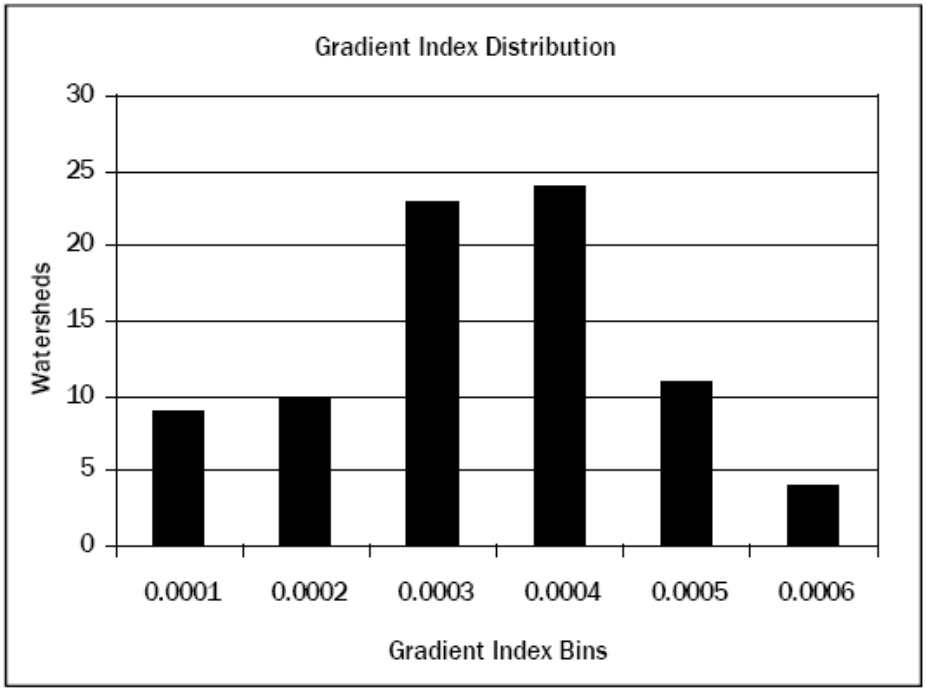

Figure 15. Gradient index is approximately normally distributed. This distribution indicates a range of availability of reaches with appropriate gradient for spawning and rearing.

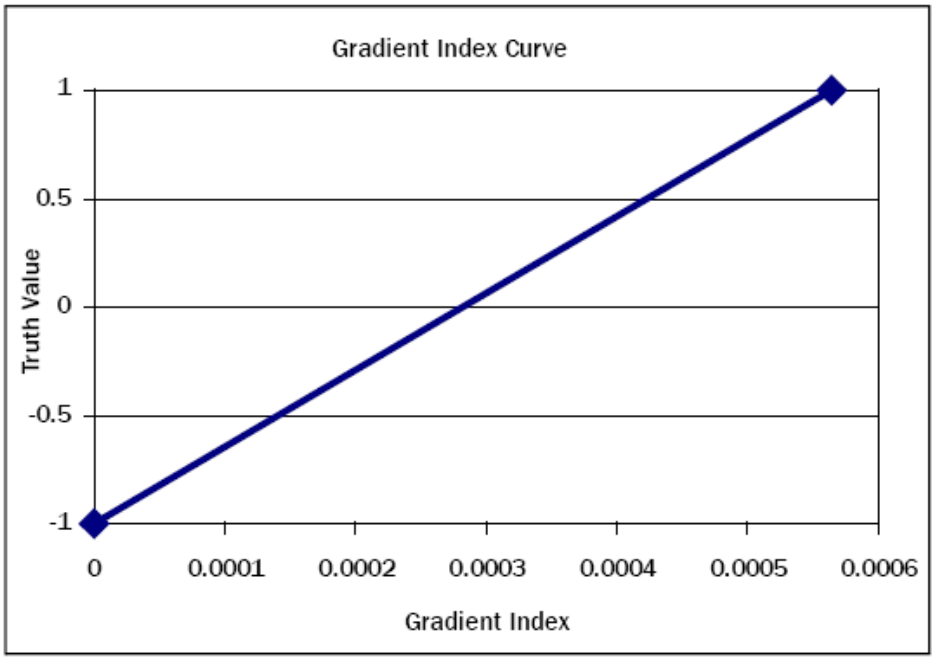

Figure 16. The gradient index will return a false (-1) truth value at 0 and a true (1) value at approximately 0.00058.

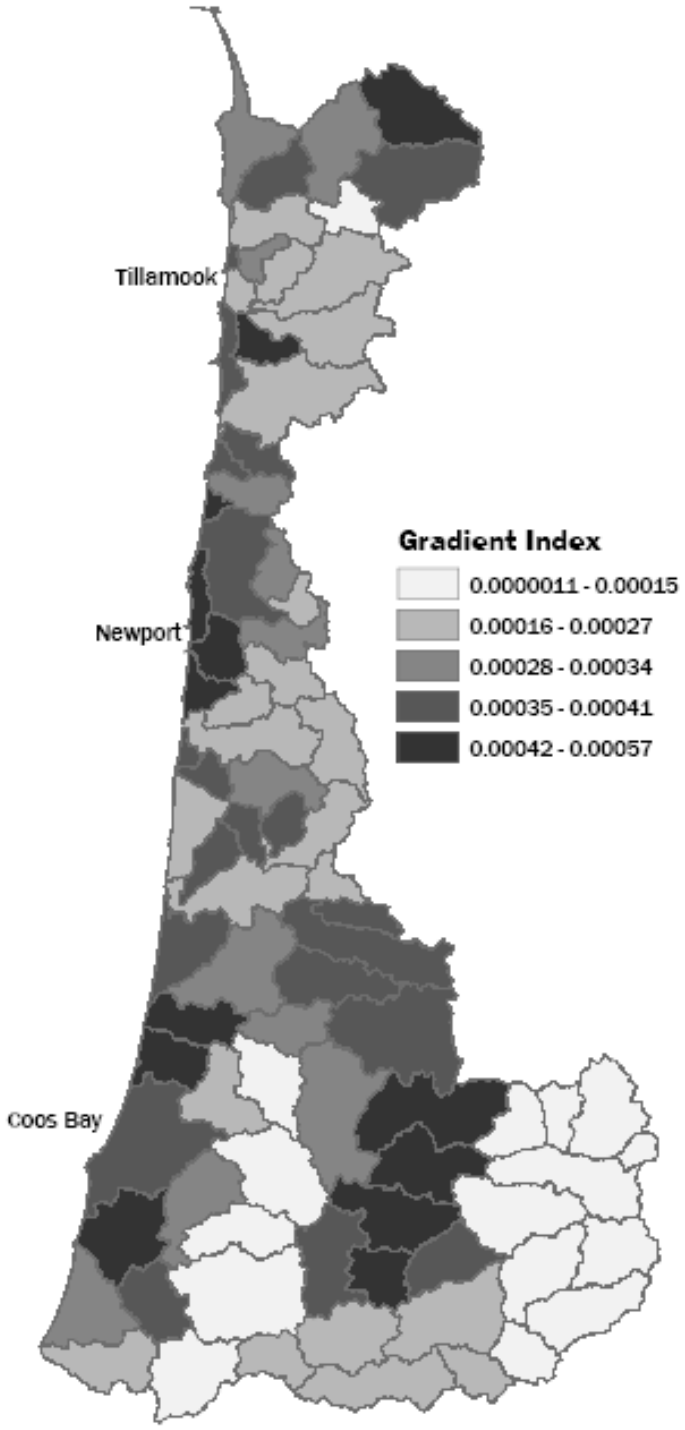

Figure 17. The gradient index indicates the relative abundance of stream reaches with gradient between 1 and 3 percent.

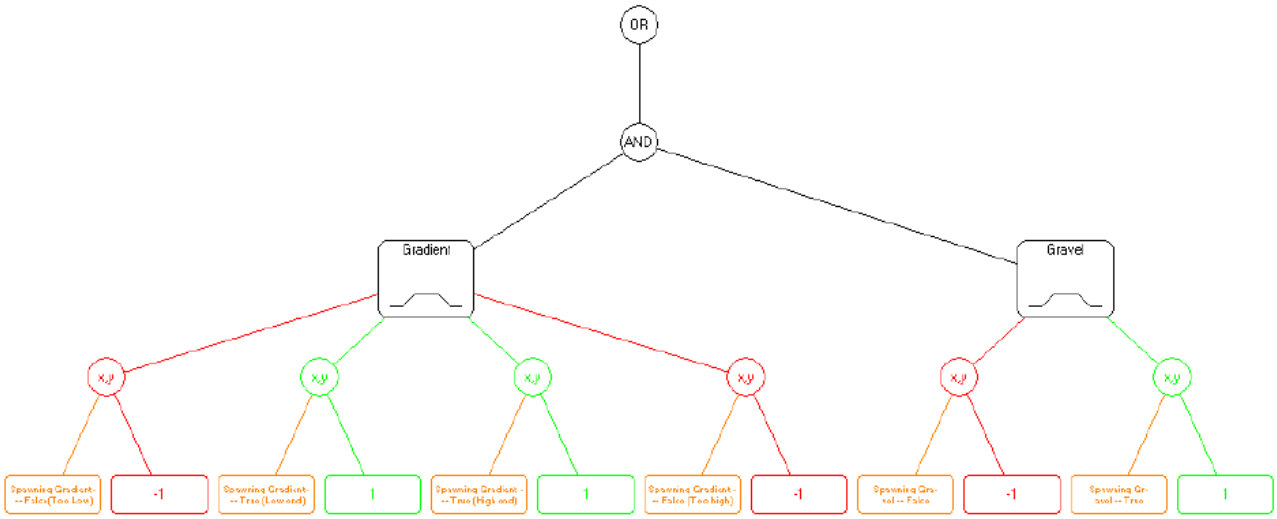

Figure 18. The network for Spawning Habitat evaluates both gradient and gravel in riffles.

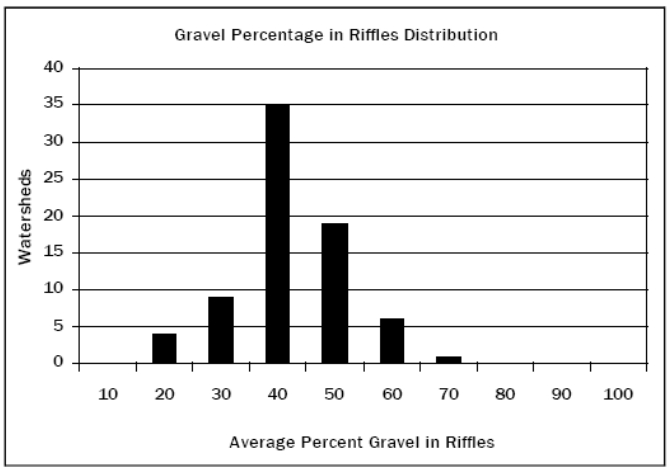

Figure 19. The average percentage of gravel in riffles is an indication of availability of suitable spawning sites, and is nearly normally distributed.

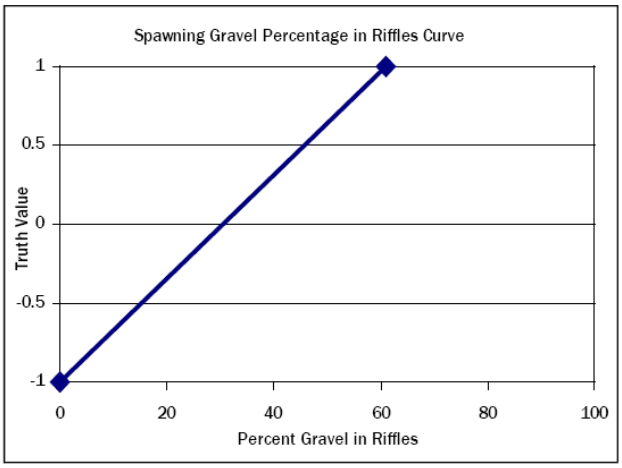

Figure 20. The spawning gravel truth value will be false (-1) for 0 percent and true (1) for 61 percent.

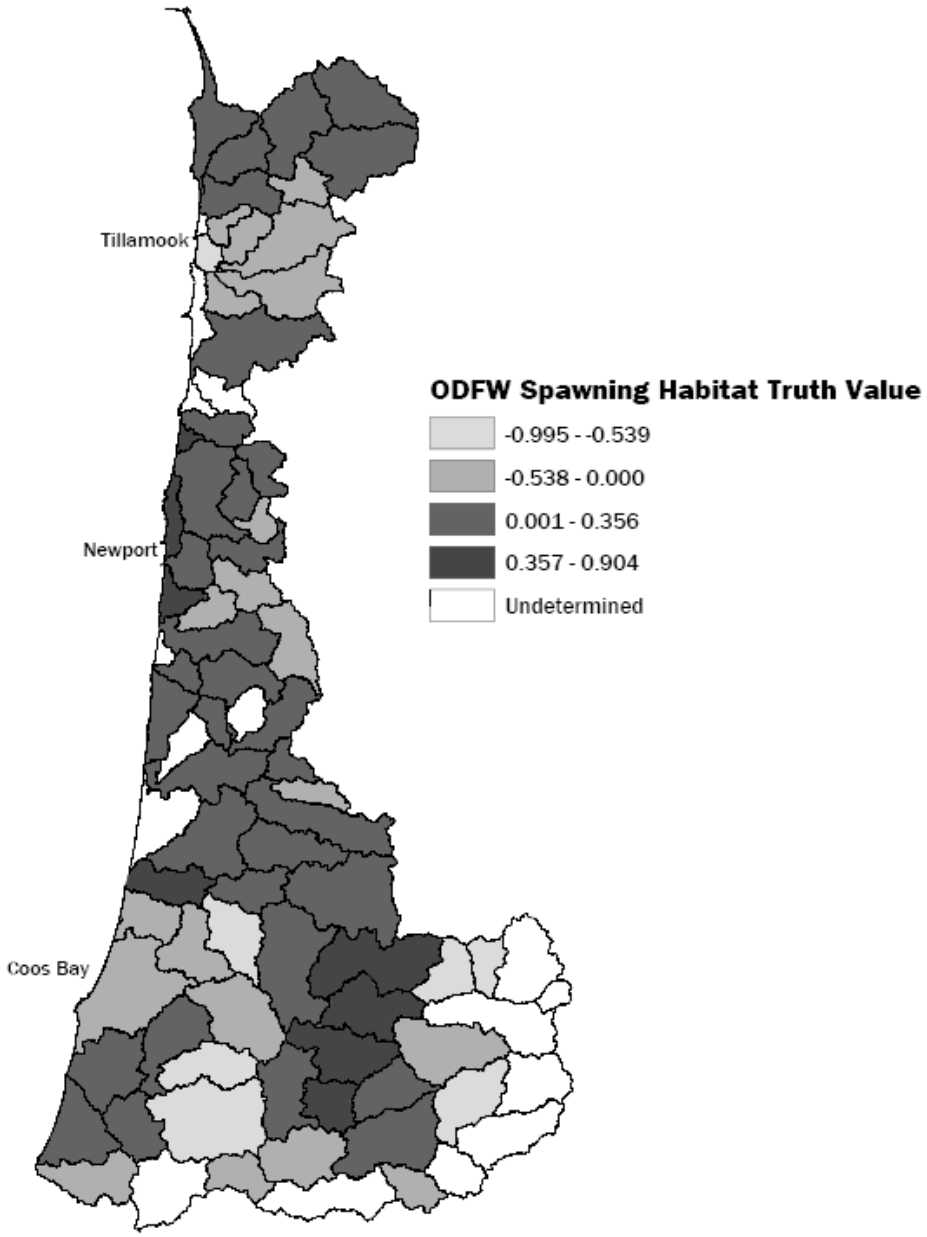

Figure 21. Distribution of ODFW Spawning Habitat truth values.

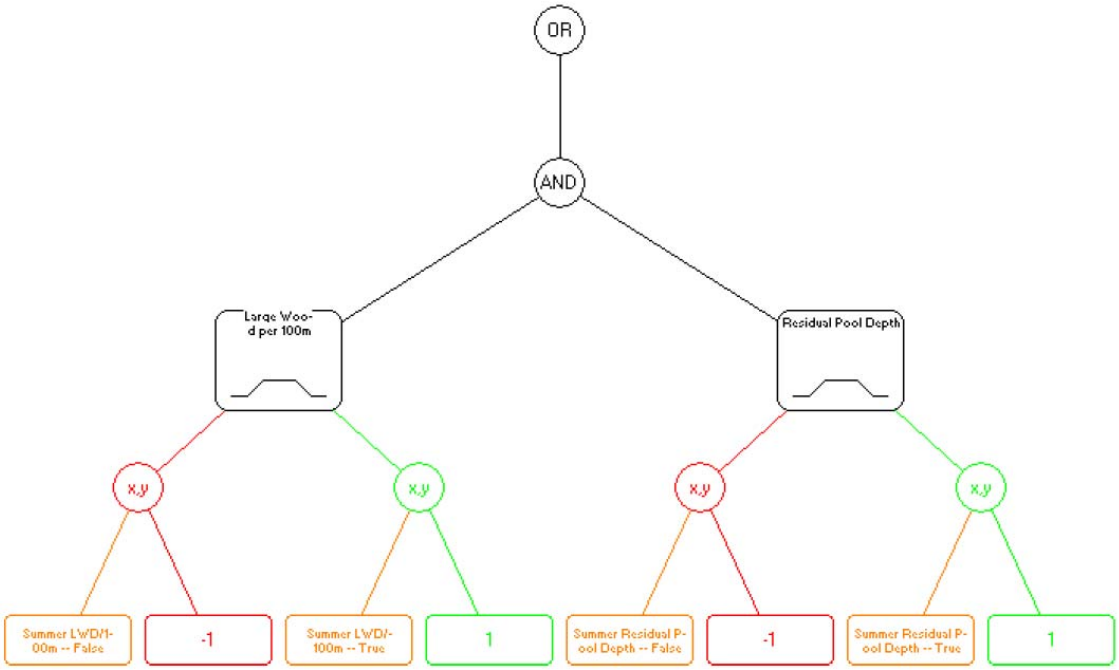

Figure 22. The Summer Habitat network evaluates the number of pieces of large wood per 100 meters and the average residual pool depth.

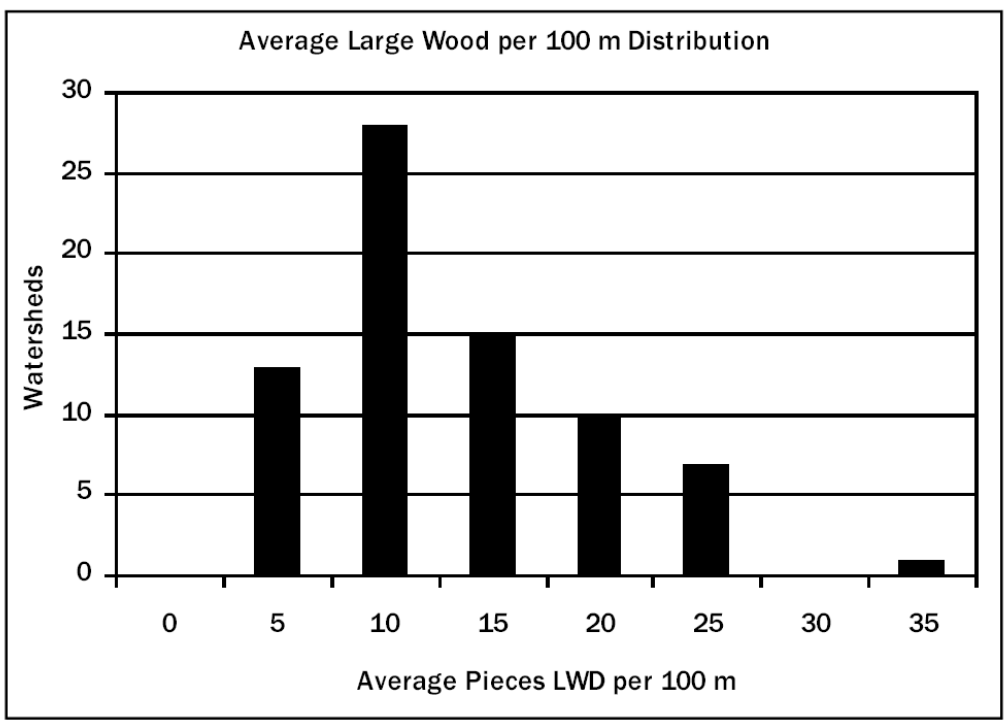

Figure 23. The average number of pieces of large wood (in the ODFW records) per 100 meters is mostly distributed below 20 pieces per 100 meters.

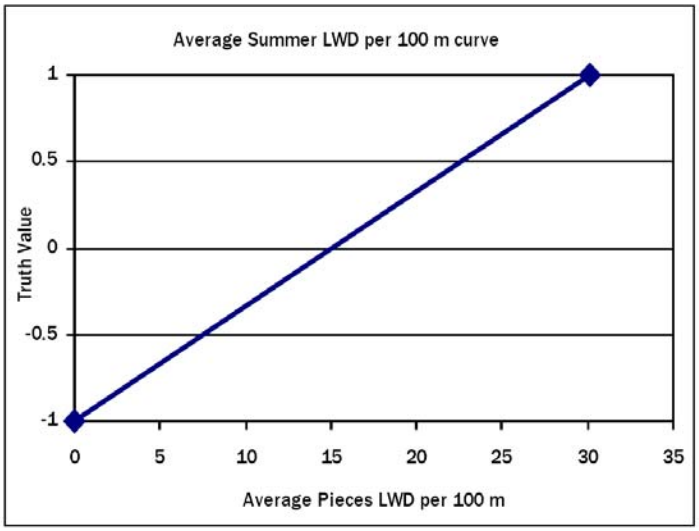

Figure 24. The Summer large wood curve will return a false value (-1) on 0 pieces of wood per 100 m and true (1) on values of about 31 pieces.

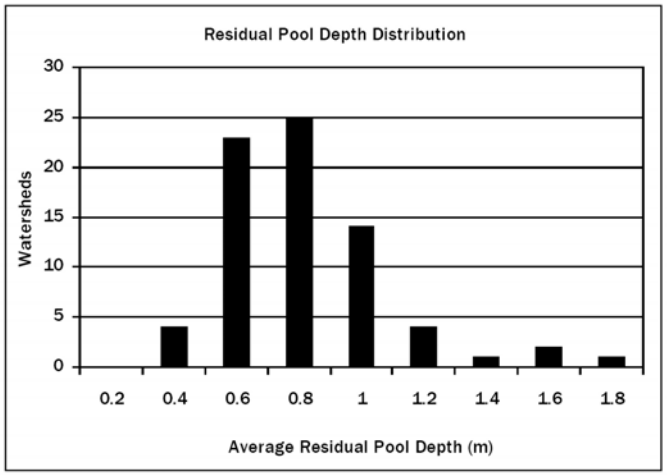

Figure 25. Residual pool depth is approximately normally distributed, with a mean around 0.7 meters.

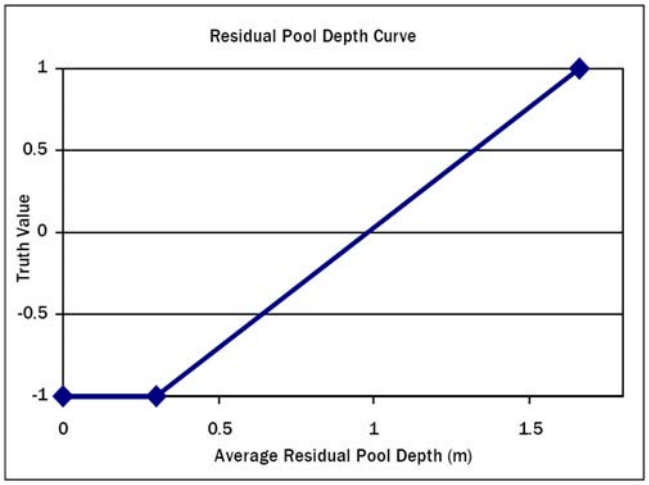

Figure 26. The ODFW residual pool depth curve will be false below 0.3 m (the minimum measured in the ODFW dataset) and true at 1.72.

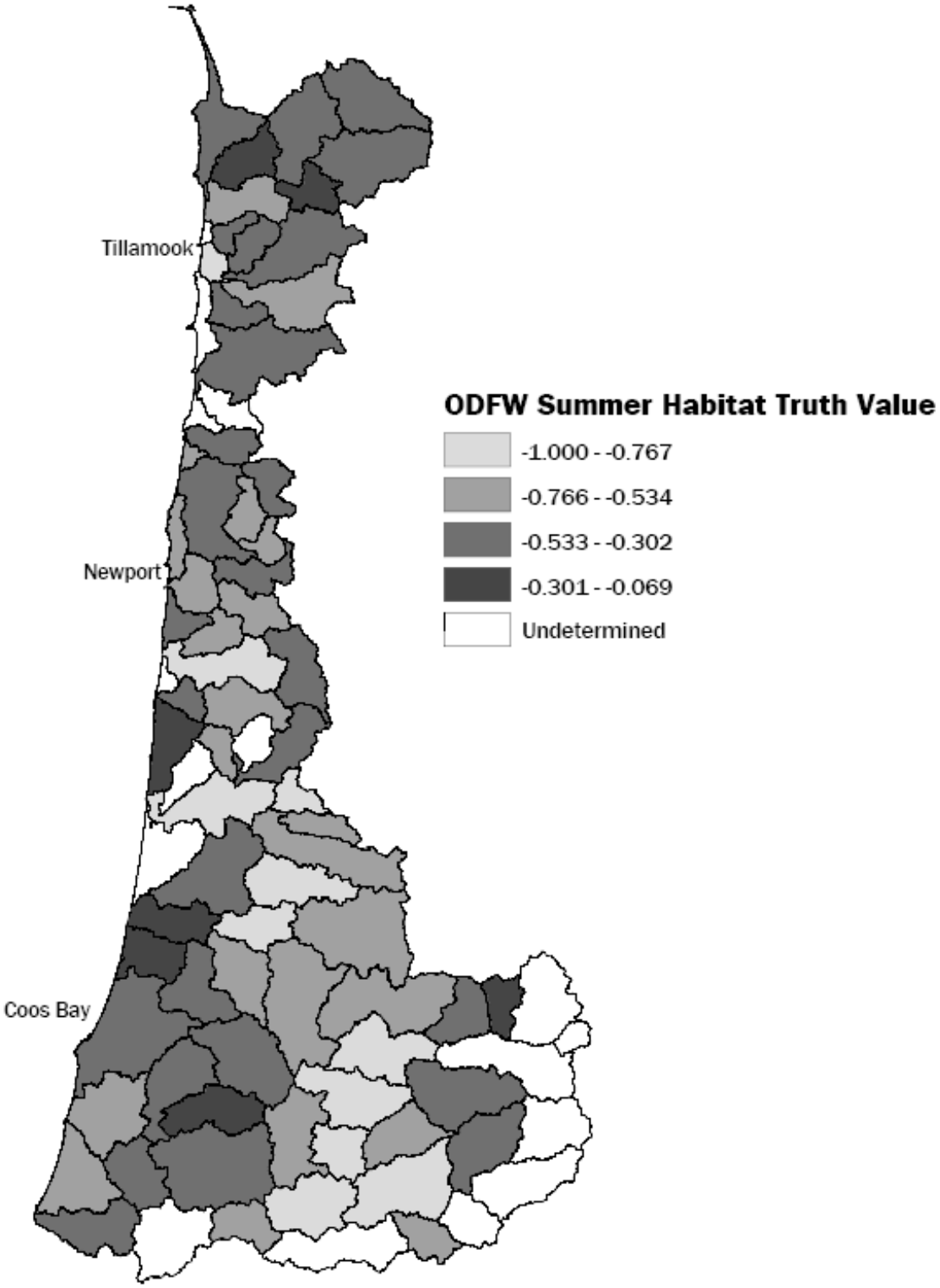

Figure 27. Distribution of all truth values for summer habitat are below zero.
The highest value is about -0.007.

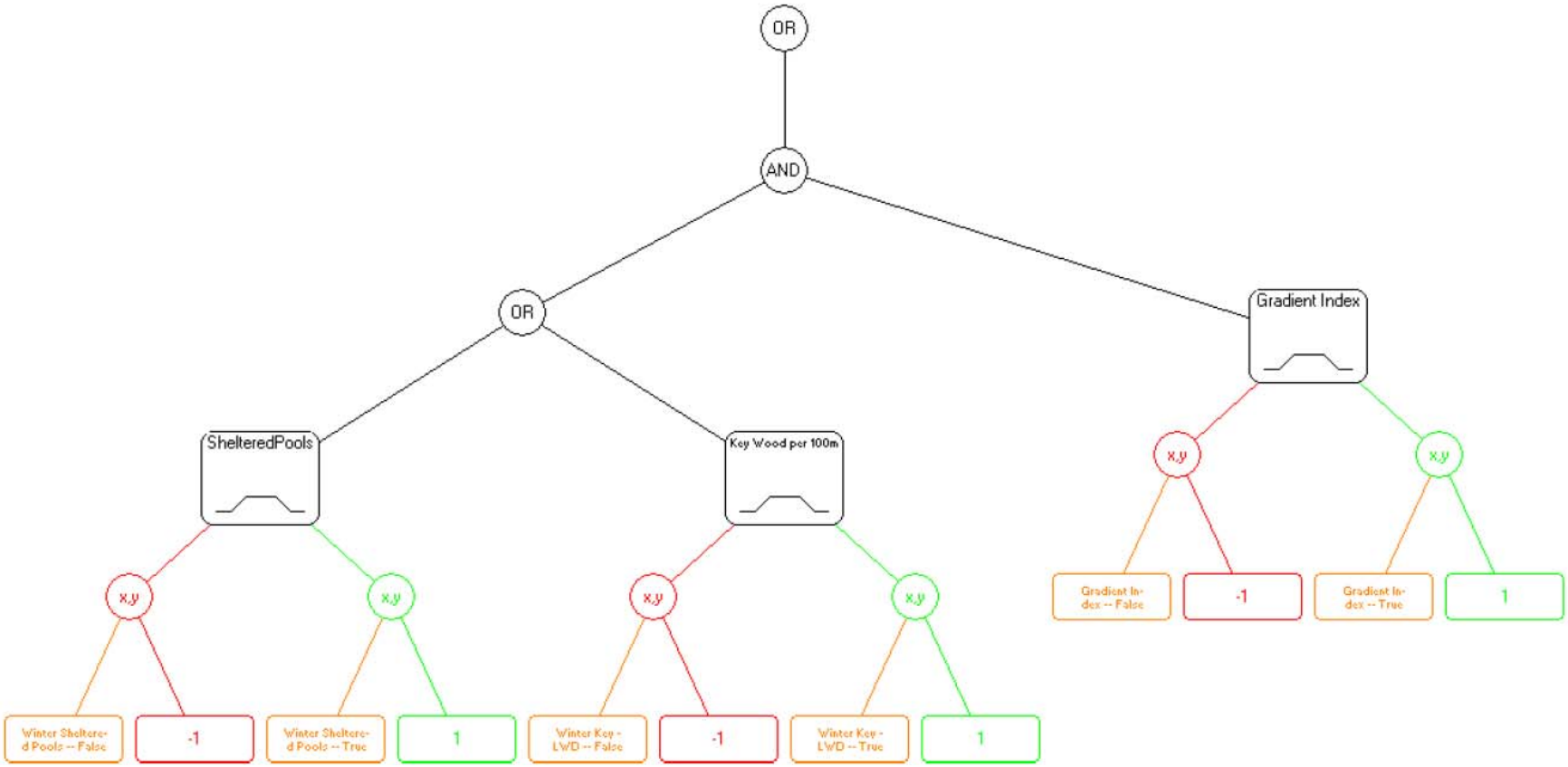

Figure28. The Winter Habitat network evaluates gradient, percentage of area in sheltered pools, and large woody debris per 100 m. The gradient rating curve for winter habitat is different from the spawning habitat curve to reflect the different habitat needs of overwintering juvenile coho from incubating eggs.

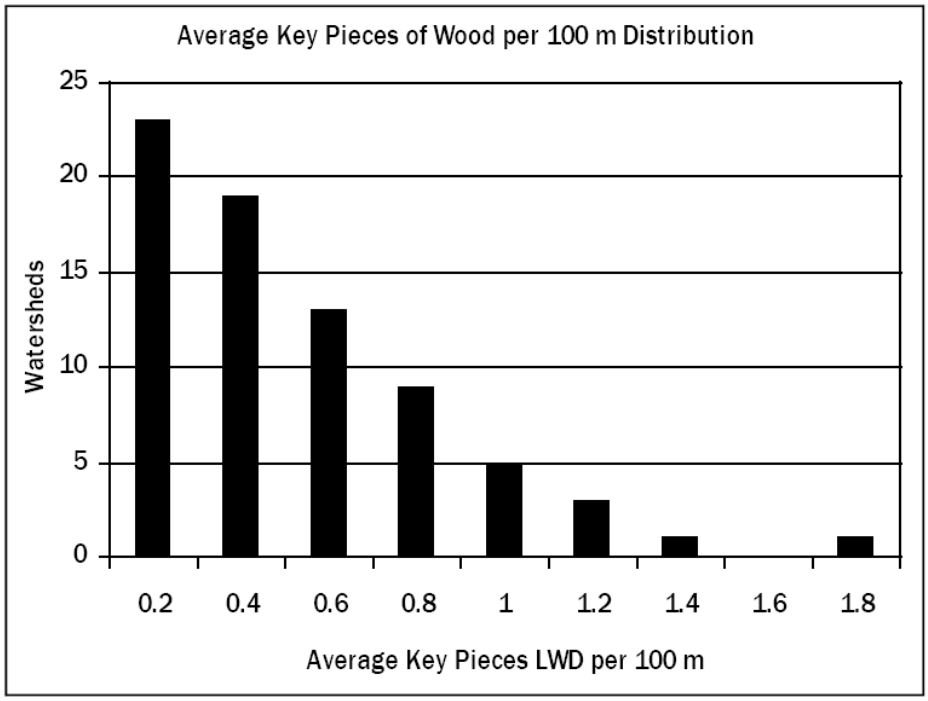

Figure 29. Most watersheds average below 0.6 pieces of key large woody debris per 100 meters of stream channel.

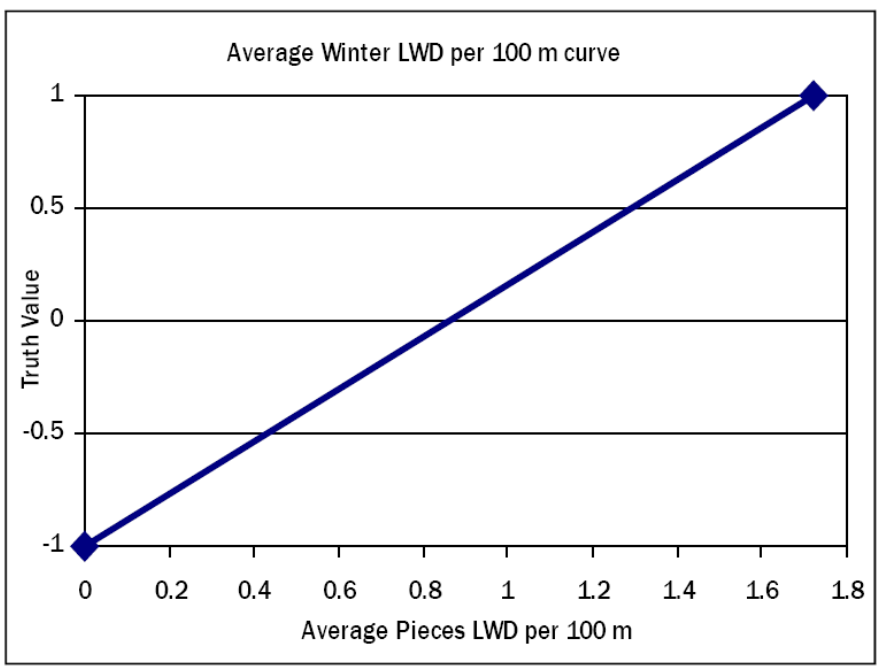

Figure 30. The winter key large woody debris curve will return a truth value of false (-1) for watersheds at 0 key pieces per 100 m, and true (1) for inputs at 1.62 pieces per 100 m.

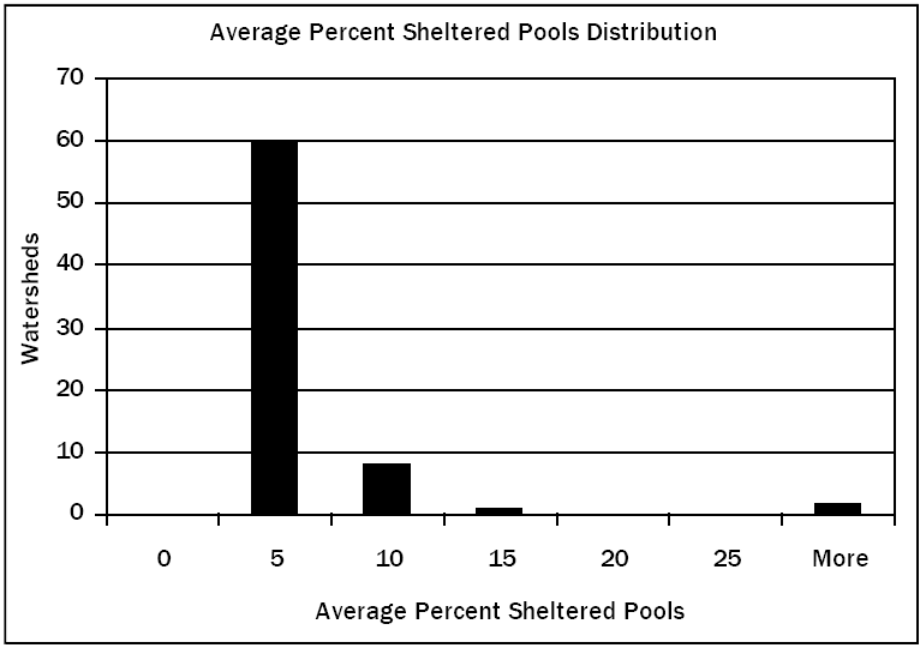

Figure 31. Most watersheds average less than five percent of channel area in sheltered pools. These pools include backwaters, beaver dams, secondary channel pools, and alcoves.

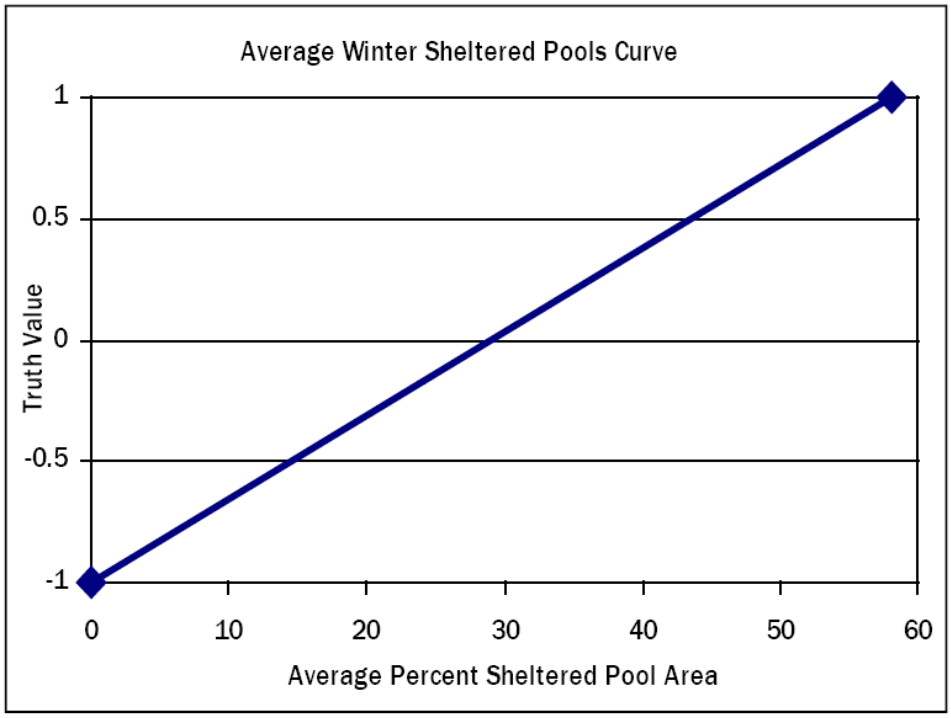

Figure 32. The winter sheltered pools curve will return a truth value of false (-1) for watersheds with 0 percent of channel area in sheltered pools, and true (1) for those with about 58 percent. If the two highest data points (58 and 27 percent) were removed as outliers, the true value would occur at about 14 percent.

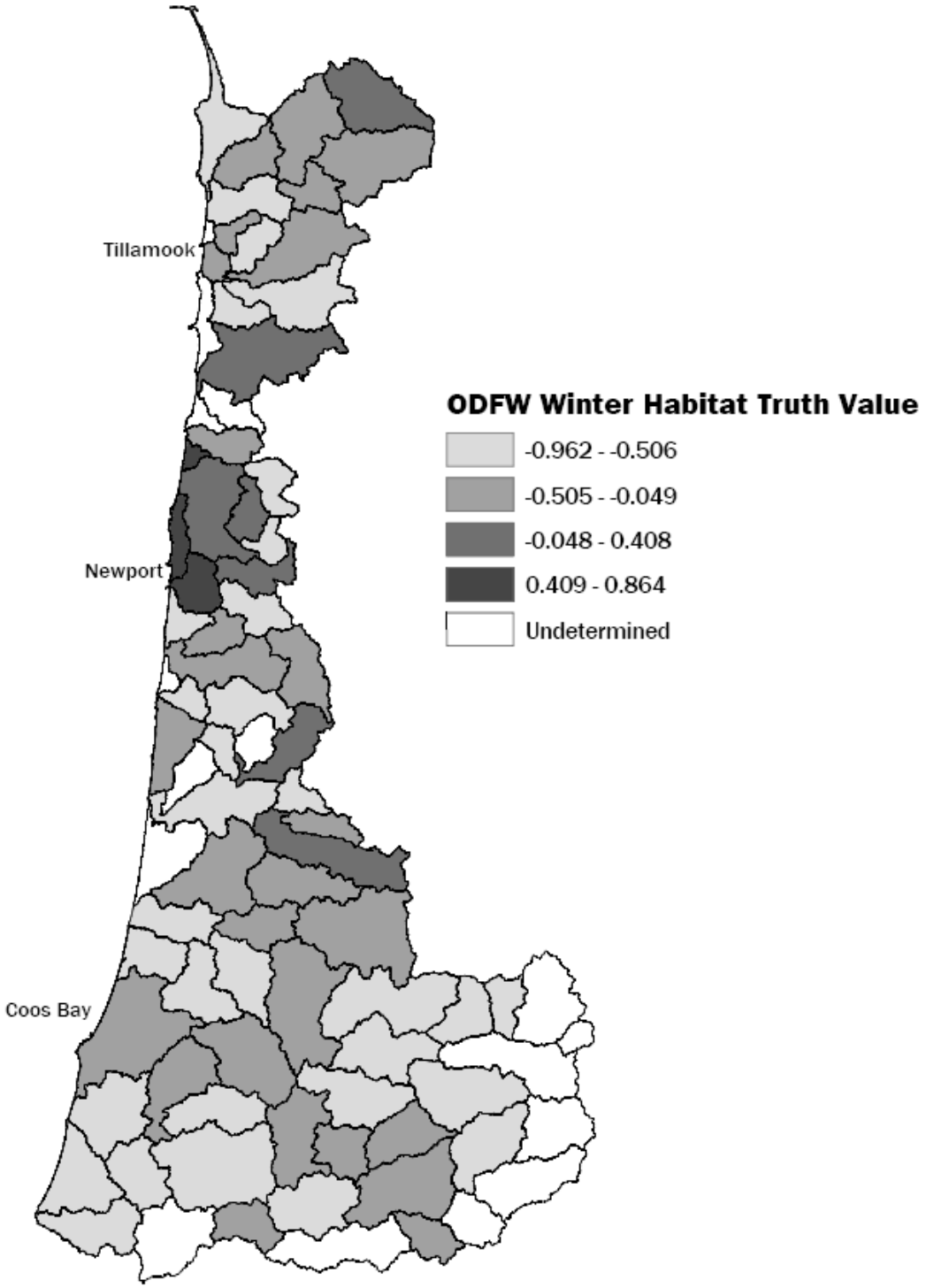

Figure 33. Winter habitat is distributed across the ESU with most watersheds receiving poor or moderate support.

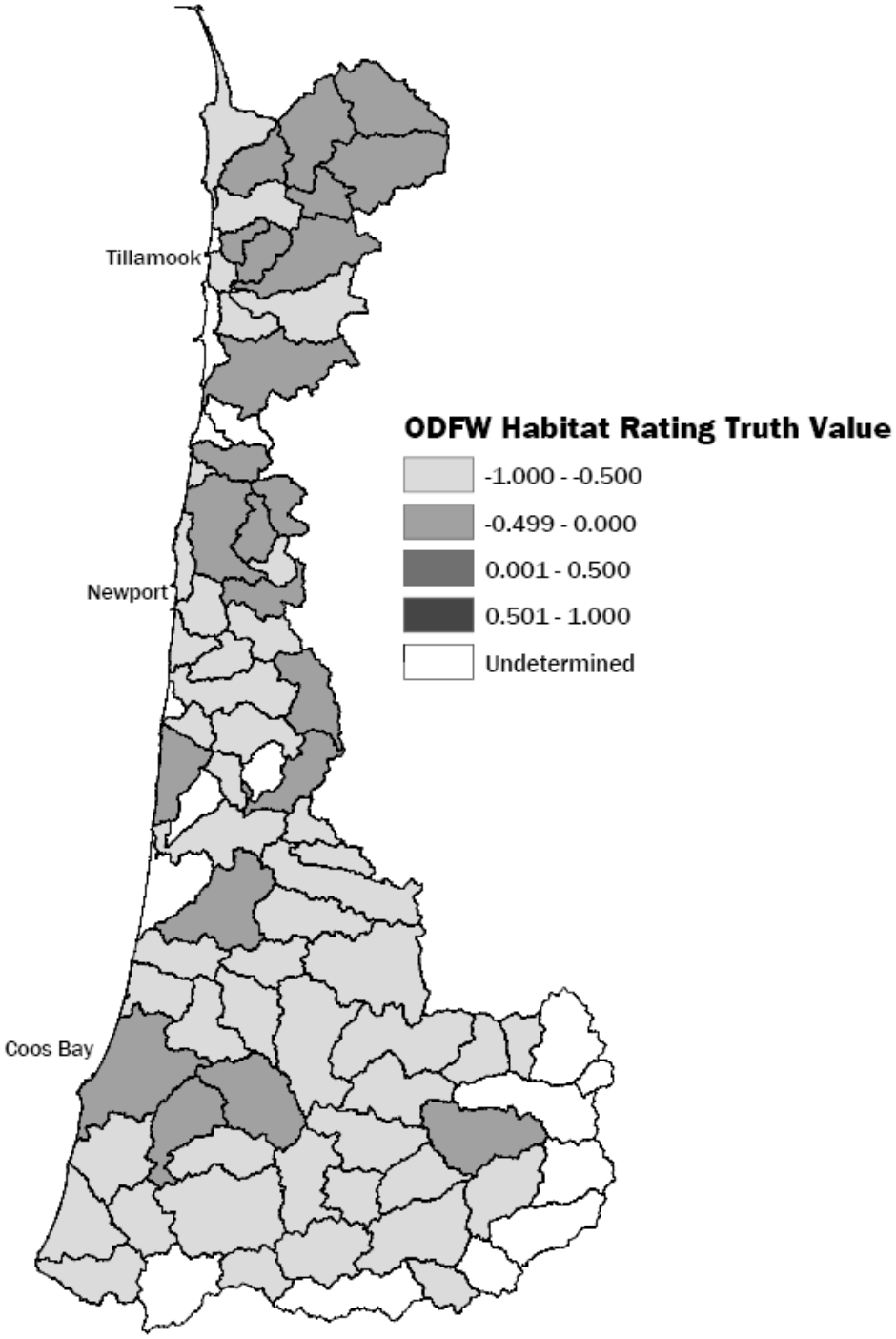

Figure 34. The ODFW habitat rating network returns truth values below zero for all watersheds evaluated.

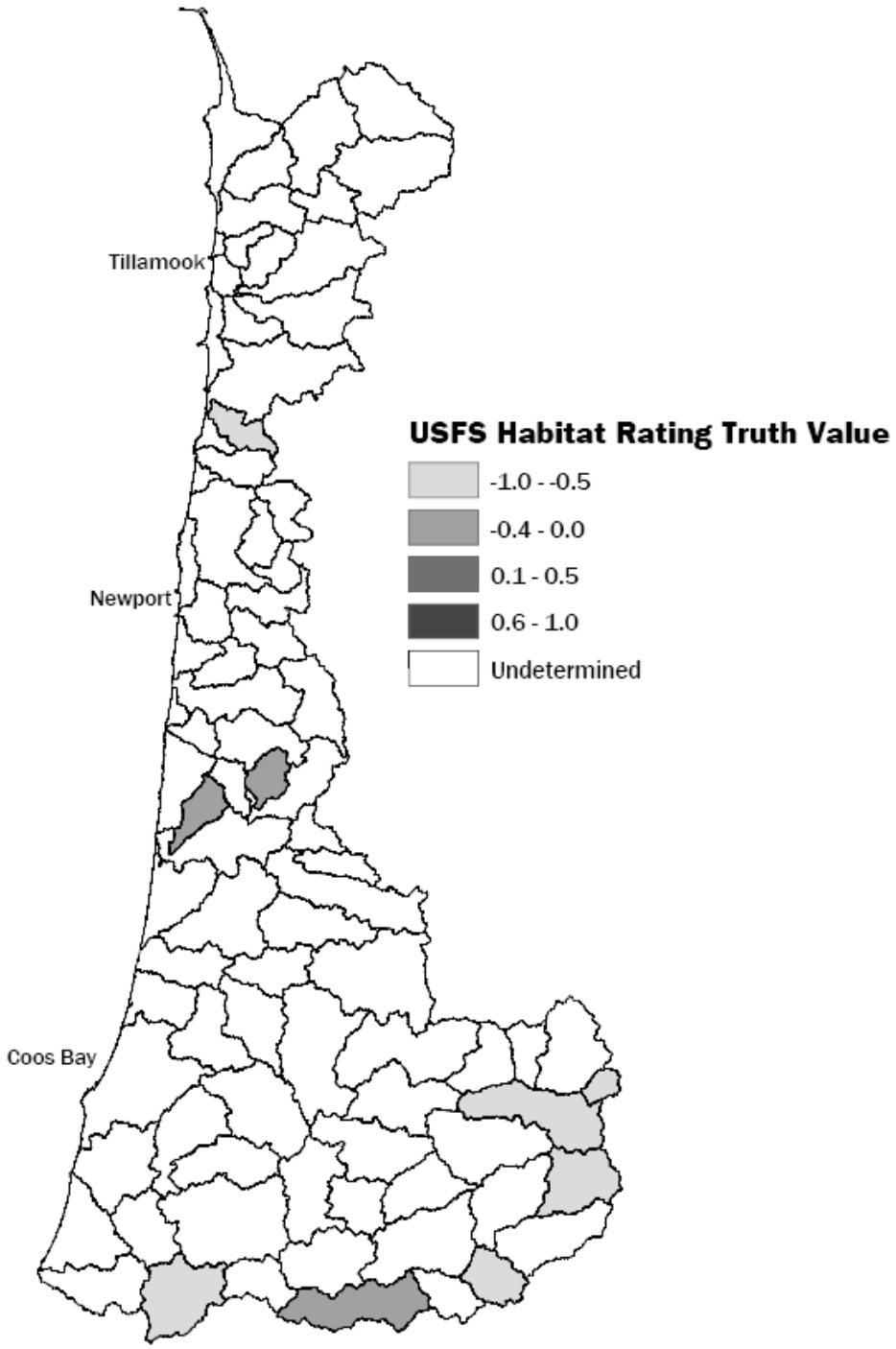

Figure 35. The USFS habitat rating network returns truth values below zero for all watersheds.

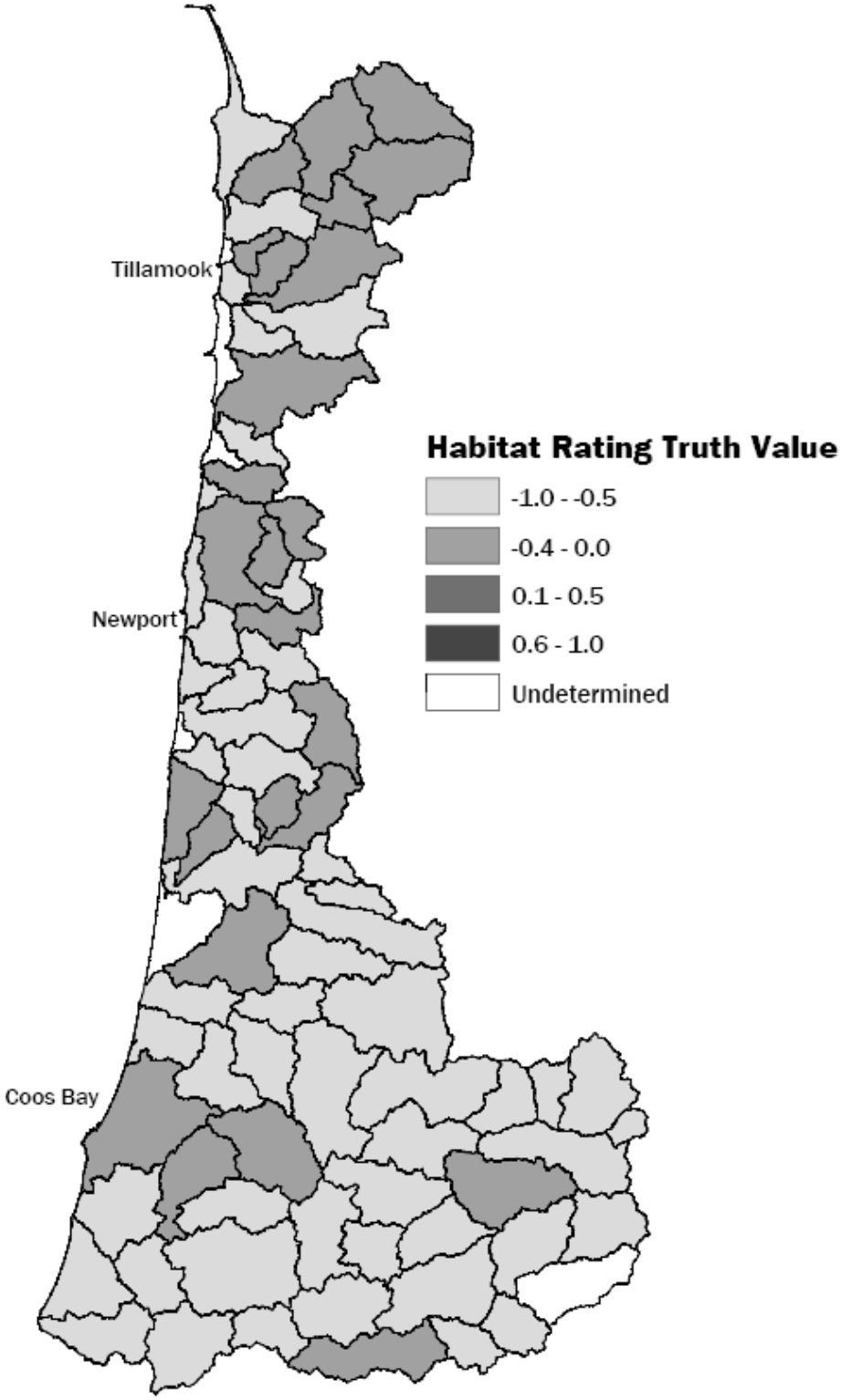

Figure 36. The combined habitat rating, using both the USFS and ODFW habitat survey data, returns habitat truth values below zero for all watersheds evaluated. Five watersheds did not have enough data to be evaluated under either network.

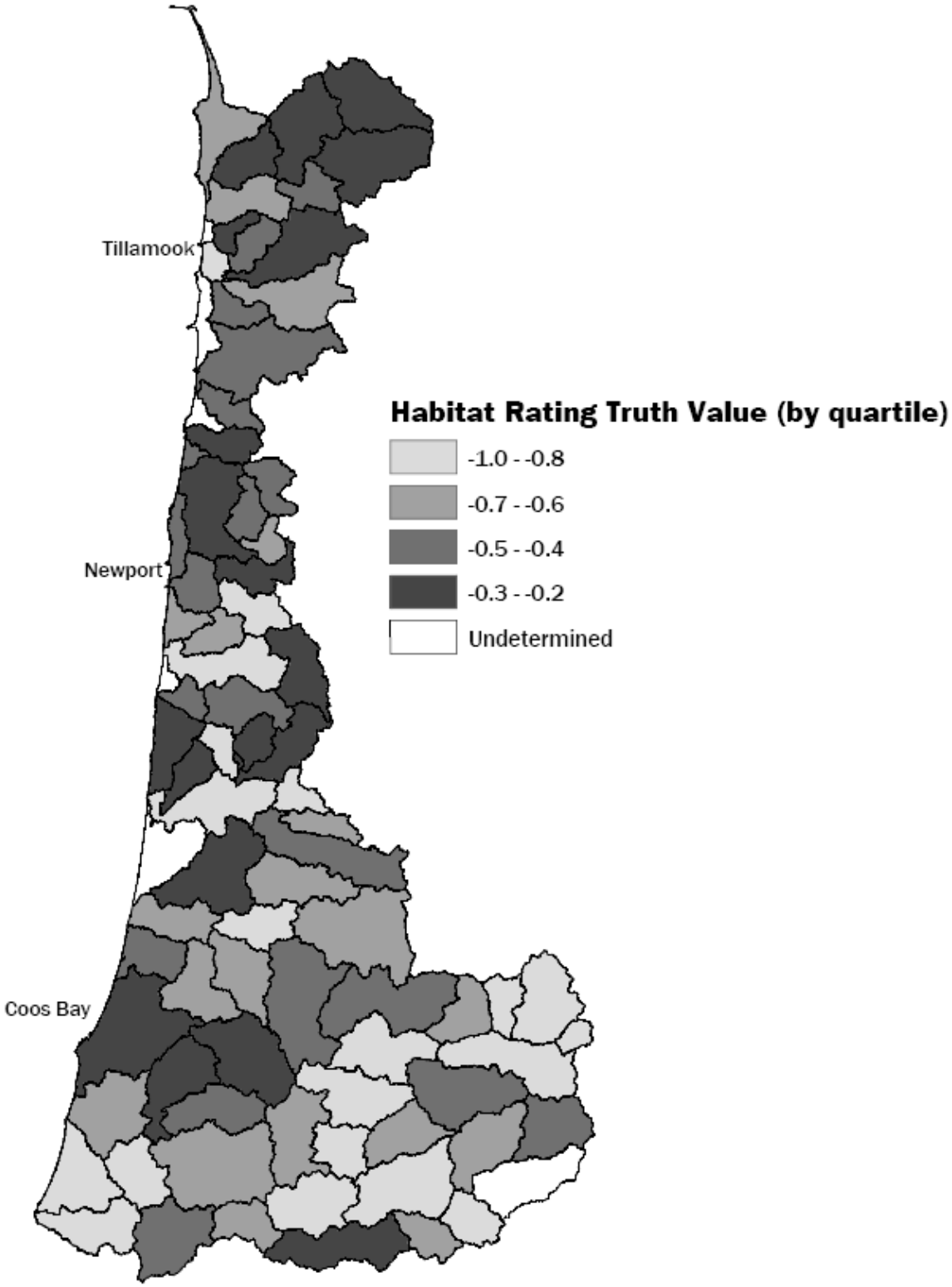

Figure 37. Variation between habitat rating truth values becomes apparent when watersheds are classified by quartiles.

Watershed-Based Truth Values

Fourth-field watershed: Alsea

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710020501	Upper Alsea River	-0.685	-0.538	-0.	-0.3	-0.3	-0.	-0.7	3.047	ODFW	-0.1	-0.3	-0.1
1710020502	Five Rivers / Lobster Creek	-0.373	0.02	0.2	-0.5	0.056	0.	0.123	5.266	ODFW	-0.5	-0.5	0.19
1710020503	Drift Creek	-0.452	0.13	0.5	-0.5	0.133	0.	0.509	5.654	ODFW	-0.3	-0.6	-0.2
1710020504	Lower Alsea River	-1	-0.586	-0.	-1	0.171	0.	-0.8	5.843	ODFW	-9.8	-1	0.11
1710020505	Beaver Creek / Waldport Bay	-0.567	0.03	0.4	-0.6	-0.1	0.	0.668	4.365	ODFW	-0.7	-0.3	0.61
1710020506	Yachats River	-0.698	-0.524	-0.	-0.5	-0.11	0.	-0.7	4.439	ODFW	-0.5	-0.4	0.28
1710020507	Cummins Creek / Tenmile Creek / Mercer Lake Frontal	-0.789	-0.613	-0.	-0.3	-0.5	0.	-0.8	2.435	ODFW	-0.3	-0.2	3.99
1710020508	Big Creek / Vingie Creek	-0.557	-0.412	-0.	0	-0.4	-0.	-0.6	2.698	None			

Fourth-field watershed: Coos

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710030401	South Fork Coos	-0.278	0.08	0.5	-0.4	-0.4	0.	1	2.980	ODFW	-0.4	-0.3	-0.4
1710030402	Millicoma River	-0.468	0.06	0.5	-0.6	-0.1	0.	1	4.183	ODFW	-0.6	-0.4	-0.1
1710030403	Lakeside Frontal	-0.43	0.23	0.8	-0.5	-0.2	0.	1	3.804	ODFW	-0.6	-0.2	-0.4
1710030404	Coos Bay	-0.245	0.20	0.7	-0.4	-0.2	0.	1	3.671	ODFW	-7.0	-0.5	-1.3

Fourth-field watershed: Coquille

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710030501	Coquille S Fk, Lwr	-0.668	-0.631	-0.	-0.5	-0.6	-0.	-0.7	1.827	USFS	-0.5	-0.1	-0.4
1710030502	Middle Fork Coquille	-0.706	-0.465	-0.	-0.7	-0.6	-0.	0.228	1.727	ODFW	-0.7	-0.4	-0.7
1710030503	Middle Main Coquille	-0.793	-0.49	-0.	-0.8	0.167	0.	-0.7	5.822	ODFW	-0.8	-0.5	0.20
1710030504	East Fork Coquille	-0.543	-0.272	0.0	-0.5	-0.6	-0.	1	1.949	ODFW	-0.5	-0.2	-0.5
1710030505	North Fork Coquille	-0.244	0.17	0.4	-0.4	0.177	0.	0.351	5.871	ODFW	-0.1	-0.5	0.21
1710030506	Lower Coquille	-0.628	-0.375	-0.	-0.65	0.504	0.	-0.7	7.504	ODFW	-0.6	-0.6	0.11

Fourth-field watershed: Necanicum

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710020101	Necanicum River	-0.694	-0.434	-0.	-0.7	-0.2	0.	-0.4	3.835	ODFW	-0.7	-0.5	0.14

Fourth-field watershed: Nehalem

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710020201	Upper Nehalem River	-0.306	-0.003	0.1	-0.4	0.057	0.	-0.04	5.274	ODFW	-0.1	-0.5	0.22
1710020202	Middle Nehalem River	-0.255	-0.186	-0.	-0.2	0.119	0.	-0.4	5.583	ODFW	0.0	-0.4	0.35
1710020203	Lower Nehalem River	-0.333	-0.172	-0.	-0.4	0.223	0.	-0.41	6.102	ODFW	-0.1	-0.4	0.22
1710020204	Salmonberry River	-0.513	-0.441	-0.	-0.4	-0.5	-0.	0	2.322	ODFW	-0.4	-6.8	-0.4
1710020205	North Fork Of Nehalem River	-0.054	0.23	0.5	-0.2	0.09	0.	0.464	5.438	ODFW	-0.3	-0.2	0.24
1710020206	Lower Nehalem River / Cook Creek	-0.965	-0.627	-0.	-0.6	0.094	0.	-0.9	5.457	ODFW	-0.6	-0.6	2.09

Fourth-field watershed: North Umpqua

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710030106	Boulder Creek	-1	-0.947	-1	-0.9	-0.8	-1	0	7.818	USFS	-0.7	-0.2	-0.9
1710030107	Middle North Umpqua	-0.74	-0.534	-0.	-0.7	-0.5	-0.	0	2.475	USFS	-0.7	-0.3	-0.7
1710030108	Steamboat Creek	-0.995	-0.987	-0.	-0.9	-0.9	-0.	0	9.539	USFS	-0.9	0.5	-0.9
1710030109	Canton Creek	-1	-1	-1	-0.9	-0.9	-1	0	1.135	ODFW	-0.9	-0.1	-0.9
1710030110	Rock Creek / North Umpqua River	-0.634	-0.543	-0.	-0.6	-0.6	-0.	0	1.730	ODFW	-0.6	-0.4	-0.6
1710030111	Little River	-0.619	-0.497	-0.	-0.4	-0.6	-0.	0	1.768	ODFW	-0.5	-0.4	-0.4
1710030112	Lower North Umpqua River	-0.782	-0.15	0.0	-0.8	0.046	0.	0	5.218	ODFW	-0.8	-0.8	0.44

Fourth-field watershed: Siletz / Yaquina

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710020401	Upper Yaquina River	-0.258	0.12	0.4	-0.4	0.111	0.	0.351	5.544	ODFW	8.6	-0.5	0.17
1710020402	Big Elk Creek	-0.689	-0.047	0.2	-0.7	0.027	0.	0.127	5.126	ODFW	-0.7	-0.5	-0.3
1710020403	Lower Yaquina River	-0.411	-0.115	0.0	-0.5	0.003	0.	-0.1	5.006	ODFW	0.8	-0.6	0.20
1710020404	Upper Siletz River	-1	-1	-1	-0.47	-1	-1	0		ODFW	-0.5	-0.4	2.70
1710020405	Middle Siletz River	-0.335	0.00	0.2	-0.4	0.015	0.	0.453	5.065	ODFW	-8.9	-0.5	0.11
1710020406	Rock Creek / Siletz River	-0.624	-0.068	0.2	-0.7	-0.1	0.	0.618	4.215	ODFW	-0.5	-0.7	-3.7
1710020407	Lower Siletz River	-0.489	-0.261	-0.	-0.4	0.464	0.	-0.6	7.302	ODFW	4.5	-0.5	0.26
1710020408	Salmon River / Siletz / Yaquina Bay	-0.384	-0.313	-0.	-0.4	-0.22	0.	-0.3	3.892	ODFW	-0.1	-0.4	0.10
1710020409	Devils Lake / Moolack Frontal	-0.469	-0.199	0.0	-0.5	-0.42	0.	0.051	2.891	ODFW	0.7	-0.6	0.38

Fourth-field watershed: Siltcoos

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710020701	Waohink River / Siltcoos River / Tahkenitch Lake Frontal	0.02	0.39	0.8	0	-0.2	0.	1	3.931	None			

Fourth-field watershed: Siuslaw

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710020601	Upper Siuslaw River	-0.465	-0.167	-0.	-0.5	0.076	0.	-0.3	5.369	ODFW	6.1	-0.6	0.22
1710020602	Wolf Creek	-0.623	-0.213	-0.	-0.6	-0.1	0.	-0.2	4.457	ODFW	-0.2	-0.7	-0.3
1710020603	Wildcat Creek	-0.756	-0.585	-0.	-0.7	-0.1	0.	-0.7	4.030	ODFW	-0.8	-0.8	0.13
1710020604	Lake Creek	-0.214	-0.021	0.1	-0.3	-0.0	0.	-0.0	4.959	ODFW	-2.8	-0.4	8.60
1710020605	Deadwood Creek	-0.423	-0.286	-0.	-0.3	0.143	0.	-0.6	5.704	USFS	-0.1	-0.4	7.59
1710020606	Indian Creek / Lake Creek	-0.888	-0.349	-0.	-0.9	0.285	0.	-0.5	6.411	ODFW	-0.9	-0.7	0.28
1710020607	North Fork Siuslaw River	-0.355	-0.22	-0.	-0.4	0.316	0.	-0.5	6.568	USFS	-0.4	-0.3	0.11
1710020608	Lower Siuslaw River	-0.926	-0.452	-0.	-0.9	-0.0	0.	-0.5	4.958	ODFW	-0.6	-0.9	6.89

Fourth-field watershed: Sixes

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710030603	Sixes River	-1	-0.748	-1	-0.8	-0.19	0.	-1	4.044	ODFW	-0.8	-0.4	-0.0
1710030604	New River Frontal	-0.685	-0.08	0.2	-0.7	-0.1	0.	1	4.371	ODFW	-0.8	-0.5	0.15

Fourth-field watershed: South Umpqua

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710030201	Upper South Umpqua River	-0.945	-0.8	-0.	-0.5	-0.7	-0.	-0.6	1.133	USFS	-0.5	3.2	-0.5
1710030202	Jackson Creek	-0.973	-0.68	-0.	0	-0.7	-0.	-0.9	1.175	None			
1710030203	Middle South Umpqua River	-0.699	-0.641	-0.	-0.7	-0.6	-0.	-0.6	1.793	ODFW	-0.7	-0.4	-0.6
1710030204	Elk Creek / South Umpqua	-1	-0.873	-1	-0.7	-0.6	-0.	-1	1.499	USFS	-0.3	-0.3	-0.8
1710030205	South Umpqua River	-0.763	-0.633	-0.	-0.7	-0.3	0.	-0.7	3.169	ODFW	-5.2	-0.8	1.89
1710030206	Upper Cow Creek	-1	-1	-1	-0.6	-0.4	-1	0	2.790	ODFW	-0.3	-0.7	-8.5
1710030207	Middle Cow Creek	-0.511	-0.434	-0.	-0.2	-0.3	0.	-0.61	3.077	USFS	-0.3	-0.1	0
1710030208	West Fork Cow Creek	-0.659	-0.452	-0.	-0.6	-0.4	-0.	-0.3	2.660	ODFW	-0.3	-0.7	-0.2
1710030209	Lower Cow Creek	-0.773	-0.657	-0.	-0.7	-0.4	-0.	-0.7	2.967	ODFW	-0.6	-0.8	-0.2
1710030210	Middle South Umpqua River	-1	-0.729	-1	-0.92	0.005	0.	-1	5.015	ODFW	-0.2	-0.9	0.48
1710030211	Myrtle Creek	-0.771	-0.624	-0.	-0.6	-0.3	0.	-0.8	3.446	ODFW	-0.3	-0.6	0.15
1710030212	Ollala Creek / Lookingglass	-0.954	-0.738	-0.	-0.6	-0.3	0.	-0.9	3.130	ODFW	-0.2	-0.7	0.20
1710030213	Lower South Umpqua River	-0.913	-0.683	-0.	-0.8	-0.0	0.	-0.9	4.771	ODFW	-0.8	-0.8	0.90

Fourth-field watershed: Umpqua

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710030301	Upper Umpqua River	-0.545	-0.37	-0.	-0.5	0.23	0.	-0.6	6.138	ODFW	-0.3	-0.5	9.70
1710030302	Calapooya Creek	-0.411	-0.115	0.1	-0.5	-0.2	0.	0.061	3.647	ODFW	-0.5	-0.5	0.45
1710030303	Elk Creek	-0.867	-0.661	-0.	-0.6	-0.2	0.	-0.9	3.661	ODFW	-0.4	-0.6	0.33
1710030304	Middle Umpqua River	-0.71	-0.408	-0.	-0.7	0.372	0.	-0.7	6.845	ODFW	-0.4	-0.7	0.17
1710030305	Lake Creek	-0.731	-0.634	-0.	-0.7	-0.71	-0.	-0.3	1.447	ODFW	-0.7	-0.5	-0.7
1710030306	Upper Smith River	-0.687	-0.365	-0.	-0.7	-0.0	0.	-0.5	4.612	ODFW	-0.2	-0.7	0.30
1710030307	Lower Smith River	-0.188	0.22	0.5	-0.3	0.143	0.	0.544	5.703	ODFW	-0.1	-0.4	0.11
1710030308	Lower Umpqua River	-0.599	0.18	0.2	-0.7	1	0.	0.078	9.979	ODFW	-0.7	-8.2	0.56

Fourth-field watershed: Wilson / Trask / Nestucca

HUC	Watershed	CH	CH U	Bio	Habitat	Rest	Util	Prod	IP	Agenc	Win	Sum	Spawn
1710020301	Little Nestucca River	-0.75	-0.583	-0.	-0.5	-0.2	0.	-0.8	3.753	USFS	0.2	-0.6	5.60
1710020302	Nestucca River	-0.444	-0.376	-0.	-0.4	-0.1	0.	-0.5	4.395	ODFW	-0.0	-0.5	4.50
1710020303	Tillamook River	-0.875	-0.545	-0.	-0.5	0.204	0.	-0.9	6.009	ODFW	-0.6	-0.3	-7.6
1710020304	Trask River	-0.587	-0.471	-0.	-0.6	-0.1	0.	-0.6	4.456	ODFW	-0.6	-0.6	-0.1
1710020305	Wilson River	-0.436	-0.338	-0.	-0.2	-0.1	0.	-0.5	4.328	ODFW	-0.1	-0.3	-0.1
1710020306	Kilchis River	-0.573	-0.426	-0.	-0.4	-0.01	0.	-0.6	4.940	ODFW	-0.5	-0.3	-0.2
1710020307	Miami River	-0.706	-0.499	-0.	-0.3	-0.1	0.	-0.8	4.165	ODFW	-0.4	-0.3	-4.0
1710020308	Tillamook Bay	-0.863	-0.687	-0.	-0.8	-0.4	0.	-0.7	2.630	ODFW	-0.2	-0.8	-0.5
1710020309	Spring Creek / Sand Lake / Neskowin Creek Frontal	-0.953	-0.604	-0.	0	-0.4	0.	-0.9	2.507	None			

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