# CHAPTER 3: FACTORS LEADING TO FEDERAL LISTING

*"Man in his misguidance has powerfully interfered with Nature. He has devastated the forests, and thereby even changed the atmospheric conditions and the climate. Some species of plants and animals have become entirely extinct through man, and the purity of the air is affected by smoke and the like, and the rivers are defiled. These and other things are serious encroachments upon Nature, which men nowadays entirely overlook but which are of the greatest importance, and at once show their evil effect not only upon plants but upon animals as well, the latter not having the endurance and power of resistance of man."*

*Goethe, 1832*

## PURPOSE

To comply with ESA, case law and recovery planning policies, an analysis of threats (*e.g.,* listing factors) identified at the time of and since listing was conducted according to the following guidelines:

1. Directives by the U. S. Government Accountability Office (GAO 2006), from an audit of all recovery plans, to ensure all new recovery plans have criteria evidencing consideration of all factors considered to affect the species at time of listing; and
2. Case law outlining plans must recognize identified threats and recommend appropriate actions to address threats. The administrative record should reflect the agency considered new ESA section 4(a) threats that have arisen since listing, document the existence of new threats or the elimination of a threat since listing, and develop criteria that address these threats Fund for Animals at 111; Defenders of Wildlife v. Babbitt, 130 F. Supp. 2d. 121 {D.D.C. 2001}. The *Federal Register* notices analyses should facilitate the development of criteria that address the factors that affect the species and provide a benchmark to measure whether threats have been reduced or removed.

All pertinent *Federal Register* notices, including both proposed and final listing determinations for the CCC coho salmon were reviewed (Table 5). The listing factors described in this Chapter are those specified at the time of listing and explicitly described in the listing determination notices for which the notice pertained, or those incorporated by reference. The current status of all listing factors were assessed in context to the recovery plan threats analysis and through consultation with staff/personnel from NMFS, DFG, and other entities. All data were catalogued to facilitate tracking of threats at the time of listing, those changed since listing and newly identified threats. Each table records the date and page number of publication in the *Federal Register*, and describes each as it was presented in the *Federal Register* at the time of publication. New and forecasted threats are compared against the listing factors and linked to associated strategies by threat category. These tables can be provided upon request, are part of the administrative record and will be included in the final recovery plan. These analyses allow tracking

during reclassification to a possible downlisted or delisted status, and provide the framework to assessing how implementation will ensure underlying causes of decline are being addressed or mitigated. The status of listing factors and associated recovery criteria to improve conditions and abate threats is outlined in Table 6. The analysis results indicate little to no change in threats since listing; a short summary is provided.

**Table 9: Federal Register Notices analyzed to assess threats and protective measures**

| Date | Citation | Title | Content Description |
|---|---|---|---|
| July 25, 1995 | 60 FR 38011 | Endangered and Threatened Species; Proposed Threatened Status for Three Contiguous ESUs of Coho Salmon Ranging From Oregon Through Central California | Proposed rule: threatened status for CCC coho salmon. |
| October 31, 1996 | 61 FR 56138 | Endangered and Threatened Species; Threatened Status for CCC Coho Salmon ESU | Final rule: threatened status for CCC coho. |
| June 14, 2004 | 69 FR 33102 | Endangered and Threatened Species: Proposed Listing Determinations for 27 ESUs of West Coast Salmonids | Proposed rule: endangered status for CCC coho salmon, threatened status update for CC Chinook, threatened status update for CCC steelhead, threatened status update for NC steelhead. |
| June 28, 2005 | 70 FR 37160 | Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs | Final rule, endangered status for CCC coho salmon, threatened status update for CC Chinook salmon. Extend final listing for *O. mykiss* DPSs. |

## FACTORS AFFECTING CCC COHO SALMON AT THE TIME, AND SINCE, LISTING

Section 4(a)(1) of the ESA and NMFS implementing regulations (50 CFR Part 424) direct NMFS to determine if a species is threatened or endangered through one or a combination of the following factors:

**Federal Register Listing Factors:**

**(A) The present or threatened destruction, modification or curtailment of habitat or range;**

**(B) Overutilization for commercial, recreational, scientific, or educational purposes;**

**(C) Disease or predation;**

**(D) Inadequacy of existing regulatory mechanisms; or**

**(E) Other natural or man-made factors affecting its continued existence.**

Through the regulatory process, the Secretary of Commerce has determined that the CCC coho salmon ESU is an endangered species based on the combination of the five factors as summarized below. The factors threatening naturally reproducing coho salmon throughout its range are numerous and varied. For the CCC coho salmon ESU the present depressed condition is the result of several long-standing

human-induced factors (*e.g.*, habitat degradation, harvest, water diversions, and artificial propagation) that serve to exacerbate the adverse effects of natural environmental variability from such factors as drought and poor ocean conditions (61 FR 56138).

## Factor A (At Time of Listing): Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Logging, agriculture and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals and unscreened diversions for irrigation contributed to the decline of the CCC coho salmon ESU. Land use activities associated with logging, road construction, urban development, mining, agriculture, and recreation have significantly altered coho salmon habitat quantity and quality (61 FR 56138). Impacts of concern associated with these activities include the following: alteration of streambank and channel morphology, alteration of ambient stream water temperatures, elimination of spawning and rearing habitat, fragmentation of available habitats, elimination of downstream recruitment of spawning gravels and LWD, removal of riparian vegetation resulting in increased stream bank erosion, and degradation of water quality (61 FR 56138). Of particular concern was the increased sediment input into spawning and rearing areas resulting from the loss of channel complexity, pool habitat, suitable gravel substrate, and LWD (61 FR 56138). Decreased large woody material in streams also reduced habitat complexity and contributed to the loss of cover, shade, and pools which are required by juvenile coho salmon (60 FR 38011). Logging activities altered the natural hydrograph.

Agricultural practices contributed to the degradation of salmonid habitat in the ESU through irrigation diversions, overgrazing in riparian areas, and compaction of soils in upland areas from livestock. Habitat degradation resulting from the negative impacts of livestock grazing on riparian vegetation are described in 61 FR 56138. Urbanization has degraded coho salmon habitat through stream channelization, changes to the hydrologic regime (including floodplain drainage), riparian damage, and point source and non-point pollution (including sediments with trace metals, pesticides, herbicides, fertilizers, gasoline, and other petroleum products).

Depletion and storage of natural flows have drastically altered natural hydrological cycles in many central California rivers and streams. Alteration of stream flows has increased juvenile salmonid mortality for a variety of reasons described in 61 FR 56138. Reduced flows degrade or diminish fish habitats via increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, encroachment of riparian and non native vegetation into spawning and rearing areas, and increased water temperatures (60 FR 38011; 61 FR 56138).

The destruction or modification of estuarine areas has resulted in the loss of important rearing and migration habitats. California has experienced a 91 percent loss of its wetland habitat.

## Factor A (Since Listing): Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

No significant changes to this factor have occurred since listing and the threats remain. Land use activities associated with logging, road construction, urban development, mining, agriculture, ranching, and recreation, and their associated impacts continue to result in the loss, degradation, simplification, and fragmentation of CCC coho salmon habitat, and cause resulting declines in CCC coho salmon populations. Depletion and storage of natural flows have drastically altered natural hydrological cycles in many central California rivers and streams. Many habitat blockages, including major dams such as Coyote and Warm Springs Dams located in the Russian River Basin, exist within the ESU.

## Factor B (At Time of Listing): Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Coho salmon were historically a part of tribal fisheries, and were targeted in recreational and commercial fisheries since the early 1800s. Overfishing in the early days of European settlement led to the depletion of many stocks of salmonids, prior to extensive modifications and degradation of natural habitats (69 FR 33102). Marine harvest of coho salmon occurs primarily in nearshore waters off British Columbia, Washington, Oregon, and California. Recreational fishing for coho salmon was pursued in numerous streams throughout the central California coast when adults return on the fall spawning migration. Coho salmon stocks were managed by NMFS in conjunction with the Pacific Fisheries Management Council, the States, and certain tribes. The central California coast falls within the Federal salmon fishery management zone stretching from Horse Mountain, just north of Fort Bragg, California, to the Mexico border. Coho salmon ocean harvests were managed by setting escapement goals for Oregon Coastal Natural coho salmon. This stock aggregate constituted the largest portion of naturally produced coho salmon caught in ocean salmon fisheries off California and Oregon. Using this index may have resulted in pre-1994 exploitation rates higher than central California populations could sustain. The confounding effects of habitat deterioration, drought, and poor ocean conditions on coho salmon survival make it difficult to assess the degree to which recreational and commercial harvest have contributed to the overall decline of coho salmon in West Coast rivers (61 FR 56138). However, during periods of decreased habitat availability (*e.g.*, drought conditions) the impacts of incidental capture from recreational fishing may be heightened.

Collection for scientific research and educational programs had little or no impact on California coho salmon populations. In California, most of the scientific collection permits are issued to environmental consultants, Federal resource agencies, and educational institutions by DFG and NMFS. Regulation of take is controlled by conditioning individual permits. DFG and NMFS require reporting of any coho salmon taken incidental to other monitoring activities; however, no comprehensive total or estimate of coho salmon mortalities related to scientific sampling are kept for any watershed in California. DFG does not believe that indirect mortalities associated with scientific use are detrimental to coho salmon in California (61 FR 56138).

## Factor B (Since Listing): Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

No significant changes to this factor have occurred since listing and the threats remain. State sport fishing regulations no longer allow retention of CCC coho salmon in inland or nearshore waters. Commercial harvest of coho salmon is not permitted in California. A global moratorium on high seas driftnet fishing (via a United Nations resolution implemented by the US in 1992) has reduced the impact of this threat to salmonids. Collection for scientific research and education programs is currently not being tracked; therefore, it is unknown how collecting may be affecting CCC coho salmon populations. Given the extremely low population, any collection may have a significant adverse effect and should be monitored.

## Factor C (At Time of Listing): Disease or Predation

Relative to the effects of fishing, habitat degradation, and hatchery practices, disease and predation were not believed to be major factors contributing to the decline of West Coast coho salmon populations. However, disease and predation may have substantial adverse impacts in local areas.

Coho salmon are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment. Specific diseases known to be present in and affect salmonids are listed in 69 FR 33102. Very little current or historical information existed to quantify changes in infection levels and mortality rates attributable to these diseases for coho salmon. However, studies have shown native fish tend to be less susceptible to these pathogens than hatchery-reared fish (Buchanan *et al*., 1983; Sanders *et al.,* 1992). In California, many natural and hatchery coho salmon populations were tested positive for the bacterium *Renibacterium salmoninarum*, the causative agent of bacterial kidney disease (BKD). Within the CCC coho salmon ESU, the overall incidence of BKD infection in fish at Scott and Waddell Creeks was believed to be 100 percent (61 FR 56138). Stress, caused by migration or poor water quality or quantity, may trigger the onset of the disease. DFG initiated a treatment protocol to attempt to control BKD outbreaks in hatchery fish released into the Russian River and Scott Creek (61 FR 56138).

Introductions of non-native species and habitat modifications resulted in increased predator populations in numerous rivers and lakes. Predation by marine mammals (primarily harbor seals and California sea lions) was also of concern in areas experiencing dwindling run sizes of salmon. Predation by seabirds can decrease the survival of juvenile coho salmon. Known avian predators include ring-billed gulls, common merganser, herons, cormorants, and alcids. Piscivorous predators may also affect the abundance and survival of salmonids. Although predation does occur, it is believed to be a minor factor in the overall decline of coastwide salmonid populations. The increased impact of certain predators was largely the result of ecosystem modification related to habitat changes and a decrease in water quantity and quality. For example, decreases in cover habitat and adequate migration and rearing flows make fish more vulnerable to predation.

## Factor C (Since Listing): Disease or Predation Since Time of Listing

The threats identified at the time of listing remain. Relative to other effects (*i.e.*, habitat degradation and hatchery practices), disease and predation are not believed to be major factors contributing to the decline of West Coast coho salmon populations (61 FR 56138). Predation by marine mammals (principally seals and sea lions) is of concern in areas experiencing dwindling run sizes of salmon (69 FR 33102) and has been found to be watershed specific. Predation by marine mammals coincidental with salmonid migrations may, in some cases, kill a significant fraction of a run and local depletion might occur (NMFS 1997; Quinn 2005). Habitat conditions such as low water flows and high temperatures can exacerbate susceptibility to infectious diseases (69 FR 33102).

## Factor D (At Time of Listing): Inadequacy of Existing Regulatory Mechanisms

Despite the Federal and non-federal efforts, due to funding and implementation uncertainties, and the voluntary nature of many programs, the regulatory mechanisms that existed at the time of listing were determined as not providing sufficient certainty that combined Federal and non-federal efforts are reducing threats to CCC coho salmon. The information below outlines what the FRN articulated on each topic at the time of listing.

### Federal Efforts

The U.S. Army Corps of Engineers (USACE) regulates dredging and filling in the waters of the United States through the Clean Water Act (CWA) Section 404 Program. The USACE program is implemented through the issuance of a variety of Individual, Nation-Wide and Emergency permits. USACE does not permit a discharge that would "cause or contribute to significant degradation of the waters of the United States." One of the factors that must be considered in this determination is cumulative effects. However, COE guidelines do not specify a methodology for assessing cumulative impacts or how much weight to assign them in decision-making. Furthermore, COE does not have in place any process to address the cumulative effects of the continued development of water front, riverine, coastal, and wetland properties. A variety of factors, including inadequate staffing, training, and in some cases policy direction, results in ineffective protection of aquatic habitats important to migrating, spawning, or rearing coho salmon. The deficiencies of the current program are particularly acute during large-scale flooding events, such as those associated with EI Nino conditions, which can put additional strain on the administration of the CWA Section 404 program.

The Federal Emergency Management Agency (FEMA) administers a Flood Insurance Program which strongly influences the development in waterways and floodplains. Regulations allow for development in the margins of active waterways if they are protected against 100-year flood events, and do not raise the water elevations within the active channel (floodway) more than one foot during such flood events. This standard did not adequately reflect the dynamic, mobile nature of watercourses in the CCC coho salmon ESU, and the critical role that margins of active waterways (riparian areas) play in the maintenance of aquatic habitats. FEMA conducts technical and financial assistance to public and private property owners who incur damages from flooding resulting from natural disasters. FEMA programs for repairing flood related damages (Public Assistance Program, Individual and Households Program, and Hazard Mitigation Grant Program) promote the replacement of damaged facilities and structures in their

original locations, which are prone to repeated damage from future flooding, and thus lead to repeated disturbance of riparian and aquatic habitats important to migrating, spawning, or rearing steelhead.

The CWA intent to protect beneficial uses associated with aquatic habitats, including fishery resources had not been found fully effective in adequately protecting fishery resources, particularly with respect to non-point sources of pollution (including increased sedimentation from routine maintenance and emergency flood control activities within the active channel and floodplain).

Section 303(d)(1)(C) and(D) of the CWA requires states to prepare Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards. TMDLs are a method for quantitative assessment of environmental problems in a watershed and identifying pollution reductions needed to protect drinking water, aquatic life, recreation, and other use of rivers, lakes, and streams. TMDLs may address all pollution sources including point sources such as sewage or industrial plant discharges, and non-point discharges such as runoff from roads, farm fields, and forests.

The CWA gives state governments the primary responsibility for establishing TMDLs. However, the Environmental Protection Agency (EPA) is required to do so if a state does not meet this responsibility. EPA made a commitment guaranteeing that either EPA or the State of California will establish TMDLs that identify pollution reduction targets for 18 impaired river basins in California by the year 2007. The State of California made a commitment to establish TMDLs for approximately half the 18 river basins by 2007. EPA outlined they would develop TMDLs for the remaining impaired basins in the State and agreed to complete all TMDLs if the State failed to meet its commitment by 2007. The ability of these TMDLs to protect salmon and steelhead should be significant in the long term. However, implementation of this statute was not determined as adequate to protect coho salmon habitat at the time of listing with their efficacy in protecting salmonid habitat uncertain.

The North Coast Regional Water Quality Control Board was in the process of updating its north coast basin plan, which would establish water quality standards for all of the northern California rivers and streams (including the Ten Mile, Noyo, Navarro, Garcia, Gualala and Russian Rivers). These plans would also incorporate TMDL standards developed for water bodies that are listed as 303(d) impaired under section 303(d) of the CWA. These plans were anticipated to help reduce human impacts to aquatic environments and thus protect ESA listed salmonids.

NMFS staff conduct ESA section 7 consultations with Federal action agencies that fund, conduct or authorize projects in the range of CCC coho salmon. NMFS evaluates mpacts to CCC coho salmon from a wide variety of projects including: irrigation and water diversion, timber harvest, watershed restoration, fish passage, gravel mining, grazing, and transportation projects. One important consultation was the Potter Valley Project (which included the Russian River). Other important consultations were ongoing with the USACE and the Sonoma County Water Agency (for the Russian River). These consultations were expected to improve, or minimize adverse impacts to, the CCC coho salmon ESU and associated habitat. NMFS was engaged in an ongoing effort to assist in the development of HCPs for State and private lands under section 10 of the ESA.

The National Forest Plan (NFP) is a Federal management policy with potential benefits for CCC coho salmon. Under the NFP the US Forest Service (USFS) and the Bureau of Land Management (BLM) made

efforts to reduce adverse effects to aquatic and riparian dependent species including salmon in the range of the Northern spotted owl. The most significant element of the NFP for anadromous fish is its Aquatic Conservation Strategy, which includes an objective for salmon habitat conservation. However, Federal lands comprise only about five percent of the CCC coho salmon ESU, a proportion too small to secure recovery even with the strictest of Federal forest management practices.

The PFMC manages ocean fisheries consistent with NMFS' requirements for listed salmonids. This management reduced the impact of ocean harvest to listed salmon such as the coho salmon. While ocean fishing is regulated to reduce impact on coho salmon, State sport fishing regulations continue to allow fishing for coho salmon in inland waters.

The Pacific Coastal Salmon Recovery Fund allowed NMFS to provide annual grants to the State to assist salmon recovery efforts in coho watersheds from the Oregon border to southern California – the program as implemented by the state was competitive in nature, and did not adequately prioritize funding based on listing status and ESU.

### Non-Federal Efforts

Several management efforts were implemented to protect listed salmonid ESUs in California. These included restricted exploitation rates on Rogue River/Klamath River hatchery stocks to protect CCC coho salmon and no retention take prohibitions for coho salmon in the marine environment off the coast of California.

Due to the lack of comprehensive abundance and trend data for coastal salmonids, the DFG funded a development effort for a Statewide coastal salmonid monitoring plan, and monitoring program. DFG and NMFS identified the need for a programmatic coordinated effort which would utilize peer-reviewed and standardized methodologies as a critical need in assessing the viability of listed ESU's.

Resource Conservation Districts (RCDs) along the California coast allow the agricultural community to voluntarily address and correct management practices impacting ESA listed salmonids and their habitats. The RCDs assist landowners in developing and implementing best management practices protective of salmonids.

The Rangeland Management Advisory Committee developed a management plan for inclusion in the State's Non-point Source Management Plan. The purpose of the plan was to maintain and improve the quality and associated beneficial uses of surface water that passes through rangeland resources.

Long-term sustained gravel mining plans were being developed by Mendocino County, which comprises a significant portion of the range of the CCC coho salmon with extant independent populations.

A Memorandum of Understanding between NMFS and five northern California counties (including Mendocino) was developed to create standardized county routine road maintenance manual to assist in the protection of ESA listed species and their habitat. This manual includes best management practices (BMPs) for reducing impacts to listed species and the aquatic environment, a five-county inventorying and prioritization of all fish passage barriers associated with county roads, annual training of road crews and county planners, and a monitoring framework for adaptive management.

The Sotoyome RCD developed a voluntary certification program (Fish Friendly Farming) for grape growers in Sonoma and Mendocino Counties who implemented land management practices that decrease soil erosion and sediment delivery to streams.

FishNet 4C is a multi-county group comprised of representatives from Mendocino, Sonoma, Marin, San Mateo, and Santa Cruz Counties. The program coordinated county efforts such as road maintenance, fish barrier assessment and removal, riparian and grading ordinances, erosion control, implementation of bioengineering projects and the development of guidelines for public works departments that enhance or protect salmonid habitat.

Local watershed councils and other groups throughout California successfully developed restoration plans and worked to implement habitat restoration projects expected to contribute to the conservation of listed salmonid ESUs. In the range of the CCC coho salmon ESU watershed, groups are addressing: Tomales Bay, Lagunitas Creek, and the Russian River.

Many other sub-watershed groups, landowners, environmental groups, and non-profit organizations throughout the range of CCC coho salmon conducted habitat restoration and planning efforts that may contribute to species conservation.

The California State Water Resources Control Board (SWRCB) administers a water rights permitting system which controls utilization of waters for beneficial uses throughout the State. This system, while it contains provisions (including public trust provisions) for the protection of instream aquatic resources, does not provide an explicit regulatory mechanism to implement DFG Code Section 5937 requirements to protect fish populations below impoundments. Additionally, SWRCB generally lacks the oversight and regulatory authority over groundwater development comparable to surface water developments for out-of-stream beneficial uses.

Local governments have the most direct responsibility for permitting land uses on non-Federal and non-State owned lands. Local efforts to control development within the floodplains and active channels is in many cases limited to the protection of public properties such as county or city roads, bridges, and other infrastructure. Local government regulation of floodplain development depends to a large extent on the standards provided by FEMA's Flood Insurance Program which does not explicitly provide for the protection of natural fluvial processes essential for the maintenance of naturally functioning riverine and riparian habitats important for coho salmon migration, spawning, and rearing.

The State of California's forest practice rules (FPRs) contain provisions that can be protective of coho salmon if fully implemented. However, the Board of Forestry did not adopt DFG's proposal to designate coho salmon as a sensitive species, preventing adoption of special management practices for sensitive species and their habitat.

## Factor D (Since Listing): Inadequacy of Existing Regulatory Mechanisms

Other than those listed below, no significant changes to this factor have occurred since listing and the threats remain. A variety of State and Federal regulatory mechanisms exist to protect coho salmon habitat and address the decline in the ESU, but they have not been adequately implemented (61 FR 56138 at 56143). Collectively protective efforts do not provide sufficient certainty of implementation and effectiveness to substantially ameliorate the level of assessed extinction risk for the CCC coho salmon ESU (70 FR 37160 at 37190).

Changes in Federal and non-federal efforts include: (1) the issuance of California's Recovery Strategy for California Coho Salmon and (2) the issuance of a final biological opinion for the Sonoma County Water Agency's activities in the Russian River and (3) under a court order, the State of California with assistance from EPA have developed TMDLs for nearly all of the 18 impaired rivers. The Statewide coastal monitoring program, funded by the DFG, California's Watershed Protection Program and the PACFISH or Infish, the sister plan for non-Columbia River Basin, have not been funded, developed and/or implemented as anticipated. While the Statewide Coastal Monitoring Plan is in final draft, the delay in funding and implementing the Statewide Coastal Monitoring Program is a concern, and remains a top priority within the CCC coho salmon recovery plan.

## Factor E (At Time of Listing): Other Natural and Man-made Factors Affecting the Species' Continued Existence

Long-term trends in rainfall and marine productivity associated with atmospheric conditions in the North Pacific Ocean had a major influence on coho salmon production. Natural climatic conditions may have exacerbated or mitigated the problems associated with degraded and altered riverine and estuarine habitats (69 FR 33102 2004). Coho salmon have evolved behaviors and life history traits allowing them to survive a variety of environmental conditions. When populations are fragmented or reduced in size and range, however, they are more vulnerable to extinction by natural events.

The effects of extended drought on water supplies and water temperatures were a major concern for California populations of coho salmon. Drought conditions reduced the amount of water available, resulting in reductions (or elimination) of flows needed for adult coho salmon passage, egg incubation, and juvenile rearing and migration. The decline of many coho salmon populations began prior to numerous years of drought conditions in California.

Flood events increased sedimentation to streams, particularly in areas with inherent erosion risk, urban encroachment, intensive timber management, and land disturbances resulting from logging, road construction, mining, urbanization, livestock grazing, agriculture, and fire. Sedimentation of stream beds

was implicated as a principal cause of declining salmonid populations throughout their range. Central coastal California has some of the most erodible terrain in the world. In this region, catastrophic erosion and subsequent stream sedimentation (such as during the 1955 and 1964 floods) resulted from areas which had been clearcut or had roads constructed on unstable soils (61 FR 56138).

Poor ocean conditions were believed to have a prominent role in the decline of coho salmon populations in California. Unusually warm ocean surface temperatures and associated changes in coastal currents and upwelling, known as El Niño conditions, resulted in ecosystem alterations such as reductions in primary and secondary productivity and changes in prey and predator species distributions. El Niño was often cited as a cause for the decline of West Coast salmonids. Near-shore conditions during the spring and summer months along the California coast may have dramatically affected year-class strength of salmonids (Kruzic *et al.* 2001). Coho salmon along the California coast may be especially sensitive to upwelling patterns because of the lack of other coastal habitat types that normally buffer adverse oceanographic effects (*i.e.*, extensive bays, straits, and estuaries). The paucity of high quality near-shore habitat, coupled with variable ocean conditions, makes freshwater rearing habitat more crucial for the survival and persistence of many coho salmon populations.

The use of artificial propagation had a significant impact on the production of West Coast coho salmon. Non-native coho salmon stocks were introduced as broodstock in hatcheries and widely transplanted in many coastal rivers and streams in central California (Bryant 1994; Weitkamp et al. 1995). Potential problems associated with hatchery programs include genetic impacts on indigenous, naturally-reproducing populations (Waples 1991), disease transmission, predation of wild fish, difficulty in determining wild stock status due to incomplete marking of hatchery fish, depletions of wild stock to increase brood stock, and replacement rather than supplementation of wild stocks through competition and continued annual introduction of hatchery fish (61 FR 56138).

While non-native fish were introduced in the CCC coho salmon ESU, most hatchery programs were currently conducted without inter-ESU import of broodstock. Hatchery fish releases were conducted based on a determination that the hatchery stocks are considered similar to the native run. Efforts were made to return hatchery fish to their natal streams, and they are held for an acclimation period to increase the probability of imprinting. However, there were inadequate resources to tag enough hatchery coho salmon to monitor return rates and rates of straying (61 FR 56138).

## Factor E (Since Listing): Other Natural and Man-made Factors Affecting the Species' Continued Existence

No significant changes to this factor have occurred since listing and the threats remain. The best available scientific information indicates that the Earth's climate is warming, driven by the accumulation of greenhouse gasses in the atmosphere (Oreskes 2004; Battin *et al.* 2007; Lindley *et al*. 2007). Because CCC coho salmon depend upon freshwater streams and the ocean during different stages of their life history cycle, the population is likely to be significantly impacted by climate change.

## Table 10: Listing Factors, Status and Associated Recovery Criteria References

| Listing Factor A: Habitats | Status of Listing Factor | See Restoration, ESU or Threat Abatement Actions/Criteria |
|---|---|---|
| **Agriculture** | Persisting; Expected to worsen | Threats (Agriculture; Logging) |
| **Estuarine modification** | Persisting; Expected to worsen | Threats (Channel Modification) |
| **Forestry** | Persisting; Expected to worsen | Threats (Logging) |
| **Freshwater Conditions** | Persisting; Expected to worsen | All Restoration |
| **Habitat Degradation** | Persisting; Expected to worsen | All Restoration |
| **Mining** | Persisting; Watershed specific | Threat (Mining) |
| **Removal of Riparian Habitat** | Persisting; Expected to worsen | Restoration (Riparian) |
| **Removal of Wetland Habitat** | Persisting; Expected to worsen | Restoration (Off channel) |
| **Urbanization** | Persisting; Expected to worsen | Threat (Development) |
| **Water Diversions** | Persisting; Expected to worsen | Threat (Water Diversion) |
| **Wildfires** | Currently Low; Expected to worsen | Threats (Fire) (Climate Change) |

| Listing Factor B: Overutilization | Status of Listing Factor | See Restoration, ESU or Threat Abatement Actions/Criteria |
|---|---|---|
| **Collection** | Persisting; Magnitude unknown; Information needed | Criteria Needed |
| **Freshwater Harvest** | Persisting; Expected to worsen | Threat (Fishing) |
| **Illegal Harvest** | Persisting; Expected to worsen | Threat (Fishing) |
| **Overfishing** | Improved; Bycatch and freshwater interception persisting; Magnitude unknown | Threat (Ocean Harvest & Fishing) |

| Listing Factor C Disease & Predation | Status of Listing Factor | See Restoration, ESU or Threat Abatement Actions/Criteria |
|---|---|---|
| **Avian Freshwater Predation** | Persisting; Magnitude unknown | Threat (Disease, Predation, Competition) |
| **Predation** | Persisting; Magnitude watershed specific | Threat (Disease, Predation, Competition) |
| **Disease and Predation** | Disease Improved; Predation Persisting; Watershed specific | Threat (Disease, Predation, Competition) |
| **Infectious Disease** | Threat Unknown; Magnitude unknown | Threat (Disease, Predation, Competition) |
| **Marine Mammal Predation** | Persisting; Magnitude watershed specific | Threat (Disease, Predation, Competition) |
| **Marine Predation** | Threat Unknown; Magnitude unknown | Threat (Disease, Predation, Competition) |
| **Piscivorous Predators** | Threat Unknown; Magnitude unknown | Threat (Disease, Predation, Competition) |
| **Predation** | Persisting; Magnitude unknown | Threat (Disease, Predation, Competition) |
| **Predation by non-native species** | Persisting; Magnitude unknown | Threat (Disease, Predation, Competition) |
| **Predation by seabirds** | Persisting; Magnitude unknown | Threat (Disease, Predation, Competition) |

**Table 6 (cont.): Listing Factors, Status and Associated Recovery Actions and Criteria**

| Listing Factor D<br>Inadequate Regulatory Mechanisms | Status of Listing Factor | Criteria |
|---|---|---|
| **All Federal, State, local governments, municipalities and others** | Threat Persisting; Expected to worsen | |

| Listing Factor E<br>Other Factors | Status of Listing Factor | See Restoration, ESU or Threat Abatement Actions/Criteria |
|---|---|---|
| **Artificial Propagation** | Improved; Conservation practices implemented | Hatchery Criteria (Spence *et al.* 2008) |
| **Drought** | Persisting; Expected to worsen | Threat (Drought) |
| **El Nino conditions** | Persisting; Expected to worsen | Threat (Marine) |
| **Floods** | Persisting; Expected to worsen | Threat (Storms & Flooding) |
| **Floods – scour** | Persisting; Expected to worsen | Threat (Storms & Flooding) |
| **Floods – sediment** | Persisting; Expected to worsen | Threat (Storms & Flooding) |
| **Floods – sedimentation** | Persisting; Expected to worsen | Threat (Storms & Flooding) |
| **Floods – erosion** | Persisting; Expected to worsen | Threat (Storms & Flooding) |
| **Forest Fires** | Persisting; Expected to worsen | Threat (Fire) |
| **Hatchery Programs** | Improved; Conservation practices implemented | HGMP and Hatchery Criteria (Spence *et al.* 2008) |
| **Natural Climatic Conditions** | Persisting; Expected to worsen | Threat (Climate Change) |
| **Natural Events** | Threat Persisting; Expected to worsen | Threats (Storms & Flooding; Drought; Climate Change) |
| **Ocean Conditions** | Threat Persisting; Expected to worsen | Threat (Marine) |
| **Ocean Conditions - El Nino** | Threat Persisting; Expected to worsen | Threat (Marine) |