Monday
March 9, 1998

Part II

Department of Commerce

National Oceanic and Atmospheric Administration

50 CFR Parts 222, 226, and 227

Endangered and Threatened Species: West Coast Chinook Salmon; Listing Status Change; Proposed Rule

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 222, 226, and 227

[Docket No. 980225050–8050–01; I.D. 022398C]

RIN 0648–AK65

Endangered and Threatened Species: Proposed Endangered Status for Two Chinook Salmon ESUs and Proposed Threatened Status for Five Chinook Salmon ESUs; Proposed Redefinition, Threatened Status, and Revision of Critical Habitat for One Chinook Salmon ESU; Proposed Designation of Chinook Salmon Critical Habitat in California, Oregon, Washington, Idaho

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; proposed redefinition; proposed designation and revision of critical habitat; request for comments.

SUMMARY: NMFS completed a comprehensive status review of west coast chinook salmon (*Oncorhynchus tshawytscha,* or *O. tshawytscha*) populations in Washington, Oregon, Idaho, and California in response to petitions filed to list chinook salmon under the Endangered Species Act (ESA). Based on this review, NMFS identified a total of 15 Evolutionarily Significant Units (ESUs) of chinook salmon within this range, including two Snake River ESUs already listed under the ESA, one previously identified ESU (mid-Columbia River summer/fall run) for which no listing was proposed, and one population (Sacramento River winter run) that was listed as a ‘‘distinct population segment’’ prior to the formulation of the NMFS ESU policy. With respect to the 12 ESUs that are the subject of this proposed rule, NMFS has concluded that two ESUs are at risk of extinction and five ESUs are at risk of becoming endangered in the foreseeable future. NMFS also concluded that one currently listed ESU should be redefined to include additional chinook salmon populations and that this redefined ESU is at risk of becoming endangered in the foreseeable future. NMFS also concluded that four ESUs are not at risk of extinction nor at risk of becoming endangered in the foreseeable future. Finally, NMFS also renamed the previously identified Mid-Columbia River summer/fall-run ESU as the Upper Columbia River summer/fall-run ESU.

NMFS is now issuing a proposed rule to list two ESUs as endangered, five ESUs as threatened, and to redefine one currently listed ESU to include additional chinook populations, under the ESA. The endangered chinook salmon are located in California (Central Valley spring-run ESU) and Washington (Upper Columbia River spring-run ESU). The threatened chinook salmon are dispersed throughout California, Oregon, and Washington. They include the California Central Valley fall-run ESU, the Southern Oregon and California Coastal ESU, the Puget Sound ESU, the Lower Columbia River ESU, and the Upper Willamette River ESU. NMFS also proposes to redefine the Snake River fall-run chinook salmon ESU to include fall chinook salmon populations in the Deschutes River, and proposes to list this redefined ESU as a threatened species. This proposal does not affect the current definition and threatened status of the listed Snake River fall chinook salmon ESU.

In each ESU identified as threatened or endangered, only naturally spawned, non-introduced chinook salmon are proposed for listing. Prior to the final listing determinations, NMFS will examine the relationship between hatchery and natural populations of chinook salmon in these ESUs and assess whether any hatchery populations are essential for the recovery of the natural populations and thus will be listed.

NMFS is proposing to designate critical habitat for the chinook salmon ESUs newly proposed for listing within this notice, and for the Snake River fall-run ESU, proposing to revise its existing critical habitat. At this time, proposed critical habitat for these ESUs is the species’ current freshwater and estuarine range, certain marine areas, and includes all waterways, substrate, and adjacent riparian zones below longstanding, impassible, natural barriers.

NMFS is requesting public comments on the issues pertaining to this proposed rule. NMFS is also requesting suggestions and comments on integrated local/state/tribal/Federal conservation measures that will achieve the purposes of the ESA to recover the health of chinook salmon populations and the ecosystems upon which they depend. Should the proposed listing be made final, NMFS will adopt protective regulations and a recovery plan under the ESA.

DATES: Comments must be received by June 8, 1998. NMFS will announce the dates and locations of public hearings in Washington, Oregon, Idaho, and California in a forthcoming **Federal Register** notice. Requests for additional public hearings must be received by April 23, 1998.

ADDRESSES: Comments on this proposed rule, requests for reference materials, and requests for public hearings should be sent to Chief, Protected Species Division, NMFS, 525 NE Oregon Street, Suite 500, Portland, OR 97232–2737.

FOR FURTHER INFORMATION CONTACT: Garth Griffin, 503–231–2005, Craig Wingert, 562–980–4021, or Joe Blum, 301–713–1401.

SUPPLEMENTARY INFORMATION:

Previous Federal ESA Actions Related to West Coast Chinook

West Coast chinook salmon have been the subject of many Federal ESA actions. In November 1985, NMFS received a petition to list Sacramento River winter-run chinook salmon from the American Fisheries Society (AFS). NMFS determined that the petitioned action might be warranted and announced it would conduct a review of the run’s status (51 FR 5391, February 13, 1986). In its status review, NMFS determined that Sacramento River winter-run chinook salmon was a ‘‘species’’ for the purposes of the ESA, but based upon the conservation and restoration efforts by California and other Federal resource agencies, declined to list the winter-run chinook at that time (52 FR 6041, February 27, 1987). Subsequent low returns prompted NMFS to adopt an emergency rule listing Sacramento River winter-run chinook salmon as a threatened species under the ESA (54 FR 10260, August 4, 1989). NMFS then issued a proposed rule to list Sacramento River winter-run chinook as a threatened species under the ESA (55 FR 102260, March 20, 1990), and also published a second emergency rule listing the winter-run chinook as threatened to avoid any lapse in ESA protections while considering the proposed rule (55 FR 12191, April 2, 1990). On November 5, 1990, NMFS completed its listing determination for Sacramento River winter-run chinook, and published a final rule listing the run as a threatened species under the ESA (55 FR 46515).

In June 1991, AFS petitioned NMFS to reclassify the winter-run as an endangered species. Based on the information submitted by AFS, and after reviewing all other available data, NMFS determined that the petitioned action may be warranted, and announced its intention to review the status of the winter-run chinook (56 FR 58986, November 7, 1991), and then published a proposed rule to reclassify winter-run chinook salmon as endangered under the ESA (57 FR 27416, June 19, 1992). Critical habitat for Sacramento winter-run chinook salmon was designated on June 16, 1993 (58 FR 33212). After several extensions of the listing determination and the comment period, NMFS finalized its proposed rule and re-classified the winter-run chinook as an endangered species under the ESA (59 FR 440, January 4, 1994).

While NMFS was reviewing and reclassifying the status of Sacramento River chinook, NMFS also received a petition from Oregon Trout and five co-petitioners on June 7, 1990, to list Snake River spring/summer and fall chinook salmon as threatened species under the ESA. On September 11, 1990, NMFS determined that the petition presented substantial scientific information indicating that the proposed action may be warranted, and initiated a status review (55 FR 37342). NMFS published a proposed rule listing two Snake River chinook salmon runs as threatened under the ESA on June 27, 1991 (56 FR 29542 and 56 FR 29547). NMFS finalized its rule listing these Snake River chinook salmon runs as threatened species on April 22, 1992 (57 FR 14653).

Meanwhile, on June 3, 1993, American Rivers and 10 other organizations petitioned NMFS to add Mid-Columbia River summer chinook salmon to the list of endangered species. NMFS determined that this petition presented substantial scientific information indicating that the petitioned action may be warranted, and initiated a status review (58 FR 46944, September 3, 1993). Subsequently, NMFS determined that mid-Columbia River summer chinook salmon did not qualify as an ESU, and therefore was not a ''distinct population segment'' under the ESA (59 FR 48855, September 23, 1994). However, NMFS determined that mid-Columbia River summer chinook salmon were part of a larger ESU that included all late-run (summer and fall) Columbia River chinook salmon between McNary and Chief Joseph dams. NMFS also concluded that this ESU did not warrant listing as a threatened or endangered species (59 FR 48855, September 23, 1994).

Immediately prior to that determination, NMFS determined that a petition filed on March 14, 1994, by Professional Resources Organization-Salmon (PRO-Salmon) to list various populations of chinook salmon in Washington contained substantial scientific information indicating that the petitioned action may be warranted (59 FR 46808, September 12, 1994). NMFS then announced that it would commence a coast-wide status review of all west coast chinook salmon (59 FR 46808). Shortly after initiating this comprehensive coast wide status review for chinook and other salmon species, NMFS received a petition from Oregon Natural Resource Council and Dr. Richard Nawa on February 1, 1995, to list chinook salmon throughout its range. NMFS determined that this petition contained substantial scientific information indicating that the petitioned action may be warranted, and reconfirmed its intention to conduct a comprehensive coast wide status review of west coast chinook salmon (60 FR 30263, June 8, 1995).

In the intervening period between the two most recent petitions to list various populations of west coast chinook salmon, NMFS published an emergency rule on August 18, 1994 (59 FR 42529) after determining that the status of Snake River spring/summer-run and Snake River fall-run chinook salmon warranted reclassification as endangered, based on projected declines and low abundance levels of adult chinook salmon. Because emergency rules under the ESA have a maximum duration of 240 days (see 16 U.S.C. 1533(b)(7) and 50 CFR § 424.20(a)), NMFS published a proposed rule reclassifying listed Snake River spring/summer-run and Snake River fall-run chinook salmon ESUs as endangered on December 28, 1994 (59 FR 66784). Since publishing that proposed rule, a congressional moratorium on listing activities, a large ESA listing determination backlog and other delays prevented NMFS from completing its assessment of the proposed rule. During this period, abundance of both stocks of Snake River chinook salmon has increased. Based on these increases, along with improved management activities affecting these chinook salmon, NMFS concluded that the risks facing these chinook salmon ESUs are lower than they were at the time of the proposed rule, and thus NMFS withdrew the proposed reclassification (63 FR 1807, January 12, 1998).

During the coast wide chinook salmon status review initiated in September, 1994, NMFS assessed the best available scientific and commercial data, including technical information from Pacific Salmon Biological Technical Committees (PSBTCs) and interested parties in Washington, Oregon, Idaho, and California. The PSBTCs consisted primarily of scientists (from Federal, state, and local resource agencies, Indian tribes, industries, universities, professional societies, and public interest groups) possessing technical expertise relevant to chinook salmon and their habitats.

A NMFS Biological Review Team, composed of scientists from NMFS' Northwest and Southwest Fisheries Science Centers, NMFS' Northwest and Southwest Regional Offices, as well as a representative of the National Biological Service, completed a coast wide status review for chinook salmon [Memorandum to W. Stelle and W. Hogarth from M. Schiewe, December 18, 1997, Chinook Salmon Status Review Report]. The review (summary follows) evaluates the status of 15 chinook salmon ESUs in the four states. The complete results of NMFS' status review for chinook salmon populations will be published in a forthcoming NOAA Technical Memorandum (Myers et al., 1998).

Chinook Salmon Life History and Ecology

Chinook salmon (*O. tshawytscha*) are easily distinguished from other *Oncorhynchus* species by their large size. Adults weighing over 120 pounds have been caught in North American waters. Chinook salmon are very similar to coho salmon (*O. kisutch*) in appearance while at sea (blue-green back with silver flanks), except for their large size, small black spots on both lobes of the tail, and black pigment along the base of the teeth. Chinook salmon are anadromous and semelparous. This means that as adults, they migrate from a marine environment into the fresh water streams and rivers of their birth (anadromous) where they spawn and die (semelparous). Adult female chinook will prepare a spawning bed, called a redd, in a stream area with suitable gravel composition, water depth and velocity. Redds will vary widely in size and in location within the stream or river. The adult female chinook may deposit eggs in 4 to 5 ''nesting pockets'' within a single redd. After laying eggs in a redd, adult chinook will guard the redd from 4 to 25 days before dying. Chinook salmon eggs will hatch, depending upon water temperatures, between 90 to 150 days after deposition. Stream flow, gravel quality, and silt load all significantly influence the survival of developing chinook salmon eggs. Juvenile chinook may spend from 3 months to 2 years in freshwater after emergence and before migrating to estuarine areas as smolts, and then into the ocean to feed and mature. Historically, chinook salmon ranged as far south as the Ventura River, California, and their northern extent reaches the Russian Far East.

Among chinook salmon, two distinct races have evolved. One race, described as a ''stream-type'' chinook, is found most commonly in headwater streams. Stream-type chinook salmon have a longer freshwater residency, and perform extensive offshore migrations before returning to their natal streams in the spring or summer months. The second race is called the ''ocean-type'' chinook, which is commonly found in coastal streams in North America. Ocean-type chinook typically migrate to sea within the first three months of emergence, but they may spend up to a year in freshwater prior to emigration. They also spend their ocean life in coastal waters. Ocean-type chinook salmon return to their natal streams or rivers as spring, winter, fall, summer, and late-fall runs, but summer and fall runs predominate (Healey, 1991). The difference between these life history types is also physical, with both genetic and morphological foundations.

Juvenile stream- and ocean-type chinook salmon have adapted to different ecological niches. Ocean-type chinook salmon tend to utilize estuaries and coastal areas more extensively for juvenile rearing. The brackish water areas in estuaries also moderate physiological stress during parr-smolt transition. The development of the ocean-type life history strategy may have been a response to the limited carrying capacity of smaller stream systems and glacially scoured, unproductive, watersheds, or a means of avoiding the impact of seasonal floods in the lower portion of many watersheds (Miller and Brannon, 1982).

Stream-type juveniles are much more dependent on freshwater stream ecosystems because of their extended residence in these areas. A stream-type life history may be adapted to those watersheds, or parts of watersheds, that are more consistently productive and less susceptible to dramatic changes in water flow, or which have environmental conditions that would severely limit the success of subyearling smolts (Miller and Brannon, 1982; Healey, 1991). At the time of saltwater entry, stream-type (yearling) smolts are much larger, averaging 73–134 mm depending on the river system, than their ocean-type (subyearling) counterparts and are therefore able to move offshore relatively quickly (Healey, 1991).

Coastwide, chinook salmon remain at sea for 1 to 6 years (more commonly 2 to 4 years), with the exception of a small proportion of yearling males (called jack salmon) which mature in freshwater or return after 2 or 3 months in salt water (Rutter, 1904; Gilbert, 1912; Rich, 1920; Mullan *et al.*, 1992). Ocean- and stream-type chinook salmon are recovered differentially in coastal and mid-ocean fisheries, indicating divergent migratory routes (Healey, 1983 and 1991). Ocean-type chinook salmon tend to migrate along the coast, while stream-type chinook salmon are found far from the coast in the central North Pacific (Healey 1983 and 1991; Myers *et al.*, 1984). Differences in the ocean distribution of specific stocks may be indicative of resource partitioning and may be important to the success of the species as a whole.

There is a significant genetic influence to the freshwater component of the returning adult migratory process. A number of studies show that chinook salmon return to their natal streams with a high degree of fidelity (Rich and Holmes 1928; Quinn and Fresh, 1984; McIssac and Quinn, 1988). Salmon may have evolved this trait as a method of ensuring an adequate incubation and rearing habitat. It also provides a mechanism for reproductive isolation and local adaptation. Conversely, returning to a stream other than that of one's origin is important in colonizing new areas and responding to unfavorable or perturbed conditions at the natal stream (Quinn, 1993).

Chinook salmon stocks exhibit considerable variability in size and age of maturation, and at least some portion of this variation is genetically determined. The relationship between size and length of migration may also reflect the earlier timing of river entry and the cessation of feeding for chinook salmon stocks that migrate to the upper reaches of river systems. Body size, which is correlated with age, may be an important factor in migration and redd construction success. Roni and Quinn (1995) reported that under high density conditions on the spawning ground, natural selection may produce stocks with exceptionally large-sized returning adults.

Early researchers recorded the existence of different temporal ''runs'' or modes in the migration of chinook salmon from the ocean to freshwater. Freshwater entry and spawning timing are believed to be related to local temperature and water flow regimes (Miller and Brannon, 1982). Seasonal ''runs'' (*ie.*, spring, summer, fall, or winter) have been identified on the basis of when adult chinook salmon enter freshwater to begin their spawning migration. However, distinct runs also differ in the degree of maturation at the time of river entry, the thermal regime and flow characteristics of their spawning site, and their actual time of spawning. Egg deposition must occur at a time to ensure that fry emerge during the following spring when the river or estuary productivity is sufficient for juvenile survival and growth.

Other Life History Traits

Pathogen resistance is another locally adapted trait. Chinook salmon from the Columbia River drainage were less susceptible to *Ceratomyxa shasta*, an endemic pathogen, than stocks from coastal rivers where the disease is not known to occur (Zinn *et al.*, 1977). Alaskan and Columbia River stocks of chinook salmon exhibit different levels of susceptibility to the infectious hematopoietic necrosis virus (IHNV) (Wertheimer and Winton 1982). Variability in temperature tolerance between populations is likely due to selection for local conditions; however, there is little information on the genetic basis of this trait (Levings, 1993).

Consideration as a ''Species'' Under the ESA

To qualify for listing as a threatened or endangered species, the identified populations of chinook salmon must be considered ''species'' under the ESA. The ESA defines a ''species'' to include ''any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.'' NMFS published a policy (56 FR 58612, November 20, 1991) describing the agency's application of the ESA definition of ''species'' to anadromous Pacific salmonid species. NMFS' policy provides that a Pacific salmonid population will be considered distinct and, hence, a species under the ESA if it represents an ESU of the biological species. A population must satisfy two criteria to be considered an ESU, it must be reproductively isolated from other conspecific population units, and it must represent an important component in the evolutionary legacy of the biological species. The first criterion, reproductive isolation, need not be absolute, but must be strong enough to permit evolutionarily important differences to accrue in different population units. The second criterion is met if the population contributes substantially to the ecological and genetic diversity of the species as a whole. Guidance on the application of this policy is contained in a scientific paper ''Pacific Salmon (*Oncorhynchus* spp.) and the Definition of 'Species' under the Endangered Species Act'' (Waples, 1991) and a NOAA Technical Memorandum ''Definition of 'Species' Under the Endangered Species Act: Application to Pacific Salmon'' (NMFS F/NWC–194) which are available upon request (see **ADDRESSES**). The following sections describe the genetic, ecological, and life history characteristics, as well as human-induced genetic changes that NMFS assessed to determine the number and geographic extent of chinook salmon ESUs.

Reproductive Isolation

Genetic data provide useful indirect information on reproductive isolation because they integrate information about migration and gene flow over evolutionarily important time frames.

Genetic information obtained from allozyme, DNA, and chromosomal sampling indicate strong differentiation between chinook salmon ESUs, and were largely consistent with those described in previous studies of chinook salmon. Puget Sound populations of chinook salmon appear to constitute a genetically distinct group, a conclusion that is consistent with the results of Utter *et al.* (1989) and Marshall *et al.* (1995). In NMFS' analyses, Washington coastal populations appeared to form a genetically distinct group that was most similar to, but still distinct from, Oregon coastal populations. The Washington coastal group included the Hoko River population in the western part of the Strait of Juan de Fuca. Chinook salmon in the Elwha River, which also drains into the Strait of Juan de Fuca, were genetically intermediate between Puget Sound and Washington coastal populations.

Chinook salmon populations in the Columbia and Snake Rivers appear to be separated into two large genetic groups: those producing ocean-type outmigrants and those producing stream-type outmigrants. The first group includes populations in lower Columbia River tributaries, with both spring-run and fall-run (''tule'') life histories. These ocean-type populations exhibit a range of juvenile life history patterns that appear to depend on local environmental conditions. The Willamette River hatchery populations form a distinct subgroup within the lower Columbia River group. Ocean-type chinook salmon populations east of the Cascade Range Crest include both summer-and fall-run (''bright'') populations, and are genetically distinct from lower Columbia River ocean-type populations. Fall-run populations in the Snake River, Deschutes River, and Marion Drain (Yakima River) form a distinct subgroup.

The second major group of chinook salmon in the Columbia and Snake River drainage consists of spring- or summer-run fish. Based on analysis of genetic clusters, three relatively distinct subgroups appeared within these stream-type populations. One subgroup includes spring-run populations in the Klickitat, John Day, Deschutes, and Yakima Rivers of the mid-Columbia River. A second subgroup includes upper Columbia River spring-run chinook salmon in the Wenatchee and Methow Rivers, but also includes spring-run fish in the Grande Ronde River and Carson Hatchery. This is likely due to the releases of exotic Carson hatchery stock in these basins, rather than to natural genetic similarities. A third subgroup consists of Snake River spring- and summer-run populations in the Imnaha and Salmon Rivers, as well as those in the Rapid River and Lookingglass Hatcheries. The Klickitat River spring-run population appears to be genetically intermediate between upper and lower Columbia River groups.

All populations of chinook salmon south of the Columbia River drainage appear to consist of ocean-type fish. Populations along the north coast of Oregon form a genetically distinct group, consisting of populations north of and including the Elk River, except for the Rock Creek Hatchery spring-run population, which show greater genetic affinity to southern Oregon coastal populations. A southern coastal group includes populations south of the Elk River to and including populations in the lower Klamath River in northern California. However, Euchre Creek, which is located near the Rogue River and has been planted extensively with Elk River stock, is more similar to populations north of Cape Blanco. Upper Klamath River populations of chinook salmon are genetically distinct from other northern California, southern Oregon and California Central Valley populations.

Sacramento and San Joaquin River populations are genetically distinct from northern California coastal and Klamath River populations. Previous studies grouped populations in the Sacramento River with those in the San Joaquin River (Utter et al., 1989; Bartley and Gall, 1990; Bartley et al., 1992). However, Hedgecock et al. (1995), Banks (1996), and Nielsen (1995 and 1997) surveyed DNA markers and these results indicate that the winter, spring, fall, and late-fall runs may be genetically distinct from one another.

Genetic Changes Due to Human Activities

The effects of artificial propagation and other human activities such as harvest and habitat modification, can be relevant to ESA listing determinations in two ways. First, such activities can genetically change natural populations so much that they no longer represent an evolutionarily significant component of the biological species (Waples, 1991). For example, in 1991, NMFS concluded that, as a result of massive and prolonged effects of artificial propagation, harvest, and habitat degradation, the agency could not identify natural populations of coho salmon (*O. kisutch*) in the lower Columbia River that qualified for ESA listing consideration (56 FR 29553, June 27, 1991). Second, risks to the viability and genetic integrity of native salmon populations posed by human activities may contribute to their threatened or endangered status (Goodman, 1990; Hard et al., 1992). The severity of these effects on natural populations depends both on the nature of the effects (e.g., harvest rate, gear size, or type of hatchery practice) and their magnitude (e.g., duration of a hatchery program and number and life-history stage of hatchery fish involved).

For example, artificial propagation is a common practice to supplement chinook salmon stocks for commercial and recreational fisheries. However, in many areas, a significant portion of the naturally spawning population consists of hatchery-produced chinook salmon. In several of the chinook salmon ESUs, over 50 percent of the naturally spawning fish are from hatcheries. Many of these hatchery-produced fish are derived from a few stocks which may or may not have originated from the geographic area where they are released. However, in several of the ESUs analyzed, insufficient or uncertain information exists regarding the interactions between hatchery and natural fish, and the relative abundance of hatchery and natural stocks.

Artificial propagation is important to consider in ESA evaluations of anadromous Pacific salmonids for several reasons. First, although natural fish are the focus of ESU determinations, possible effects of artificial propagation on natural populations must also be evaluated. For example, stock transfers might change the genetic bases or phenotypic expression of life history characteristics in a natural population in such a way that the population might seem either less or more distinctive than it was historically. Artificial propagation can also alter life history characteristics such as smolt age and migration and spawn timing (e.g., Crawford, 1979, NRC 1996). Second, artificial propagation poses a number of risks to natural populations that may affect their risk of extinction or endangerment. Finally, if any natural populations are listed under the ESA, then it will be necessary to determine the ESA status of all associated hatchery populations. This latter determination would be made following a proposed listing and is not considered further in this document.

The impacts of hatchery activities on specific ESUs is discussed in the Status of Chinook Salmon ESUs and Summary of Factors Affecting the Species sections.

Ecological and Genetic Diversity

Several types of physical and biological evidence were considered in evaluating the contribution of chinook salmon from Washington, Oregon, Idaho, and California to the ecological and genetic diversity of the biological species throughout its range. Factors examined included: (1) The physical environment—geology, soil type, air temperature, precipitation, river flow patterns, water temperature, and vegetation; (2) biogeography—marine, estuarine, and freshwater fish distributions; and (3) life history traits—age at smolting, age at spawning, river entry timing, and spawning timing. An analysis of the physical environment and life history traits provides important insight into the ecological and genetic diversity of the species and can reflect unusual or distinctive adaptations that promote evolutionary processes.

The predominant differentiation in chinook salmon life history types is that between ocean- and stream-type chinook salmon. Ocean-type populations typically migrate to the ocean in their first year of life and spend most of their marine life in coastal waters, whereas stream-type populations migrate to sea as yearlings and often make extensive ocean migrations.

In some areas within the Columbia River Basin, stream- and ocean-type chinook salmon stocks spawn in relatively close proximity to one another but are separated by run timing. Stream-type chinook salmon include spring-run populations in the Columbia River and its tributaries east of the Cascade Crest, and spring- and summer-run fish in the Snake River and its tributaries. Ocean-type chinook salmon include fall-run chinook salmon in both the Columbia and Snake River Basins, summer-run chinook salmon from the Columbia River, and spring-run fish from the lower Columbia River. There are substantial genetic differences between stream- and ocean-type chinook salmon in both the Fraser and Columbia River Basins, and the genetic analyses show clearly that the two life history forms represent two major evolutionary lineages.

Adult run-time has also long been used to identify different temporal ''races'' of chinook salmon. In cases where the run-time differences correspond to differences between stream- and ocean-type fish (e.g., in the Columbia and Fraser River Basins), relatively large genetic differences (as well as ecological and life history differences) can be found between the different runs. In most coastal areas, however, life history and genetic differences between the runs are relatively modest, relative to the larger differences used in designating other ESUs. Although many populations have some fraction of yearling migrants, all the coastal populations are part of the ocean lineage, and spring- and fall-run fish are very similar in ocean distribution.

Among basins supporting only ocean-type chinook salmon, the Sacramento River system is somewhat unusual in that its large size and ecological diversity historically allowed for substantial spatial as well as temporal separation of different runs. Genetic and life history data both suggest that considerable differentiation among the runs has occurred in this basin. The Klamath River Basin, as well as chinook salmon in Puget Sound, shares some features of coastal rivers but historically also provided an opportunity for substantial spatial separation of different temporal runs. As discussed below, the diversity in run timing made identifying ESUs difficult in the Klamath and Sacramento River Basins.

NMFS considers differences in life history traits as a possible indicator of adaptation to different environmental regimes and resource partitioning within those regimes. The relevance of the ecologic and genetic basis for specific chinook salmon life-history traits as they pertain to each ESU is discussed in the brief summary that follows.

ESU Determinations

The ESU determinations described here represent a synthesis of a large amount of diverse information. In general, the proposed geographic boundaries for each ESU (i.e., the watersheds within which the members of the ESU are typically found) are supported by several lines of evidence that show similar patterns. However, the diverse data sets are not always entirely congruent (nor would they be expected to be), and the proposed boundaries are not necessarily the only ones possible. For example, in some cases (e.g., in the Middle Columbia River near the Cascade Crest), environmental changes occur over a transition zone rather than abruptly.

Based on the best available scientific and commercial information, NMFS has identified 15 ESUs of chinook salmon from Washington, Oregon, Idaho, and California, including 11 new ESUs, and one redefined ESU. The 15 ESUs are briefly described and characterized below. Genetic data (from studies of protein electrophoresis and DNA) were the primary evidence considered for the reproductive isolation criterion, supplemented by inferences about barriers to migration created by natural geographic features and human-induced changes resulting from artificial propagation and harvest. Factors considered to be most informative in evaluating ecological and genetic diversity include data pertaining to the physical environment, ocean conditions and upwelling, vegetation, estuarine and freshwater fish distributions, river entry, and spawning timing.

Most of the ESUs described below include multiple spawning populations of chinook salmon, and most also extend over a considerable geographic area. This result is consistent with NMFS' species definition paper, which states that, in general, ''ESUs should correspond to more comprehensive units unless there is clear evidence that evolutionarily important differences exist between smaller population segments'' (Waples, 1991, p. 20). However, considerable diversity in genetic or life history traits or habitat features exists within most ESUs, and maintaining this diversity is critical to their overall health. The descriptions below briefly summarize some of the notable types of diversity within each ESU, and this diversity is considered in the next section in evaluating risk to the ESUs as a whole.

(1) Sacramento River Winter-Run ESU

This run was determined to be a distinct population segment by NMFS in 1987, prior to development of the NMFS species policy. The NMFS concluded that this run meets the criteria to be considered an ESU. It includes chinook salmon entering the Sacramento River from November to June and spawning from late-April to mid-August, with a peak from May to June. No other chinook salmon populations have a similar life history pattern. In general, winter-run chinook salmon exhibit an ocean-type life-history strategy, with smolts emigrating to the ocean after 5 to 9 months of freshwater residence (Johnson et al., 1992) and remaining near the coasts of California and Oregon. Winter-run chinook salmon also mature at a relatively young age (2–3 years old). DNA analysis indicates substantial genetic differences between winter-run and other chinook salmon in the Sacramento River.

Historically, winter-run populations existed in the Upper Sacramento, Pit, McCloud, and Calaveras Rivers. The spawning habitat for these stocks was primarily located in the Sierra Nevada Ecoregion (Omernik, 1987). Construction of dams on these rivers in the 1940s led to the extirpation of populations in the San Joaquin River Basin and displaced the Sacramento River population to areas below Shasta Dam.

(2) Central Valley Spring-Run ESU

Existing populations in this ESU spawn in the Sacramento River and its tributaries. Historically, spring chinook salmon were the dominant run in the Sacramento and San Joaquin River Basins (Clark, 1929), but native populations in the San Joaquin River have apparently all been extirpated (Campbell and Moyle, 1990). This ESU includes chinook salmon entering the Sacramento River from March to July and spawning from late August through early October, with a peak in September. Spring-run fish in the Sacramento River exhibit an ocean-type life history, emigrating as fry, subyearlings, and yearlings. Recoveries of hatchery chinook salmon implanted with coded-wire-tags (CWT) are primarily from ocean fisheries off the California and Oregon coast. There were minimal differences in the ocean distribution of fall- and spring-run fish from the Feather River Hatchery (as determined by CWT analysis); however, due to hybridization that may have occurred in the hatchery between these two runs, this similarity in ocean migration may not be representative of wild runs.

Substantial ecological differences in the historical spawning habitat for spring-run versus fall- and late-fall-run fish have been recognized. Spring chinook salmon run timing was suited to gaining access to the upper reaches of river systems (up to 1,500 m elevation) prior to the onset of prohibitively high water temperatures and low flows that inhibit access to these areas during the fall. Differences in adult size, fecundity, and smolt size also occur between spring- and fall/late fall-run chinook salmon in the Sacramento River.

No allozyme data are available for naturally spawning Sacramento River spring chinook salmon. A sample from Feather River Hatchery spring-run fish, which may have undergone substantial hybridization with fall chinook salmon, shows modest (but statistically significant) differences from fall-run hatchery populations. DNA data show moderate genetic differences between the spring and fall/late-fall runs in the Sacramento River; however, these data are difficult to interpret in the context of this broad status review because comparable data are not available for other geographic regions.

(3) Central Valley Fall/Late Fall-Run ESU

This ESU includes fall and late-fall chinook salmon spawning in the Sacramento and San Joaquin Rivers and their tributaries. These populations enter the Sacramento and San Joaquin Rivers from July through April and spawn from October through February.

Both runs are ocean-type chinook salmon, emigrating predominantly as fry and subyearlings and remaining off the California coast during their ocean migration.

Sacramento/San Joaquin Basin chinook salmon are genetically and physically distinguishable from all other coastal forms (Clark, 1929; Synder, 1931). Ecologically, the Central Valley also differs in many important ways from coastal areas. There were also a number of life-history differences noted between Sacramento and San Joaquin River Basin fall/late fall-run populations. In general, San Joaquin River populations tend to mature at an earlier age and spawn later in the year than Sacramento River populations. These differences could have been phenotypic responses to the generally warmer temperature and lower flow conditions found in the San Joaquin River Basin relative to the Sacramento River Basin. There was no apparent difference in the distribution of marine CWT recoveries from Sacramento and San Joaquin River hatchery populations, nor were there genetic differences between Sacramento and San Joaquin River fall/late fall-run populations (based on DNA and allozyme analysis) of a similar magnitude to that used in distinguishing other ESUs. This apparent lack of distinguishing life history and genetic characteristics may be due, in part, to large scale transfers of Sacramento River fall/late fall-run chinook salmon into the San Joaquin River Basin.

(4) Southern Oregon and California Coastal ESU

This ESU includes all naturally spawned coastal spring and fall chinook salmon spawning from Cape Blanco (inclusive of the Elk River) to the southern extent of the current range for chinook salmon at Point Bonita (the northern landmass marking the entrance to San Francisco Bay). The Cape Blanco region is a major biogeographic boundary for numerous species (e.g., steelhead and coho salmon). Chinook salmon spawn in several small tributaries to San Francisco Bay, however it is uncertain whether these small populations are part of this ESU, or wanderers from Central Valley chinook salmon ESUs.

Chinook salmon from the Central Valley and Klamath River Basin upstream from the Trinity River confluence are genetically and ecologically distinguishable from those in this ESU. Chinook salmon in this ESU exhibit an ocean-type life-history; ocean distribution (based on marine CWT recoveries) is predominantly off of the California and Oregon coasts. Life-history information on smaller populations, especially in the southern portion of the ESU, is extremely limited. Additionally, only anecdotal or incomplete information exists on abundance of several spring-run populations including, the Chetco, Winchuck, Smith, Mad, and Eel Rivers. Allozyme data indicate that this ESU is genetically distinguishable from the Oregon Coast, Upper Klamath and Trinity River, and Central Valley ESUs. This data also shows some divergence between chinook populations north and south of the Klamath River, but the available information is incomplete to describe chinook salmon south of the Klamath River as a separate ESU. Life history differences also exist between spring- and fall-run fish in this ESU, but not to the same extent as is observed in larger inland basins.

Ecologically, the majority of the river systems in this ESU are relatively small and heavily influenced by a maritime climate. Low summer flows and high temperatures in many rivers result in seasonal physical and thermal barrier bars that block movement by anadromous fish. The Rogue River is the largest river basin in this ESU and extends inland into the Sierra Nevada and Cascades Ecoregions.

(5) Upper Klamath and Trinity Rivers ESU

Included in this ESU are all Klamath River Basin populations from the Trinity River and the Klamath River upstream from the confluence of the Trinity River. These populations include both spring- and fall-run fish that enter the Upper Klamath River Basin from March through July and July through October and spawn from late August through September and September through early January, respectively. Body morphology (vertebral counts, lateral-line scale counts, and fin-ray counts) and reproductive traits (egg size and number) for populations from the Upper Klamath River differ from those of populations in the Sacramento River Basin. Genetic analysis indicated that populations from the Upper Klamath River Basin form a unique group that is quite distinctive compared to neighboring ESUs. The Upper Klamath River crosses the Coastal Range, Sierra Nevada, and Eastern Cascades Ecoregions, although dams prevent access to the upper river headwaters of the Klamath River in the Eastern Cascades Ecoregion.

Within the Upper Klamath River Basin, there are statistically significant, but fairly modest, genetic differences between the fall and spring runs. The majority of the spring- and fall-run fish emigrate to the marine environment primarily as subyearlings. Recoveries of CWTs indicate that both runs have a coastal distribution off of the California and Oregon coasts. There was no apparent difference in the marine distribution of CWT recoveries from fall-run (Iron Gate and Trinity River Hatcheries) and spring-run populations (Trinity River Hatchery).

NMFS was concerned that the only estimate of the genetic relationship between spring and fall runs in this ESU is from a comparison of hatchery stocks that may have undergone some introgression during hatchery spawning operations, thus blurring the distinguishable traits between spring- and fall-run chinook in this ESU. NMFS acknowledges that the ESU determination should be revisited if substantial new information from natural spring-run populations becomes available.

(6) Oregon Coast ESU

This ESU contains coastal populations of spring- and fall-run chinook salmon from the Elk River north to the mouth of the Columbia River. These populations exhibit an ocean-type life-history and mature at ages 3, 4, and 5. In contrast to the more southerly ocean distribution pattern shown by populations from the lower Columbia River and farther south, CWT recoveries from populations within this ESU are predominantly from British Columbia and Alaska coastal fisheries. There is a strong genetic separation between Oregon Coast ESU populations and neighboring ESU populations. This ESU falls within the Coastal Ecoregion and is characterized by a strong maritime influence, with moderate temperatures, high precipitation levels, and easy migration access.

(7) Washington Coast ESU

Coastal populations spawning north of the Columbia River and west of the Elwha River are included in this ESU. These populations can be distinguished from those in Puget Sound by their older age at maturity and more northerly ocean distribution. Allozyme data also indicate geographical differences between populations from this area and those in Puget Sound, the Columbia River, and the Oregon coast ESUs. Populations within this ESU are ocean-type chinook salmon and generally mature at age 3, 4, and 5. Ocean distribution for these fish is more northerly than that for the Puget Sound and Lower Columbia River ESUs. The boundaries of this ESU lie within the Coastal Ecoregion, which is strongly influenced by the marine environment: high precipitation, moderate temperatures, and easy migration access.

(8) Puget Sound ESU

This ESU encompasses all naturally spawned spring, summer and fall runs of chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula, inclusive. Chinook salmon in this area all exhibit an ocean-type life history. Although some spring-run chinook salmon populations in the Puget Sound ESU have a high proportion of yearling smolt emigrants, the proportion varies substantially from year to year and appears to be environmentally mediated rather than genetically determined. Puget Sound stocks all tend to mature at ages 3 and 4 and exhibit similar, coastally-oriented, ocean migration patterns. There are substantial ocean distribution differences between Puget Sound and Washington coast stocks, with CWT recoveries of Washington coastal chinook found in much larger proportions from Alaskan waters. The marine distribution of Elwha River chinook salmon most closely resembled other Puget Sound stocks, rather than Washington coast stocks.

The NMFS concluded that, on the basis of substantial genetic separation, the Puget Sound ESU does not include Canadian populations of chinook salmon. Allozyme analysis of North Fork and South Fork Nooksack River spring chinook salmon identified them as outliers, but most closely allied with other Puget Sound samples. DNA analysis identified a number of markers that appear to be restricted to either the Puget Sound or Washington coastal stocks. Some allozyme markers suggested an affinity of the Elwha River population with the Washington coastal stocks, while others suggested an affinity with Puget Sound stocks.

The boundaries of the Puget Sound ESU correspond generally with the boundaries of the Puget Lowland Ecoregion. Despite being in the rainshadow of the Olympic Mountains, the river systems in the western portion of Puget Sound maintain high flow rates due to the melting snowpack in the surrounding mountains. Temperatures tend to be moderated by the marine environment. The Elwha River, which is in the Coastal Ecoregion, is the only system in this ESU which lies outside the Puget Sound Ecoregion. Furthermore, the boundary between the Washington Coast and Puget Sound ESUs (which includes the Elwha River in the Puget Sound ESU) corresponds with ESU boundaries for steelhead and coho salmon. In life history and genetic attributes, the Elwha River chinook salmon appear to be transitional between populations from Puget Sound and the Washington Coast ESU.

(9) Lower Columbia River ESU

This ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. Celilo Falls, which corresponds to the edge of the drier Columbia Basin Ecosystem and historically may have presented a migrational barrier to chinook salmon at certain times of the year, is the eastern boundary for this ESU. Not included in this ESU are ‘‘stream-type’’ spring chinook salmon found in the Klickitat River (which are considered part of the Mid-Columbia River spring-run ESU) or the introduced Carson spring-chinook salmon. ‘‘Tule’’ fall chinook salmon in the Wind and Little White Salmon Rivers are included in this ESU, but not introduced ‘‘upriver bright’’ fall chinook salmon populations in the Wind, White Salmon, and Klickitat Rivers. Available information suggests that spring chinook salmon presently in the Clackamas and Sandy Rivers are predominantly the result of introductions from the Willamette River ESU and are thus probably not representative of spring chinook salmon found historically.

In addition to the geographic features mentioned above, genetic and life-history data were important factors in defining this ESU. Populations in this ESU are considered ocean type. Some spring-run populations have a large proportion of yearling migrants, but this trend may be biased by yearling hatchery releases. Subyearling migrants were found to contribute to the escapement. CWT recoveries for Lower Columbia River ESU populations indicate a northerly migration route, but with little contribution to the Alaskan fishery. Populations in this ESU also tend to mature at age 3 and 4, somewhat younger than populations from the coastal, upriver, and Willamette ESUs. Ecologically, the Lower Columbia River ESU crosses several ecoregions: Coastal, Willamette Valley, Cascades and East Cascades.

(10) Upper Willamette River ESU

This ESU includes naturally spawned spring-run populations above Willamette Falls. Fall chinook salmon above the Willamette Falls are introduced and although they are naturally spawning, they are not considered a population for purposes of defining this ESU. Historic, naturally spawned populations in this ESU have an unusual life history that shares features of both the stream and ocean types. Scale analysis of returning fish indicate a predominantly yearling smolt life-history and maturity at 4 years of age, but these data are primarily from hatchery fish and may not accurately reflect patterns for the natural fish. Young-of-year smolts have been found to contribute to the returning 3 year-old year class. The ocean distribution is consistent with an ocean-type life history, and CWT recoveries occur in considerable numbers in the Alaskan and British Columbian coastal fisheries. Intra-basin transfers have contributed to the homogenization of Willamette River spring chinook salmon stocks; however, Willamette River spring chinook salmon remain one of the most genetically distinctive groups of chinook salmon in the Columbia River Basin.

The geography and ecology of the Willamette Valley is considerably different from surrounding areas. Historically, the Willamette Falls offered a narrow temporal window for upriver migration, which may have promoted isolation from other Columbia River stocks.

(11) Mid-Columbia River Spring-Run ESU

Included in this ESU are stream-type chinook salmon spawning in the Klickitat, Deschutes, John Day, and Yakima Rivers. Historically, spring-run populations from the Hood, Walla Walla, and Umatilla Rivers may have also belonged in this ESU, but these populations are now considered extinct. Chinook salmon from this ESU emigrate to the ocean as yearlings and apparently migrate far off-shore, as they do not appear in appreciable numbers in any ocean fisheries. The majority of adults spawn as 4-year-olds, with the exception of fish returning to the upper tributaries of the Yakima River, which return predominantly at age 5. Populations in this ESU are genetically distinguishable from other stream-type chinook salmon in the Columbia and Snake Rivers. Streams in this region drain desert areas east of the Cascades (Columbia Basin Ecoregion) and are ecologically differentiated from the colder, less productive, glacial streams of the upper Columbia River spring-run ESU and from the generally higher elevation streams of the Snake River.

(12) Upper-Columbia River Summer- and Fall-Run ESU

This ESU was first identified as the Mid-Columbia River summer/fall chinook salmon ESU. Previously, Waknitz et al. (1995) and NMFS (1994) identified an ESU that included all ocean-type chinook salmon spawning in areas between McNary Dam and Chief Joseph Dam (59 FR 48855, September 23, 1994). However, NMFS has now concluded that the boundaries of this ESU do not extend downstream from the Snake River. In particular, NMFS concluded that Deschutes River fall chinook salmon are not part of this ESU. The ESU status of the Marion Drain population from the Yakima River is still unresolved. NMFS also identified the importance of obtaining more definitive genetic and life history information for naturally spawning fall chinook salmon elsewhere in the Yakima River drainage.

Chinook salmon from this ESU primarily emigrate to the ocean as subyearlings but mature at an older age than ocean-type chinook salmon in the Lower Columbia and Snake Rivers. Furthermore, a greater proportion of CWT recoveries for this ESU occur in the Alaskan coastal fishery than is the case for Snake River fish. The status review for Snake River fall chinook salmon (Waples et al., 1991; NMFS, 1992) also identified genetic and environmental differences between the Columbia and Snake Rivers. Substantial life history and genetic differences distinguish fish in this ESU from stream-type spring chinook salmon from the mid- and upper-Columbia Rivers.

The ESU boundaries fall within part of the Columbia Basin Ecoregion. The area is generally dry and relies on Cascade Range snowmelt for peak spring flows. Historically, this ESU likely extended farther upstream; spawning habitat was compressed down-river following construction of Grand Coulee Dam.

(13) Upper Columbia River Spring-Run ESU

This ESU includes stream-type chinook salmon spawning above Rock Island Dam—that is, those in the Wenatchee, Entiat, and Methow Rivers. All chinook salmon in the Okanogan River are apparently ocean-type and are considered part of the Upper Columbia River summer- and fall-run ESU. These upper Columbia River populations exhibit classical stream-type life-history strategies: yearling smolt emigration with only rare CWT recoveries in coastal fisheries. These populations are genetically and ecologically well separated from the summer- and fall-run populations that exist in the lower parts of many of the same river systems.

Rivers in this ESU drain the east slopes of the Cascade Range and are fed primarily by snowmelt. The waters tend to be cooler and less turbid than the Snake and Yakima Rivers to the south. Although these fish appear to be closely related genetically to stream-type chinook salmon in the Snake River, NMFS recognized substantial ecological differences between the Snake and Columbia Rivers, particularly in the upper tributaries favored by stream-type chinook salmon. Allozyme data demonstrate even larger differences between spring chinook salmon populations from the mid- and upper-Columbia River.

Artificial propagation programs have had a considerable influence on this ESU. During the Grand Coulee Fish-Maintenance Project (GCFMP, 1939–1943), all spring chinook salmon reaching Rock Island Dam, including those destined for areas above Grand Coulee Dam, were collected and they or their progeny were dispersed into streams in this ESU (Fish and Hanavan, 1948). Some ocean-type fish were undoubtedly also incorporated into this program. Spring-run escapements to the Wenatchee, Entiat, and Methow Rivers were severely depressed prior to the GCFMP but increased considerably in subsequent years, suggesting that the effects of the program may have been substantial. Subsequently, widespread transplants of Carson stock spring chinook salmon (derived from a mixture of Columbia River and Snake River stream-type chinook salmon) have also contributed to erosion of the genetic integrity of this ESU.

In spite of considerable homogenization, this ESU still represents an important genetic resource, in part because it presumably contains the last remnants of the gene pools for populations from the headwaters of the Columbia River.

(14) Snake River Fall-Run ESU

This ESU, which includes ocean-type fish, was identified in an earlier status review (Waples et al., 1991; NMFS, 1992). In that status review and in a later review of mid-Columbia River summer chinook salmon (Waknitz et al., 1995), the ESU status of populations from Marion Drain and the Deschutes River was not resolved, so these issues were considered in the current review.

Both populations show a greater genetic affinity to Snake River fall chinook salmon than to other ocean-type Columbia River populations such as the Upper Columbia River summer/fall-run ESU. After evaluation, NMFS concluded that chinook salmon spawning in the Marion Drain could not be assigned to any historic or current ESU with any certainty.

However, after further review, NMFS has concluded that the Deschutes River chinook salmon population should be considered part of the Snake River fall-run ESU. The Deschutes River historically supported a population of fall chinook salmon, as evidenced by counts of fish at Sherars Falls in the 1940s. Genetic and life history data for the current population indicate a closer affinity to fall chinook salmon in the Snake River than to those in the Columbia River. Similarities were observed in the distribution of CWT ocean recoveries for Snake River and Deschutes River fall-run chinook salmon; however, information on Deschutes River fish was based on a limited number of releases over a relatively short time frame. CWT recovery data indicate that straying by non-native chinook salmon into the Deschutes River is very low and does not appear to be disproportionately influenced by Snake River fall-run chinook salmon (Hymer et al., 1992). Fall-run chinook populations from the John Day, Umatilla, and Walla Walla Rivers would also be included in this ESU, but are believed to have been extirpated.

(15) Snake River Spring- and Summer-Run ESU

This ESU, which includes populations of spring- and summer-run chinook salmon from the Snake River Basin (excluding the Clearwater River), was identified in a previous status review (Matthews and Waples, 1991; NMFS, 1992). These populations show modest genetic differences, but substantial ecological differences, in comparison with Mid- and Upper Columbia River spring- and summer-run chinook salmon populations. Populations from this ESU emigrate to the ocean as yearlings, mature at ages 4 and 5, and are rarely taken in ocean fisheries. The majority of the spawning habitat occurs in the Northern Rockies and Blue Mountains ecoregions.

Status of Chinook Salmon ESUs

The ESA defines the term ‘‘endangered species’’ as ‘‘any species which is in danger of extinction throughout all or a significant portion of its range.’’ The term ‘‘threatened species’’ is defined as ‘‘any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.’’ In previous status reviews (e.g., Weitkamp et al., 1995), NMFS has identified a number of factors that should be considered in evaluating the level of risk faced by an ESU, including: (1) Absolute numbers of fish and their spatial and temporal distribution; (2) current abundance in relation to historical abundance and current carrying capacity of the habitat; (3) trends in abundance; (4) natural and human-influenced factors that cause variability in survival and abundance; (5) possible threats to genetic integrity (e.g., from strays or outplants from hatchery programs); and (6) recent events (e.g., a drought or changes in harvest management) that have predictable short-term consequences for abundance of the ESU.

During the coastwide status review for chinook salmon, NMFS evaluated both qualitative and quantitative information to determine whether any proposed ESU is threatened or endangered according to the ESA. The types of information used in these assessments are described below, followed by a summary of results for each ESU.

Qualitative Evaluations

Qualitative assessments of the status of chinook salmon stocks have been published by agencies or conservation groups (Nehlsen et al., 1991; Higgins et al., 1992; Nickelson et al., 1992; WDF et al., 1993; Huntington et al., 1996). Nehlsen et al. (1991) considered salmonid stocks throughout Washington, Idaho, Oregon, and California and enumerated all stocks that they found to be extinct or at risk of extinction. Nehlsen et al. (1991) classified stocks as extinct, possibly extinct, at high risk of extinction, at moderate risk of extinction, or of special concern. They considered it likely that stocks at high risk of extinction have reached the threshold for classification as endangered under the ESA. Stocks were placed in this category if they had declined from historic levels and were continuing to decline, or had spawning escapements less than 200. Stocks were classified as at moderate risk of extinction if they had declined from historic levels but presently appear to be stable at a level above 200 spawners. They felt that stocks in this category had reached the threshold for threatened under the ESA. They classified stocks as of special concern if a relatively minor disturbance could threaten them, insufficient data were available for them, they were influenced by large releases of hatchery fish, or they possess some unique characteristic.

Higgins et al. (1992) used the same classification scheme as Nehlsen et al. (1991) but provided a more detailed review of some northern California salmonid stocks. In this review, their evaluation is relevant only to the Southern Oregon and California Coastal and Upper Klamath and Trinity Rivers ESUs.

Nickelson et al. (1992) rated wild coastal (excluding Columbia River Basin) Oregon salmon and steelhead stocks on the basis of their status over the past 20 years, classifying stocks as ‘‘healthy,’’ ‘‘depressed,’’ ‘‘of special concern,’’ or ‘‘unknown’’.

WDF et al. (1993) categorized all salmon and steelhead stocks in Washington on the basis of stock origin, production type, and status (‘‘healthy,’’ ‘‘depressed,’’ ‘‘critical,’’ or ‘‘unknown’’).

Huntington et al. (1996) surveyed the condition of healthy native or wild stocks of anadromous salmonids in the Pacific Northwest and California. Stocks were classified as healthy based upon abundance, self-sustainability, and not having been previously identified as at substantial risk of extinction. Healthy stocks were described at two levels: ‘‘adult abundance at least two-thirds as great as would be found in the absence of human impacts’’ (Level I); and ‘‘adult abundance between one-third and two-thirds as great as expected without human impacts’’ (Level II).

There are problems in applying results of these studies to ESA evaluations. A major problem is that the definition of ‘‘stock’’ or ‘‘population’’ varied considerably in scale among studies, and sometimes among regions within a study. Identified units range in size from large river basins (e.g., ‘‘Sacramento River’’ in Nehlsen et al., 1991), to minor coastal streams and tributaries. A second problem is the definition of categories used to classify stock status. Only Nehlsen et al. (1991) and Higgins et al. (1992) used categories intended to relate to ESA ‘‘threatened’’ or ‘‘endangered’’ status, and they applied their own interpretations of these terms to individual stocks, not to

ESUs as defined here. WDF *et al.* (1993) used general terms describing status of stocks that cannot be directly related to the considerations important in ESA evaluations. A third problem is the selection of stocks or populations to include in the review. Nehlsen et al. (1991) and Higgins *et al.* (1992) did not discuss stocks not perceived to be at risk, so it is difficult to determine the proportion of stocks they considered to be at risk in any given area. For chinook salmon, WDF *et al.* (1993) included only stocks considered to be substantially ''wild'' and included data only for the ''wild'' component for streams that have both hatchery and natural fish escaping to spawn, giving an incomplete evaluation of chinook salmon utilizing natural habitat.

Quantitative Evaluations

Quantitative evaluations of data included comparisons of current and historical abundance of chinook salmon, calculation of recent trends in escapement, and evaluation of the proportion of natural spawning attributable to hatchery fish. Historical abundance information for these ESUs is largely anecdotal. Time series data are available for many populations, but data extent and quality varied among ESUs. NMFS compiled and analyzed this information to provide several summary statistics of natural spawning abundance, including (where available) recent total spawning escapement, percent annual change in total escapement (both long-term and most recent ten years), recent naturally produced spawning escapement, and average percentage of natural spawners that were of hatchery origin.

Although this evaluation used the best data available, there are a number of limitations to these data, and not all summary statistics were available for all populations. For example, spawner abundance was generally not measured directly; rather, it often had to be estimated from catch (which itself may not always have been measured accurately) or from limited survey data.

Sport and commercial harvest impacts were compiled from a variety of sources. In presenting this information, NMFS has tried to maintain a clear distinction between harvest rates (usually calculated as catch divided by catch plus escapement for a cohort or brood year) and exploitation rates (age-specific rates of exploitation in individual fisheries).

Stream surveys for chinook salmon spawning abundance have been conducted by various agencies within most of the ESUs considered here. The methods and time-spans of the surveys vary considerably among regions, so it is difficult to assess the general reliability of these surveys as population indices. For most streams where these surveys are conducted, they are the best local indication of population trends.

Dam counts provide quantitative estimates of run size, but in most cases, these counts cannot be resolved to the individual population level and are subject to errors stemming from fallback, run classification, and unaccounted mortality. Run reconstructions providing estimates of both adult spawning abundance and fishery recruits are being prepared for many stream-type chinook salmon populations in the Columbia River Basin (Beamsderfer et al., 1997 draft report), but were not available in final form for this review.

As noted above, NMFS attempted to distinguish natural and hatchery production in these evaluations. Doing this quantitatively would require good estimates of the proportion of natural escapement that was of hatchery origin, and knowledge of the effectiveness of spawning by hatchery fish in natural environments. Unfortunately, this type of information is rarely available, and for most ESUs NMFS is limited to reporting whatever estimates of escapement of hatchery fish to natural systems that were made available.

Computed Statistics

To represent current run size or escapement where recent data were available, NMFS computed the geometric mean of the most recent five years reported, while trying to use only estimates that reflect the total abundance for an entire river basin or tributary, avoiding index counts or dam counts that represent only a small portion of available habitat.

Recent average abundance is reported as the geometric mean of the most recent 5 years of data. Where time-series data were not available, NMFS relied on recent estimates from state agency reports; time periods included in such estimates varied considerably.

Historic run size estimates from cannery pack data were made by converting the largest number of cases of cans packed in a single season to numbers of fish in the spawning run.

NMFS calculated recent trends from the most recent 10 years, using data collected after 1984 for series having at least 7 observations since 1984. No attempt was made to account for the influence of hatchery-produced fish on these estimates, so the estimated trends include the progeny of naturally spawning hatchery fish.

After evaluating patterns of abundance drawn on these quantitative and qualitative assessments, and evaluating other risk factors for chinook salmon from these ESUs, NMFS reached the following conclusions summarized below.

(1) Sacramento River Winter-Run ESU

Presently listed as endangered under the California and Federal Endangered Species Acts, this ESU has been extensively reviewed by NMFS (NMFS 1987, 1989, 1990a,b, 1994b). That information is only summarized and updated here.

Historically the winter run was abundant and comprised populations in the McCloud, Pit, Little Sacramento, and Calaveras Rivers. Construction of Shasta Dam in the 1940s eliminated access to all of the historic spawning habitat for winter-run chinook salmon in the Sacramento River Basin. Since then, the ESU has been reduced to a single spawning population confined to the mainstem Sacramento River below Keswick Dam (Reynolds *et al.*, 1993).

The fact that this ESU is comprised of a single population with very limited spawning and rearing habitat increases risk of extinction due to local catastrophe or poor environmental conditions. There are no other natural populations in the ESU to buffer it from natural fluctuations.

Because the Sacramento River winter-run ESU is currently listed as an endangered species, NMFS did not review its previous risk conclusion here.

(2) Central Valley Spring-Run ESU

Native spring chinook salmon have been extirpated from all tributaries in the San Joaquin River Basin, which represents a large portion of the historic range and abundance of the ESU as a whole. The only streams considered to have wild spring-run chinook salmon are Mill and Deer Creeks, and possibly Butte Creek (tributaries to the Sacramento River), and these are relatively small populations with sharply declining trends. Demographic and genetic risks due to small population sizes are thus considered to be high.

Habitat problems are the most important source of ongoing risk to this ESU. Spring-run fish cannot access most of their historical spawning and rearing habitat in the Sacramento and San Joaquin River Basins (which is now above impassable dams), and current spawning is restricted to the mainstem and a few river tributaries in the Sacramento River. The remaining spawning habitat accessible to fish is severely degraded. Collectively, these habitat problems greatly reduce the resiliency of this ESU to respond to additional stresses in the future. The general degradation of conditions in the Sacramento River Basin (including elevated water temperatures, agricultural and municipal diversions and returns, restricted and regulated flows, entrainment of migrating fish into unscreened or poorly screened diversions, and the poor quality and quantity of remaining habitat) has severely impacted important juvenile rearing habitat and migration corridors.

There appears to be serious concern for threats to genetic integrity posed by hatchery programs in the Central Valley. Most of the spring-run chinook salmon production in the Central Valley is of hatchery origin, and naturally spawning populations may be interbreeding with both fall/late fall- and spring-run hatchery fish. This problem is exacerbated by the increasing production of spring chinook salmon from the Feather River and Butte Creek Hatcheries, especially in light of reports suggesting a high degree of mixing between spring- and fall/late fall-run broodstock in the hatcheries. In addition, hatchery strays are considered to be an increasing problem due to the management practice of releasing a larger proportion of fish off station (into the Sacramento River delta and San Francisco Bay).

The only previous assessment of risk to stocks in this ESU is that of Nehlsen *et al.* (1991), who identified several stocks as being at risk or of special concern. Four stocks were identified as extinct (spring/summer-run chinook salmon in the American, McCloud, Pit, and San Joaquin (including tributaries) Rivers) and two stocks (spring-run chinook salmon in the Sacramento and Yuba Rivers) were identified as being at a moderate risk of extinction.

As discussed above, habitat problems were considered to be the most important source of ongoing risk to this ESU. However, NMFS is also quite concerned about threats to genetic integrity posed by hatchery programs in the Central Valley, as well as related harvest regimes that may not be allowing recovery of this at-risk population. Based on this risk, NMFS concluded that chinook salmon in this ESU are in danger of extinction.

(3) Central Valley Fall/Late Fall-Run ESU

Although total population abundance in this ESU is relatively high, perhaps near historic levels, NMFS identified several concerns regarding its status. The abundance of natural fall chinook salmon in the San Joaquin River Basin is low leading NMFS to conclude a large proportion of the historic range of this ESU is severely degraded. Habitat blockage is not as severe for fall/late fall-run chinook salmon as it is for winter- and spring-run chinook salmon in this region because most of fall/late fall-run spawning habitat was below dams constructed in the region. However, there has been a severe degradation of the remaining habitat, especially due to agricultural and municipal water use activities in the Central Valley (which result in point and non-point pollution, elevated water temperatures, diminished flows, and smolt and adult entrainment into poorly screened or unscreened diversions). Additionally, stray rates are high because many hatchery fish are released off-station to avoid adverse river conditions, resulting in a much larger proportion of hatchery chinook salmon present in the natural spawning population.

A mitigating factor for the overall risk to the ESU is that a few of the Sacramento and San Joaquin River Basin tributaries are showing recent, short-term increases in abundance. However, the streams supporting natural runs considered to be the least influenced by hatchery fish have the lowest abundance and the most consistently negative trends of all populations in the ESU. In general, high hatchery production combined with infrequent monitoring of natural production make assessing the sustainability of natural production problematic, resulting in substantial uncertainty in assessing the status of this ESU.

Other concerns facing chinook salmon in this ESU are the high ocean and freshwater harvest rates in recent years, which may be higher than is sustainable by natural populations given the productivity of the ESU under present habitat conditions. The mixed stock ocean salmon off California fisheries are managed to achieve spawning escapement goals for two main indicator stocks: Sacramento River fall chinook and Klamath River fall chinook. Harvest may be further constrained to meet NMFS' ESA requirements for listed species, including Sacramento River winter chinook, Central California Coastal and Southern Oregon/Northern California coho, and Snake River fall chinook. Since 1993, the need to address Indian fishing rights in the Klamath River Basin has required significant reductions in the ocean harvest rate on Klamath River fall chinook. As a result of the need to constrain ocean harvest rates on Klamath River fall chinook, commercial fisheries have not been allowed to harvest Central Valley stocks to the extent that would be permitted by the management goal for Sacramento River fall chinook alone (122,000 to 180,000 adult hatchery and natural spawners). Spawning escapements have been well above the goal range in recent years. A record number of adults (324,000) returned in 1997. The harvest rate on Central Valley stocks is indicated by the Central Valley Harvest Rate Index, which is computed as the chinook harvest south of Point Arena divided by the sum of the chinook harvest south of Point Arena and Central Valley adult chinook spawning escapement of the same year. This harvest rate index has averaged 0.73 over the past 10 years and declined somewhat in 1996 and 1997 to 0.64 and 0.66 respectively.

The only previous assessment of risk to stocks in this ESU is that of Nehlsen *et al.* (1991), who identified two stocks (San Joaquin and Cosumnes Rivers) as of special concern.

Even though total population abundance in this ESU is relatively high, perhaps near historical levels, the abundance of natural fall chinook salmon in the San Joaquin River Basin is low. Habitat problems were considered to be the most important source of ongoing risk to this ESU, although NMFS is extremely concerned about threats to genetic integrity posed by hatchery and harvest programs related to fall/late fall-run chinook salmon. Therefore, NMFS concluded that chinook salmon in this ESU are not presently in danger of extinction but are likely to become endangered in the foreseeable future.

(4) Southern Oregon and California Coastal ESU

This ESU contains chinook salmon from the Elk River, Oregon south to the northern cape forming San Francisco Bay. Chinook salmon spawning abundance in this ESU is highly variable among populations, with populations in California and spring-run chinook salmon throughout the ESU being of particular concern. There is a general pattern of downward trends in abundance in most populations for which data are available, with declines being especially pronounced in spring-run populations. The extremely depressed status of almost all coastal populations south of the Klamath River is an important source of risk to the ESU. NMFS has a general concern that no current information is available for many river systems in the southern portion of this ESU, which historically maintained numerous large populations. Although these California coastal populations do not form a separate ESU, they represent a considerable portion of genetic and ecological diversity within this ESU.

Habitat loss and/or degradation is widespread throughout the range of the ESU. The California Advisory Committee on Salmon and Steelhead Trout (CACSST) reported habitat blockages and fragmentation, logging and agricultural activities, urbanization, and water withdrawals as the most predominant problems for anadromous salmonids in California's coastal basins (CACSST, 1988). They identified associated habitat problems for each major river system in California. CDFG (1965, Vol. III, Part B) reported that the most vital habitat factor for coastal California streams was ''degradation due to improper logging followed by massive siltation, log jams, etc.'' They cited road building as another cause of siltation in some areas. They identified a variety of specific critical habitat problems in individual basins, including extremes of natural flows (Redwood Creek and Eel River), logging practices (Mad, Eel, Mattole, Ten Mile, Noyo, Big, Navarro, Garcia, and Gualala Rivers), and dams with no passage facilities (Eel, and Russian Rivers), and water diversions (Eel and Russian Rivers). Such problems also occur in Oregon streams within the ESU. The Rogue River Basin in particular has been affected by mining activities and unscreened irrigation diversions (Rivers, 1963) in addition to the problems resulting from logging and dam construction. Kostow (1995) estimated that one-third of spring chinook salmon spawning habitat in the Rogue River was inaccessible following the construction of Lost Creek Dam (River Kilometer (RKm) 253) in 1977. Recent major flood events (February 1996 and January 1997) have probably affected habitat quality and survival of juveniles within this ESU. Although NMFS has little information on these floods specific to this ESU, effects are probably similar to those discussed below for the Oregon and Washington Coastal Region.

Artificial propagation programs in the Southern Oregon and Coastal California ESU are less extensive than those in Klamath/Trinity or Central Valley ESUs. The Rogue, Chetco and Eel River Basins and Redwood Creek have received considerable releases, derived primarily from local sources. Current hatchery contribution to overall abundance is relatively low except for the Rogue River spring run. The hatchery-to-total run ratio of Rogue River spring chinook salmon, as measured at Gold Ray Dam (RKm 201), has exceeded 60% in some years (Kostow, 1995).

Previous assessments of stocks within this ESU have identified several stocks as being at risk or of concern. Nehlsen *et al.* (1991) identified seven stocks as at high extinction risk and seven stocks as at moderate extinction risk. Higgins *et al.* (1992) provided a more detailed analysis of some of these stocks, and identified nine chinook salmon stocks as at risk or of concern. Four of these stocks agreed with the Nehlsen et al. (1991) designations, while five fall chinook salmon stocks were either reassessed from a moderate risk of extinction to stocks of concern (Redwood Creek, Mad River, and Eel River) or were additions to the Nehlsen et al. (1991) list as stocks of special concern (Little and Bear Rivers). Fall chinook salmon in the Rogue River represent the only relatively healthy population(s) NMFS could identify in this ESU (Huntington *et al.*, 1996).

There is a general pattern of downward trends in abundance in most populations for which data are available, with declines being especially pronounced in spring-run populations within this ESU. The lack of population monitoring, particularly in the California portion of the range, led to a high degree of uncertainty regarding the status of these populations. NMFS concluded that the extremely depressed status of almost all coastal populations south of the Klamath River is an important source of risk to the ESU. Overall, NMFS concluded that chinook salmon in this ESU are likely to become endangered in the foreseeable future.

(5) Upper Klamath and Trinity Rivers ESU

The question of overall risk was difficult to evaluate because of the large disparity in the status of spring- and fall-run populations within the ESU. Spring-run chinook salmon were once the dominant run type in the Klamath-Trinity River Basin. Most spring-run spawning and rearing habitat was blocked by the construction of dams in the late 1800s and early 1900s in the Klamath River Basin, and in the 1960s in the Trinity River Basin. As a result of these and other factors, spring-run populations are at less than 10 percent of their historic levels, and at least 7 spring-run populations that once existed in the basin are now considered extinct. The remaining spring runs have relatively small population sizes and are isolated in just a few areas of the basin, resulting in genetic and demographic risks.

Fall-run chinook populations in this ESU are stable or increasing slightly. Substantial numbers of fall-run chinook salmon spawn naturally in many areas of the ESU. However, natural populations have frequently failed to meet modest spawning escapement goals despite active harvest management. In addition to habitat blockages, there continues to be severe degradation of remaining habitat due to mining, agricultural and forestry activities, and water storage and transfer. Furthermore, hatchery production in the basin is substantial, with considerable potential for interbreeding between natural and hatchery fish. NMFS is concerned that hatchery fish spawning naturally may mask declines in natural populations.

Previous assessments of stocks within this ESU have identified several stocks as being at risk or of concern. Nehlsen *et al.* (1991) identified seven stocks as extinct, two stocks (Klamath River spring chinook salmon and Shasta River fall chinook salmon) as at high extinction risk, and Scott River fall chinook salmon as of special concern. Higgins *et al.* (1992) provided a more detailed analysis of some of the stocks identified by Nehlsen *et al.* (1991), classifying three chinook salmon stocks as at risk. Additionally, three chinook salmon stocks were identified as of special concern. Of these, one (Scott River fall run) agreed with Nehlsen *et al.* (1991), while two were additions (Trinity River spring run and South Fork Trinity River fall run).

In summary, the question of overall risk was difficult to evaluate because of the large disparity in the status of spring- and fall-run populations within the ESU. However, NMFS has concluded that, because of the relative health of the fall-run populations, chinook salmon in this ESU are not at significant risk of extinction, nor are they likely to become endangered in the foreseeable future.

(6) Oregon Coast ESU

Production in this ESU is mostly dependent on naturally-spawning fish, and spring-run chinook salmon in this ESU are in relatively better condition than those in adjacent ESUs. Long-term trends in abundance of chinook salmon within most populations in this ESU are upward.

In spite of a generally positive outlook for this ESU, several populations are exhibiting recent and severe (>9 percent per year) short-term declines in abundance. In addition, there are several hatchery programs and Salmon and Trout Enhancement Programs (STEP) releasing chinook salmon throughout the ESU, and many of the fish released are derived from a single stock (Trask River). Most importantly, there is a lack of clear information on the degree of straying of these hatchery fish into naturally-spawning populations. There are also many populations within the ESU for which there are no abundance data; thus NMFS is concerned about the uncertain risk assessment given these data gaps. Finally, exploitation rates on chinook salmon from this ESU have been high in the past, and the level of harvest could be a significant source of risk if it continues at historically high rates. Also, freshwater habitats are generally in poor condition, with numerous problems such as low summer flows, high temperatures, loss of riparian cover, and streambed changes.

Previous assessments of stocks within this ESU have identified several as being at risk or of concern; however, the preponderance of stocks have been identified as healthy. Nehlsen *et al.* (1991) identified two stocks as at high extinction risk (South Umpqua River and Coquille River spring-run), one stock as at moderate extinction risk (Yachats River fall-run) and five stocks as of special concern. Of the 44 stocks within this ESU considered by Nickelson *et al.* (1992), 26 were identified as healthy, 2 as depressed (South Umpqua River and Coquille River spring chinook salmon), 7 as of special concern due to hatchery strays, and 9 of unknown status (4 of which they suggested may not be viable). Huntington *et al.* (1996) identified 18 stocks in their survey: 6 healthy Level I and 12 healthy Level II stocks.

Abundance of this ESU is relatively high, and fish are well distributed among numerous, relatively small river basins. Long-term trends in abundance of chinook salmon within most populations in this ESU are upward. NMFS has concluded that chinook salmon in this ESU are neither presently in danger of extinction nor are they likely to become endangered in the foreseeable future.

(7) Washington Coast ESU

Long-term trends in population abundance have been predominantly upward for the medium and larger populations but are sharply downward for several of the smaller populations. In general, abundance and trend indicators are more favorable for stocks in the northern portion of the ESU, and more favorable for fall-run populations than for spring- or summer-run fish. This disparity was a source of concern regarding the overall health of the ESU.

All basins are affected by habitat degradation, largely related to forestry practices. Tributaries inside Olympic National Park are generally in the best condition regarding habitat quality. Special concern was expressed regarding the status of spring-run populations throughout the ESU and fall-run populations in Willapa Bay and parts of the Grays Harbor drainage.

Hatchery production is substantial in several basins within the range of the ESU, and several populations are identified as being of composite production. There is considerable potential for hatchery fish to stray into natural populations, especially since some hatcheries are apparently unable to effectively attract returning adults. Hatchery influence is greatest in the southern part of the ESU region, especially in Willapa Bay, where there have been numerous introductions of stocks from outside of the ESU. Furthermore, the use of an exotic spring-run stock at the Sol Duc Hatchery was cited as a cause of concern.

Previous assessments of stocks within this ESU have identified several as being at risk or of concern, but more stocks have been identified as healthy than at risk. Nehlsen *et al.* (1991) identified one stock as extinct (Pysht River fall run), one as possibly extinct (Ozette River fall run), and one as at high risk of extinction (Wynoochee River spring run), although there is some question whether the Wynoochee River spring run ever existed (WDFW, 1997a). WDF *et al.* (1993) considered the status of 18 native stocks, and concluded that 11 were healthy, 4 were depressed, and 3 were unknown. Huntington *et al.* (1996) identified 12 stocks in their survey: 1 healthy Level I stock (Quillayute/Bogachiel River fall run) and 11 healthy Level II stocks.

Recent abundance has been relatively high, although it is less than estimated peak historical abundance in this region. Chinook salmon in this ESU are distributed among a relatively large number of populations, most of which are large enough to avoid serious genetic and demographic risks associated with small populations. NMFS concluded that chinook salmon in this ESU are not presently in danger of extinction nor are they likely to become endangered in the foreseeable future.

(8) Puget Sound ESU

Overall abundance of chinook salmon in this ESU has declined substantially from historical levels, and many populations are small enough that genetic and demographic risks are likely to be relatively high. Both long- and short-term trends in abundance are predominantly downward, and several populations are exhibiting severe short-term declines. Spring chinook salmon populations throughout this ESU are all depressed.

Habitat throughout the ESU has been blocked or degraded. In general, upper tributaries have been impacted by forest practices and lower tributaries and mainstem rivers have been impacted by agriculture and/or urbanization. Diking for flood control, draining and filling of freshwater and estuarine wetlands, and sedimentation due to forest practices and urban development are cited as problems throughout the ESU (WDF et al., 1993). Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in several basins. Bishop and Morgan (1996) identified a variety of important habitat issues for streams in the range of this ESU, including changes in flow regime (all basins), sedimentation (all basins), high temperatures (Dungeness, Elwha, Green/Duwamish, Skagit, Snohomish, and Stillaguamish Rivers), streambed instability (most basins), estuarine loss (most basins), loss of large woody debris (Elwha, Snohomish, and White Rivers), loss of pool habitat (Nooksack, Snohomish, and Stillaguamish Rivers), and blockage or passage problems associated with dams or other structures (Cedar, Elwha, Green/Duwamish, Snohomish, and White Rivers). The Puget Sound Salmon Stock Review Group (PFMC) provided an extensive review of habitat conditions for several of the stocks in this ESU (PFMC, 1997a). They concluded that reductions in habitat capacity and quality have contributed to escapement problems for Puget Sound chinook salmon, citing evidence of curtailment of tributary and mainstem habitat due to dams, and losses of slough and side-channel habitat due to diking, dredging, and hydromodification.

Nearly 2 billion fish have been released into Puget Sound tributaries since the 1950s. The preponderance of hatchery production throughout the ESU may mask trends in natural populations and makes it difficult to determine whether they are self-sustaining. This difficulty is compounded by the dearth of data pertaining to proportion of naturally-spawning fish that are of hatchery origin. There has also been widespread use of a limited number of hatchery stocks, resulting in increased risk of loss of fitness and diversity among populations. WDF *et al.* (1993) classified 11 out of 29 stocks in this ESU as being sustained, in part, through artificial propagation. The vast majority of these have been derived from local returning fall-run adults. Returns to hatcheries have accounted for over half of the total spawning escapement, although the hatchery contribution to spawner escapement is probably much higher than that, due to hatchery-derived strays on the spawning grounds. In the Stillaguamish River, summer chinook have been supplemented under a wild broodstock program for the last decade. In some years, returns from this program have comprised up to 30–50% of the natural spawners, suggesting that the unaided stock is not able to maintain itself (NWIFC, 1997). Almost all of the releases into this ESU have come from stocks within this ESU, with the majority of within ESU transfers coming from the Green River Hatchery or hatchery broodstocks that have been derived from Green River stock (Marshall *et al.,* 1995). The electrophoretic similarity between Green River fall-chinook salmon and several other fall chinook salmon stocks in Puget Sound (Marshall *et al.,* 1995) suggests that there may have been a significant effect from some hatchery transplants. Overall, the pervasive use of Green River stock throughout much of the extensive hatchery network that exists in this ESU may reduce the genetic diversity and fitness of naturally spawning populations.

Harvest impacts on Puget Sound chinook salmon stocks are quite high. Ocean exploitation rates on natural stocks averaged 56–59%; total exploitation rates average 68–83% (1982–89 brood years) (Pacific Salmon Commission (PSC), 1994). Total exploitation rates on some stocks have exceeded 90% (PSC, 1994).

Previous assessments of stocks within this ESU have identified several stocks as being at risk or of concern. Nehlsen et al. (1991) identified four stocks as extinct, four stocks as possibly extinct, six stocks as at high risk of extinction, one stock as a moderate risk (White River spring run), and one stock (Puyallup River fall run) as of special concern. WDF et al. (1993) considered 28 stocks within the ESU, of which 13 were considered to be of native origin and predominantly natural production. The status of these 13 stocks was: 2 healthy (Upper Skagit River summer run and Upper Sauk River spring run), 5 depressed, 2 critical (South-Fork Nooksack River spring/summer run and Dungeness River spring/summer run), and 4 unknown.

Overall abundance of chinook salmon in this ESU has declined substantially from historical levels, and both long-and short-term trends in abundance are predominantly downward. Several populations are exhibiting severe short-term declines. Spring chinook salmon populations throughout this ESU are all depressed. NMFS concluded that chinook salmon in this ESU are not presently in danger of extinction, but they are likely to become endangered in the foreseeable future.

(9) Lower Columbia River ESU

Apart from the relatively large and apparently healthy fall-run population in the Lewis River, production in this ESU appears to be predominantly hatchery-driven with few identifiable naturally spawned populations.

All basins are affected (to varying degrees) by habitat degradation. Major habitat problems are primarily related to blockages, forest practices, urbanization in the Portland and Vancouver areas, and agriculture in floodplains and low-gradient tributaries. Substantial chinook salmon spawning habitat has been blocked (or passage substantially impaired) in the Cowlitz (Mayfield Dam 1963, RKm 84), Lewis (Merwin Dam 1931, RKm 31), Clackamas (North Fork Dam 1958, RKm 50), Hood (Powerdale Dam 1929, RKm 7), and Sandy (Marmot Dam 1912, RKm 48; Bull Run River dams early 1900s) Rivers (WDF *et al.,* 1993; Kostow, 1995).

Hatchery programs to enhance chinook salmon fisheries abundance in the lower Columbia River began in the 1870s, expanded rapidly, and have continued throughout this century. Although the majority of the stocks have come from within this ESU, over 200 million fish from outside the ESU have been released since 1930. A particular concern at the present time is the straying by Rogue River fall chinook salmon, which are released into the lower Columbia River to augment harvest opportunities. Available evidence indicates a pervasive influence of hatchery fish on natural populations throughout this ESU, including both spring-and fall-run populations (Howell *et al.,* 1985; Marshall *et al.,* 1995). In addition, the exchange of eggs between hatcheries in this ESU has led to the extensive genetic homogenization of hatchery stocks (Utter *et al.,* 1989). The large numbers of hatchery fish in this ESU make it difficult to determine the proportion of naturally produced fish. In spite of the heavy impact of hatcheries, genetic and life history characteristics of populations in this ESU still differ from those in other ESUs. The loss of fitness and diversity within the ESU as an important concern.

Harvest rates on fall-run stocks are moderately high, with an average total exploitation rate of 65 percent (1982–89 brood years) (PSC, 1994). The average ocean exploitation rate for this period was 46 percent, while the freshwater harvest rate on the fall run has averaged 20 percent, ranging from 30 percent in 1991 to 2.4 percent in 1994. Harvest rates are somewhat lower for spring run stocks, with estimates for the Lewis River averaging 24 percent ocean and 50 percent total exploitation rates in 1982–89 (PSC, 1994). In inriver fisheries, approximately 15 percent of the lower river hatchery stock was harvested, 29 percent of the lower river wild stock was harvested, and 58 percent of the Spring Creek hatchery stock was harvested, while the average inriver exploitation rate on the stock as a whole was 29 percent during the 1991–1995 period (PFMC, 1996b).

Previous assessments of stocks within this ESU have identified several stocks as being at risk or of concern. Nehlsen *et al.* (1991) identified two stocks as extinct (Lewis River spring run and Wind River fall run), four stocks as possibly extinct, and four stocks as at high risk of extinction. WDF et al. (1993) considered 20 stocks within the ESU, of which only 2 (Lewis River and East Fork Lewis River fall runs) were considered to be of native origin, predominantly natural production, and healthy. Huntington *et al.* (1996) identified one healthy Level I stock in their survey (Lewis River fall run).

There have been at least six documented extinctions of populations in this ESU, and it is possible that extirpation of other native populations has occurred but has been masked by the presence of naturally spawning hatchery fish. Long-and short-term trends in abundance of individual populations are mostly negative, some severely so. About half of the populations comprising this ESU are very small, increasing the likelihood that risks due to genetic and demographic drift processes in small populations will be important. NMFS concluded that chinook salmon in this ESU are not presently in danger of extinction but are likely to become endangered in the foreseeable future.

(10) Upper Willamette River ESU

While the abundance of Willamette River spring chinook salmon has been relatively stable over the long term, and there is evidence of some natural production, it is apparent that at present production and harvest levels the natural population is not replacing itself. With natural production accounting for only ⅓ of the natural spawning escapement, it is questionable whether natural spawners would be capable of replacing themselves even in the absence of fisheries. While hatchery programs in the Willamette River Basin have maintained broodlines that are relatively free of genetic influences from outside the basin, they may have homogenized the population structure within the ESU. The introduction of fall-run chinook salmon into the basin and laddering of Willamette Falls have increased the potential for genetic introgression between wild spring-and hatchery fall-run chinook salmon, but there is no direct evidence of hybridization (other than an overlap in spawning times and spawning location) between these two runs. Prolonged artificial propagation of the majority of the production from this ESU may also have had deleterious effects on the ability of Willamette River spring chinook salmon to reproduce successfully in the wild.

Habitat blockage and degradation are significant problems in this ESU. Available habitat has been reduced by construction of dams in the Santiam, McKenzie, and Middle Fork Willamette River Basins, and these dams have probably adversely affected remaining production via thermal effects. Agricultural development and urbanization are the main activities that have adversely affected habitat throughout the basin (Bottom *et al.*, 1985, Kostow, 1995).

Another concern for this ESU is that commercial and recreational harvests are high relative to the apparent productivity of natural populations. The average total harvest mortality rate was estimated to be 72 percent in 1982–89, with a corresponding ocean exploitation rate of 24 percent (PSC, 1994). This estimate does not fully account for escapement, and ODFW is in the process of revising harvest rate estimates for this stock; revised estimates may average 57 percent total harvest rate, with 16 percent ocean and 48 percent freshwater components (Kostow,1995). The inriver recreational harvest rate (Willamette River sport catch/estimated run size) for the period from 1991 through 1995 was 33 percent (data from PFMC, 1996b).

The only previous assessment of risk to stocks in this ESU is that of Nehlsen *et al.* (1991), who identified the Willamette River spring-run chinook salmon as of special concern. They noted vulnerability to minor disturbances, insufficient information on population trend, and the special character of this stock as causes for concern.

NMFS concluded that chinook salmon in this ESU are not presently in danger of extinction but are likely to become endangered in the foreseeable future. Total abundance has been relatively stable at approximately 20,000 to 30,000 fish; however, recent natural escapement is less than 5,000 fish and has been declining sharply. Furthermore, it is estimated that about two-thirds of the natural spawners are first-generation hatchery fish, suggesting that the natural population is falling far short of replacing itself. Another concern for this ESU is that commercial and recreational harvest are high relative to the apparent productivity of natural populations.

(11) Middle Columbia River Spring-Run ESU

Total abundance of this ESU is low relative to the total basin area, and 1994–96 escapements have been very low. Several historical populations have been extirpated, and the few extant populations in this ESU are not widely distributed geographically. In addition, there are only two populations (John Day and Yakima Rivers) with substantial run sizes. However, these major river basins are predominantly comprised of naturally produced fish, and both of these exhibit long-term increasing trends in abundance. Additionally, recent analyses done as part of the PATH process indicates that productivity of natural populations in the Deschutes and John Day Rivers has been more robust than most other stream-type chinook salmon in the Columbia River (Schaller *et al.*, 1995).

Habitat problems are common in the range of this ESU. The only large blockage of spawning area for spring chinook salmon is at the Pelton/Round Butte dam complex on the Deschutes River, which probably eliminated a natural population utilizing the upper Deschutes River Basin (Kostow, 1995; Nehlsen, 1995). Spawning and rearing habitat are affected by agriculture including water withdrawals, grazing, and riparian vegetation management. Mainstem Columbia River hydroelectric development has resulted in a major disruption of migration corridors and affected flow regimes and estuarine habitat.

Hatchery production accounts for a substantial proportion of total escapement to the region. However, screening procedures at the Warm Springs River weir apparently minimize the potential for hatchery-wild introgression in the Deschutes River basin. Although straying is less of a problem with returning spring-run adults, the use of the composite, out-of-ESU Carson Hatchery stock to reestablish the Umatilla River spring run would be a cause for concern if fish from that program stray out of the basin.

Stocks in this ESU experience very low ocean harvest rates and only moderate instream harvest. Harvest rates have been declining recently (PSC, 1996).

Previous assessments of stocks within this ESU have identified several as being at risk or of concern. Nehlsen *et al.* (1991) identified five stocks as extinct, one as possibly extinct (Klickitat River spring chinook salmon), and one as of special concern (John Day River spring chinook salmon). WDF *et al.* (1993) considered five stocks within the ESU, of which three, all within the Yakima River Basin, were considered to be of native origin and predominantly natural production (Upper Yakima, Naches, and American Rivers). Despite increasing trends in these three stocks, these stocks and the two remaining (not native/natural) stocks were considered to be depressed on the basis of chronically low escapement numbers (WDF *et al.*, 1993).

Despite low abundances relative to estimated historical levels, long-term trends in abundance have been relatively stable, with an approximately even mix of upward and downward trends in populations. NMFS concluded that chinook salmon in this ESU are not presently in danger of extinction, nor is it likely to become endangered in the foreseeable future.

(12) Upper Columbia River Summer- and Fall-Run ESU

The status of this ESU was recently reviewed by NMFS (Waknitz *et al.*, 1995). In the earlier review, this ESU was determined to be neither at risk of extinction nor likely to become so. However, new data shows the proportion of naturally spawning summer chinook salmon of hatchery origin has been increasing rapidly in areas above Wells Dam. There is corresponding concern about the possible genetic and/or life-history consequences to the sustainability of natural populations in that area from the shift in hatchery releases from subyearlings to yearlings.

Nearly 38 million summer-run fish have been released from the Wells Dam Hatchery since 1967. Efforts to establish the Wells Dam summer-run broodstock removed a large proportion of the spawners (94 percent of the run in 1969) destined for the Methow River and other upstream tributaries (Mullan *et al.*, 1992). Additionally, a number of fall-run fish have been incorporated into the summer-run program, especially during the 1980s (Marshall et al., 1995). Large numbers of fall chinook salmon have been released into the mainstem Columbia River and into the Yakima River. Although no hatcheries operate on the Yakima River, releases of upriver bright fall-run chinook salmon into the lower Yakima River (below Prosser Dam) are thought to have overwhelmed local naturally spawning stocks (WDF *et al.*, 1993; Marshall *et al.*, 1995). Fall chinook salmon also spawn in the mainstem Columbia River; this occurs primarily in the Hanford Reach portion of the Columbia River, with additional spawning sites in the tailrace areas of mainstem dams. Upriver bright fall chinook salmon hatchery stocks represent a composite of stocks intercepted at various dams. This stock has also been released in large numbers by hatcheries on the mainstem Columbia River. Although the upriver bright stocks incorporated representatives from the mainstem spawning populations in the Hanford Reach and those displaced by the construction of Grand Coulee Dam and other mainstem dams, they have also incorporated individuals from the Snake River fall-run ESU (Howell *et al.*, 1985). The mixed genetic background of upriver bright stocks may result in less accurate homing (McIssac and Quinn 1988; Chapman *et al.*, 1994). However, the naturally spawning Hanford Reach fall-run population appears to stray at very low levels (Hymer *et al.*, 1992b).

Previous assessments of stocks within this ESU have identified several as being at risk or of concern. Nehlsen *et al.* (1991) identified six stocks as extinct, one as a moderate extinction risk (Methow River summer chinook salmon), and one as of special concern (Okanogan River summer chinook salmon). WDF *et al.* (1993) considered 10 stocks within the ESU, of which 3 were considered to be of native origin and predominantly natural production. The status of these three stocks was two healthy (Marion Drain and Hanford Reach fall-runs) and one depressed (Okanogan River summer-run). Huntington *et al.* (1996) identified one healthy Level I stock in their survey (Hanford Reach fall run).

In an earlier review, NMFS concluded that this ESU was not in danger of extinction, nor likely to become endangered in the foreseeable future. None of the information reviewed in this assessment provides a basis for NMFS to change this earlier conclusion. However, if negative trends in this ESU continue, NMFS will reevaluate the status of these chinook salmon.

(13) Upper Columbia River Spring-Run ESU

Access to a substantial portion of historical habitat was blocked by Chief Joseph and Grand Coulee Dams. There are local habitat problems related to irrigation diversions and hydroelectric development, as well as degraded riparian and instream habitat from urbanization and livestock grazing. Mainstem Columbia River hydroelectric development has resulted in a major disruption of migration corridors and affected flow regimes and estuarine habitat. Some populations in this ESU must migrate through nine mainstem dams.

Artificial propagation efforts have had a significant impact on spring-run populations in this ESU, either through hatchery-based enhancement or the extensive trapping and transportation activities associated with the GCFMP. Prior to the implementation of the GCFMP, spring-run chinook salmon populations in the Wenatchee, Entiat, and Methow Rivers were at severely depressed levels (Craig and Suomela, 1941). Therefore, it is probable that the majority of returning spring-run adults trapped at Rock Island Dam for use in the GCFMP were probably not native to these three rivers (Chapman et al., 1995). All returning adults were either directly transported to river spawning sites or spawned in one of the National Fish Hatcheries (NFHs) built for the GCFMP.

In the years following the GCFMP, several stocks were transferred to the NFHs in this area. Naturally spawning populations in tributaries upstream of hatchery release sites have apparently undergone limited introgression by hatchery stocks, based on CWT recoveries and genetic analysis (Chapman *et al.* 1995). Artificial propagation efforts have recently focused on supplementing naturally spawning populations in this ESU (Bugert, 1998), although it should be emphasized that these naturally spawning populations were founded by the same GCFMP homogenized stock. Furthermore, the potential for hatchery-derived non-native stocks to genetically impact naturally spawning populations exists, especially given the recent low numbers of fish returning to rivers in this ESU. Risks associated with interactions between wild and hatchery chinook salmon are a concern, because there continues to be substantial production of the composite, non-native Carson stock for fishery enhancement and hydropower mitigation.

Harvest rates are low for this ESU, with very low ocean and moderate instream harvest. Harvest rates have been declining recently (ODFW and WDFW, 1995).

Previous assessments of stocks within this ESU have identified several as being at risk or of concern. Nehlsen *et al.* (1991) identified six stocks as extinct. Due to lack of information on chinook salmon stocks that are presumed to be extinct, the relationship of these stocks to existing ESUs is uncertain. They are listed here based on geography and to give a complete presentation of the stocks identified by Nehlsen et al. (1991). WDF *et al.* (1993) considered nine stocks within the ESU, of which eight were considered to be of native origin and predominantly natural production. The status of all nine stocks was considered depressed. Populations in this ESU have experienced record low returns for the last few years.

Recent total abundance of this ESU is quite low, and escapements in 1994–1996 were the lowest in at least 60 years. At least 6 populations of spring chinook salmon in this ESU have become extinct, and almost all remaining naturally-spawning populations have fewer than 100 spawners. In addition to extremely small population sizes, both recent and long-term trends in abundance are downward, some extremely so. NMFS concluded that chinook salmon in this ESU are in danger of extinction.

(14) Snake River Fall-Run ESU

Snake River fall-run chinook salmon are currently listed as a threatened species under the ESA (57 FR 14653, April 22, 1992). As discussed above, NMFS concluded that the Snake River fall-run ESU also includes fall chinook salmon in the Deschutes River and, historically, populations from the John Day, Umatilla, and Walla Walla Rivers that have been extirpated in the twentieth century.

Almost all historical Snake River fall-run chinook salmon spawning habitat in the Snake River Basin was blocked by the Hells Canyon Dam complex; other habitat blockages have also occurred in Columbia River tributaries. Hydroelectric development on the mainstem Columbia and Snake Rivers continues to affect juvenile and adult migration. Remaining habitat has been reduced by inundation in the mainstem Snake and Columbia Rivers, and the ESU's range has also been affected by agricultural water withdrawals, grazing, and vegetation management.

The continued straying by non-native hatchery fish into natural production areas is an additional source of risk to the Snake River chinook salmon.

Assessing extinction risk to the newly-configured ESU is difficult because of the geographic discontinuity and the disparity in the status of the two remaining populations. NMFS also notes considerable uncertainty regarding the origins of fall chinook salmon in the lower Deschutes River and their relationship to fish in the upper Deschutes River. Historically, the

Snake River populations dominated production in this ESU; total abundance is estimated to have been about 72,000 in the 1930s and 1940s, and it was probably substantially higher before that. Production from the Deschutes River was presumably only a small fraction of historic production in the ESU. In contrast, recent (1990–96) returns of naturally spawning fish to the Deschutes River (about 6,000 adults per year) have been much higher than in the Snake River (5-year mean about 500 adults per year, including hatchery strays). The relatively recent extirpation of fall-run chinook in the John Day, Umatilla and Walla Walla Rivers is also a factor in assessing the risk to the overall ESU.

Long term trends in abundance are mixed—slightly upward in the Deschutes River and downward in the Snake River. Short-term trends in both remaining populations are upward. After considering the addition of the Deschutes River fall chinook populations to the listed Snake River fall-run chinook salmon ESU, NMFS concluded that the ESU as a whole is likely to become an endangered species within in the foreseeable future throughout all or a significant portion of its range, in spite of the relative health of the Deschutes River population.

(15) Snake River Spring- and Summer-Run ESU

This ESU has been extensively reviewed by NMFS (Matthews and Waples, 1991; NMFS, 1995b). The Snake River Spring and summer-run ESU is listed as a threatened species and NMFS did not review its previous risk conclusion here.

Summary of Factors Affecting the Species

Section 2(a) of the ESA states that various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern for ecosystem conservation. Section 4(a)(1) of the ESA and the listing regulations (50 CFR Part 424) set forth procedures for listing species. NMFS must determine, through the regulatory process, if a species is endangered or threatened based upon any one or a combination of the following factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or education purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence.

NMFS has prepared two supporting documents which address the factors that have led to the decline of chinook salmon and other salmonids. The first is entitled ‘‘Factors for Decline: A Supplement to the Notice of Determination for West Coast Steelhead’’ (NMFS, 1996). That report, available upon request (see **ADDRESSES**), concluded that all of the factors identified in section 4(a)(1) of the ESA have played a role in the decline of steelhead and other salmonids, including chinook salmon. The report identifies destruction and modification of habitat, overutilization for commercial and recreational purposes, and natural and human-made factors as being the primary reasons for the decline of west coast steelhead, and other salmonids including chinook salmon. The second document is a supplement to the document referred to above. This document, entitled ‘‘Factors Contributing to the Decline of West Coast Chinook Salmon: An Addendum to the 1996 West Coast Steelhead Factors for Decline Report’’ (NMFS, 1998 In prep.) discusses specific factors affecting chinook salmon. In this report, NMFS concludes that all of the factors identified in section 4(a)(1) of the ESA have played a role in the decline of chinook salmon, and other salmonids. The report identifies destruction and modification of habitat, overutilization for recreational purposes, and natural and human-made factors as being the primary reasons for the decline of chinook salmon.

The following discussion summarizes findings regarding factors for decline across the range of chinook salmon. While these factors have been treated here in general terms, it is important to underscore that impacts from certain factors are more acute for specific ESUs. For example, impacts from hydropower development are more pervasive for ESUs in the Columbia River Basin than for some coastal ESUs.

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Chinook salmon on the west coast of the United States have experienced declines in abundance in the past several decades as a result of loss, damage or change to their natural environment. Water diversions for agriculture, flood control, domestic, and hydropower purposes (especially in the Columbia River and Sacramento-San Joaquin Basins) have greatly reduced or eliminated historically accessible habitat, and degraded remaining habitat.

Forestry, agriculture, mining, and urbanization have degraded, simplified, and fragmented habitat. Studies indicate that in most western states, about 80 to 90 percent of the historic riparian habitat has been eliminated (Botkin *et al.*, 1995; Norse, 1990; Kellogg, 1992; California State Lands Commission, 1993). Washington and Oregon wetlands are estimated to have diminished by one-third, while California has experienced a 91 percent loss of its wetland habitat. Loss of habitat complexity and habitat fragmentation have also contributed to the decline of chinook salmon. For example, in national forests within the range of the northern spotted owl in western and eastern Washington, there has been a 58 percent reduction in large, deep pools due to sedimentation and loss of pool-forming structures such as boulders and large wood (Forest Ecosystem Management Assessment Team (FEMAT), 1993). Similarly, in Oregon, the abundance of large, deep pools on private coastal lands has decreased by as much as 80 percent (FEMAT, 1993). Sedimentation from extensive and intensive land use activities (timber harvests, road building, livestock grazing, and urbanization) is recognized as a primary cause of habitat degradation in the range of west coast chinook salmon.

B. Overutilization for Commercial, Recreational, Scientific or Educational Purposes

Historically, chinook salmon were abundant in many western coastal and interior waters of the United States. Chinook salmon have supported, and still support important tribal, commercial and recreational fisheries throughout their range, contributing millions of dollars to numerous local economies, as well as providing important cultural and subsistence needs for Native Americans. Overfishing in the early days of European settlement led to the depletion of many stocks of chinook and other salmonids even before extensive habitat degradation. However, following the degradation of many west coast aquatic and riparian ecosystems, exploitation rates were higher than many chinook populations could sustain. Therefore, harvest may have contributed to the further decline of some populations.

C. Disease or Predation

Introductions of non-native species and habitat modifications have resulted in increased predator populations in numerous rivers. Predation by marine mammals is also of concern in areas experiencing dwindling chinook salmon runsizes. However, salmonids appear to be a minor component of the diet of marine mammals (Scheffer and Sperry, 1931; Jameson and Kenyon, 1977; Graybill, 1981; Brown and Mate, 1983; Roffe and Mate, 1984; Hanson, 1993). Principal food sources are small pelagic schooling fish, juvenile rockfish, lampreys (Jameson and Kenyon, 1977; Roffe and Mate, 1984), benthic and epibenthic species (Brown and Mate, 1983) and flatfish (Scheffer and Sperry, 1931; Graybill, 1981). Predation may significantly influence salmonid abundance in some local populations when other prey are absent and physical conditions lead to the concentration of adults and juveniles (Cooper and Johnson, 1992).

Infectious disease is one of many factors that can influence adult and juvenile chinook salmon survival. Chinook 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 such as bacterial kidney disease (BKD), ceratomyxosis, columnaris, furunculosis, infectious hematopoietic necrosis virus, redmouth and black spot disease, erythrocytic inclusion body syndrome, and whirling disease, among others, are present and are known to affect chinook salmon (Rucker *et al.*, 1953; Wood, 1979; Leek, 1987; Foott *et al.*, 1994; Gould and Wedemeyer, undated). Very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases for chinook salmon. However, studies have shown that naturally spawned fish tend to be less susceptible to pathogens than hatchery-reared fish (Buchanon *et al.*, 1983; Sanders *et al.*, 1992). Native chinook salmon have evolved with certain of these organisms, but the widespread use of artificial propagation has introduced exotic organisms not historically present in particular watersheds. Scientific studies may indicate that chinook salmon are more susceptible to disease organisms than other salmonids. Habitat conditions such as low water flows and high temperatures can exacerbate susceptibility to disease.

D. The Inadequacy of Existing Regulatory Mechanisms

A variety of Federal, state, tribal, and local laws, regulations, treaties and measures affect the abundance and survival of west coast chinook salmon and the quality of their habitat. NMFS prepared a separate report entitled ‘‘West Coast Steelhead Conservation Measures, A Supplement to the Notice of Determination for West Coast Steelhead Under the Endangered Species’’ which summarizes many of these existing measures and their effect on steelhead and other salmonids, including chinook salmon. This report is available from NMFS (see ADDRESSES section). The following sections briefly discuss other regulatory measures designed to conserve chinook and other salmonids (see also Efforts Being Made to Protect West Coast Chinook Salmon and Conservation Measures sections).

1. Federal Land and Water Management

The Northwest Forest Plan (NFP) is a Federal management policy with important benefits for chinook salmon. While the NFP covers a very large area, the overall effectiveness of the NFP in conserving chinook salmon is limited by the extent of Federal lands and the fact that Federal land ownership is not uniformly distributed in watersheds within the affected ESUs. The extent and distribution of Federal lands limits the NFP’s ability to achieve its aquatic habitat restoration objectives at watershed and river basin scales and highlights the importance of complementary salmon habitat conservation measures on nonfederal lands within the subject ESUs.

On February 25, 1995, the U.S. Forest Service and Bureau of Land Management adopted Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in eastern Oregon and Washington, Idaho, and portions of California (known as PACFISH). The strategy was developed in response to significant declines in naturally-reproducing salmonid stocks, including chinook salmon, and widespread degradation of anadromous fish habitat throughout Federal lands in Idaho, Washington, Oregon, and California outside the range of the northern spotted owl. Like the NFP, PACFISH is an attempt to provide a consistent approach for maintaining and restoring aquatic and riparian habitat conditions which, in turn, are expected to promote the sustained natural production of anadromous fish. However, as with the NFP, PACFISH is limited by the extent of Federal lands and Federal land ownership is not uniformly distributed in watersheds within all the affected ESUs.

Within the range of several chinook salmon ESUs (*i.e.*, Southern Oregon and California Coastal, Lower Columbia River, and Puget Sound), much of available chinook salmon habitat is covered by the requirements of the NFP. These existing conservation efforts have resulted in improvements in aquatic habitat conditions for salmonids within this region.

Since the adoption of the NFP, NMFS has consulted with the BLM and USFS on ongoing and proposed activities that may affect anadromous salmonids, including chinook salmon and their habitats. During this period of time, NMFS has reviewed thousands of activities throughout northern California, Oregon, and Washington and helped develop numerous programmatic biological assessments (BAs) with the BLM and the USFS. These BAs cover a wide range of management activities, including forest and/or resource area-wide routine and non-routine road maintenance, hazard tree removal, range allotment management, watershed and instream restoration, special use permits (*e.g.*, mining, ingress/egress), timber sale programs (*e.g.*, green tree, fuel reduction, thinning, regeneration, and salvage), and BLM’s land tenure adjustment program. Numerous other project-specific BAs were also consulted and conferenced upon. These National Forest and BLM Resource Area-wide BAs include region-specific best management practices, all necessary measures to minimize impacts for all listed or proposed anadromous salmonids, monitoring, and environmental baseline checklists for each project. These BA’s have resulted in a more consistent approach to management of Federal lands throughout the NFP and PACFISH areas.

2. Federal/State Land and Water Management in California

California’s Central Valley chinook salmon have been the subject of many conservation efforts aimed at restoring the Sacramento and San Joaquin Rivers over several decades. Past efforts have generally been unsuccessful at reducing the risks facing Central Valley chinook salmon. Despite a long history of unproductive conservation and protection efforts, Federal, state and private stakeholders joined to urge Congressional passage of the Central Valley Project Improvement Act (CVPIA) in 1992, followed by the signing of the CALFED Bay-Delta Accord (Accord) in December 1994. The Bay-Delta Accord detailed interim measures for environmental protection and paved the way for the development of the long-term CALFED Bay-Delta Program. The CALFED Bay-Delta Program which began in June of 1995 is a planning effort between state and federal agencies for developing a long-range, comprehensive solution for the Bay-Delta Estuary and its watershed. Collectively, the CVPIA and CALFED Bay-Delta conservation programs may provide a comprehensive conservation response to the extensive ecologic problems facing at-risk salmonids. The CVPIA and the CALFED Bay-Delta Program are described in more detail in the Efforts Being Made to Protect West Coast Chinook Salmon section.

3. State Land Management

The California Department of Forestry and Fire Protection (CDF) enforces the State of California's forest practice rules (CFPRs) which are promulgated through the Board of Forestry (BOF). The CFPRs contain provisions that provide significant protection for chinook salmon if fully implemented. However, NMFS believes the CFPRs do not secure properly functioning riparian habitat. Specifically, the CFPRs do not adequately address large woody debris recruitment, streamside tree retention to maintain bank stability, and canopy retention standards that assure stream temperatures are properly functioning for all life stages of chinook salmon. The current process for approving Timber Harvest Plans (THPs) under the CFPRs does not include monitoring of timber harvest operations to determine whether a particular operation damaged habitat and, if so, how it might be mitigated in future THPs. The CFPR rule that permits salvage logging is also an area where better environmental review and monitoring could ensure better protection for chinook salmon. For these reasons, NMFS is working to improve the condition of riparian buffers in ongoing habitat conservation plan negotiations with private landowners.

The Oregon Forest Practices Act (OFPA), while modified in 1995 and improved over the previous OFPA, does not have implementing rules that adequately protect salmonid habitat. In particular, the current OFPA does not provide adequate protection for the production and introduction of large woody debris (LWD) to medium, small and non-fish bearing streams. Small non-fish bearing streams are vitally important to the quality of downstream habitats. These streams carry water, sediment, nutrients, and LWD from upper portions of the watershed. The quality of downstream habitats is determined, in part, by the timing and amount of organic and inorganic materials provided by these small streams (Chamberlin *et al.* in Meehan, 1991). Given the existing depleted condition of most riparian forests on non-Federal lands, the time needed to attain mature forest conditions, the lack of adequate protection for non-riparian LWD sources in landslide-prone areas and small headwater streams (which account for about half the wood found naturally in stream channels) (Burnett and Reeves, 1997 citing Van Sickle and Gregory, 1990; McDade *et al.*, 1990; and McGreary, 1994), and current rotation schedules (approximately 50 years), there is a low probability that adequate LWD recruitment could be achieved under the current requirements of the OFPA. Also, the OFPA does not adequately consider and manage timber harvest and road construction on sensitive, unstable slopes subject to mass wasting, nor does it address cumulative effects. These issues, and other concerns about the OFPA have been analyzed in detail in a recent document prepared by NMFS. The document, entitled ''A Draft Proposal Concerning Oregon Forest Practices'' was submitted to the Oregon Board of Forestry Memorandum of Agreement Advisory Committee and to the Oregon Governor's Office to advance potential improvements in Oregon forest practices (OFP) (NMFS OFP Draft, February 17, 1998).

The Washington Department of Natural Resources implements and enforces the State of Washington's forest practice rules (WFPRs) which are promulgated through the Forest Practices Board. These WFPRs contain provisions that can be protective of chinook salmon if fully implemented. This is possible given that the WFPRs are based on adaptive management of forest lands through watershed analysis, development of site-specific land management prescriptions, and monitoring. Watershed Analysis prescriptions can exceed WFPR minimums for stream and riparian protection. However, NMFS believes the WFPRs, including watershed analysis, do not provide properly functioning riparian and instream habitats. Specifically, the base WFPRs do not adequately address LWD recruitment, tree retention to maintain stream bank integrity and channel networks within floodplains, and chronic and episodic inputs of coarse and fine sediment that maintain habitats that are properly functioning for all chinook salmon life stages.

4. Dredge, Fill, and Inwater Construction Programs

The Army Corps of Engineers (COE) regulates removal/fill activities under section 404 of the Clean Water Act (CWA), which requires that the COE 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, the COE guidelines do not specify a methodology for assessing cumulative impacts or how much weight to assign them in decision-making. Furthermore, the COE does not have in place any process to address the additive effects of the continued development of waterfront, riverine, coastal, and wetland properties.

5. Water Quality Programs

The Federal Clean Water Act (CWA), enforced in part by the Environmental Protection Agency (EPA), is intended to protect beneficial uses, including fishery resources. To date, implementation has not been effective in adequately protecting fishery resources, particularly with respect to non-point sources of pollution.

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, EPA is required to do so if a state does not meet this responsibility. In California, as a result of recent litigation, the EPA has made a legal commitment guaranteeing that either EPA or the State will establish TMDLs that identify pollution reduction targets for 18 impaired river basins in northern California by the year 2007. California has made a commitment to establish TMDLs for approximately half the 18 river basins by 2007. The EPA will develop TMDLs for the remaining basins and has also agreed to complete all TMDLS if the State fails to meet its commitment within the agreed upon time frame.

State agencies in Oregon are committed to completing TMDLs for coastal drainages within 4 years, and all impaired waters within 10 years. Similarly ambitious schedules are being developed for Washington and California.

The ability of these TMDLs to protect chinook salmon should be significant in the long term; however, it will be difficult to develop them quickly in the short term and their efficacy in protecting chinook salmon habitat will be unknown for years to come.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Natural climatic conditions have exacerbated the problems associated with degraded and altered riverine and estuarine habitats. Persistent drought conditions have reduced already limited spawning, rearing and migration habitat. Climatic conditions appear to have resulted in decreased ocean productivity which, during more productive periods, may offset poor productivity caused by degraded freshwater habitat conditions.

In an attempt to mitigate the loss of habitat, extensive hatchery programs have been implemented throughout the range of west coast chinook salmon. While some of these programs have succeeded in providing fishing opportunities, the impacts of these programs on native, naturally-reproducing stocks are not well understood. Competition, genetic introgression, and disease transmission resulting from hatchery introductions may significantly reduce the production and survival of native, naturally-reproducing chinook salmon (NMFS, 1996a). Collection of native chinook salmon for hatchery broodstock purposes often harms small or dwindling natural populations. Artificial propagation may play an important role in chinook salmon recovery and some hatchery populations of chinook salmon may be deemed essential for the recovery of threatened or endangered chinook salmon ESUs (see Proposed Determination section).

In the past, non-native chinook salmon stocks have been introduced as broodstock in hatcheries and widely transplanted in many coastal rivers and streams throughout the range of the proposed chinook salmon ESUs (Bryant, 1994; Myers *et al.*, 1998). Because of problems associated with this practice, California Department of Fish and Game (CDFG) developed its Salmon and Steelhead Stock Management Policy. This policy recognizes that such stock mixing is detrimental and seeks to maintain the genetic integrity of all identifiable California stocks of chinook salmon and other salmonids, as well as minimize interactions between hatchery and natural populations. To protect the genetic integrity of salmon and steelhead stocks, this policy directs CDFG to evaluate each salmon and steelhead stream and classify it according to its probable genetic source and degree of integrity.

Hatchery programs and harvest management have strongly influenced chinook salmon populations in the Central Valley, California ESU, the Puget Sound ESU, the Lower Columbia River ESU, the Upper Willamette ESU, and the Upper Columbia River spring-run ESU. Hatchery programs intended to compensate for habitat losses have masked declines in natural stocks and have created unrealistic expectations for fisheries.

The three state agencies (California Department of Fish and Game, Oregon Department of Fish and Wildlife, and the Washington Department of Fish and Wildlife) have adopted and are implementing natural salmonid policies designed to limit hatchery influences on natural, indigenous chinook salmon. While some limits have been placed on hatchery production of anadromous salmonids, more careful management of current programs and scrutiny of proposed programs is necessary in order to minimize impacts on listed species.

Efforts Being Made To Protect West Coast Chinook Salmon

Section 4(b)(1)(A) of the ESA requires the Secretary of Commerce to make listing determinations solely on the basis of the best scientific and commercial data available and after taking into account efforts being made to protect a species. Therefore, in making its listing determinations, NMFS first assesses chinook salmon status and identifies factors that have lead to its decline. NMFS then assesses existing conservation actions to determine if those measures ameliorate the risks faced by chinook salmon.

In judging the efficacy of existing conservation efforts, NMFS considers the following: (1) The substantive, protective, and conservation elements of such efforts; (2) the degree of certainty such efforts will be reliably implemented; and (3) the presence of monitoring provisions that permit adaptive management (NMFS 1996b). In some cases, conservation efforts may be relatively new and may not have had time to demonstrate their biological benefit. In such cases, provisions for adequate monitoring and funding of conservation efforts are essential to ensure intended conservation benefits are realized (see NMFS 1996b, see also 62 FR 24602–24607, May 6, 1997).

During a previous status review for west coast steelhead, NMFS reviewed an array of protective efforts for steelhead and other salmonids, including chinook salmon, ranging in scope from regional strategies to local watershed initiatives. NMFS summarized some of the major efforts in a document entitled ''Steelhead Conservation Efforts: A Supplement to the Notice of Determination for West Coast Steelhead Under the Endangered Species Act.'' (NMFS, 1996). This document is available upon request (see **ADDRESSES**).

Several more recently developed protective efforts have been directed towards the conservation of various salmonids and the watersheds supporting them. These efforts may affect recovery of chinook salmon in California, Oregon and Washington.

State of California Protective Measures for Central Valley Chinook

Spring- and fall/late fall-run chinook salmon in California's Central Valley are beginning to benefit from two major conservation initiatives that are under development and simultaneously being implemented to conserve and restore salmonid and other fishery resources in the rivers and streams of the Central Valley, including the Bay-Delta region. The first of these initiatives is the Central Valley Project Improvement Act (CVPIA) which Congress passed in 1992. The CVPIA is intended to remedy habitat and other problems associated with the construction and operation of the Bureau of Reclamation's (BOR) Central Valley Project. The CVPIA has two key habitat restoration features related to the recovery of chinook salmon in the Central Valley. First, it directs the Secretary of the Interior to develop and implement a program that makes all reasonable efforts to double natural production of anadromous fish in Central Valley streams (Section 3406(b)(1)) by the year 2002. The U.S. Fish and Wildlife Service (FWS) approached implementation of this CVPIA directive through development of the Anadromous Fish Restoration Program (AFRP). The AFRP contains a total of 172 actions and 117 evaluations. The Department of the Interior (DOTI) intends to finalize the AFRP in 1998 upon completion of the Programmatic Environmental Impact Statement, which is required by Section 3409 of the CVPIA. Secondly, the CVPIA annually dedicates up to 800,000 acre feet (AF) of water flows for fish, wildlife, and habitat restoration purposes (Section 3406(b)(2)), and provides for the acquisition of additional water to supplement the 800,000 AF (Section 3406(b)(3)). The FWS, in consultation with other Federal and State agencies, directs the use of these dedicated water flows.

On November 20, 1997, DOI released its final administrative proposal on the management of Section 340(b)(2) water and a set of flow-related actions for the use of so-called (b)(2) water during the next five years. These plans will be continuously updated to include new information, consistent with the adaptive management approach described in the AFRP. To make restoration efforts as efficient as possible, the AFRP has committed to coordinate restoration efforts with those developed and implemented by other groups or programs, including the CALFED Bay-Delta program.

Federal funding has been appropriated since 1995 to implement restoration projects identified through the AFRP planning and development process, or through complementary programs such as the CALFED Bay-Delta Program. In 1996, a total of $1.9 million was obligated for 11 restoration projects or evaluations identified through the AFRP planning process. These projects included restoration management planning efforts in the lower Tuolumne River, Deer Creek, and Butte Creek, modification of a fish ladder on the Yuba River, acquisition of riparian property and easements on Pine Creek and Big Chico Creek, water exchange pump and riparian restoration projects on Mill Creek, and several monitoring and evaluation projects. In 1997, $9.7 million was obligated for over 30 projects located throughout the Central Valley. The AFRP's projected budget for restoration projects in the Central Valley in 1998 is $8.2 million. The ARFP's 1998 work plan identifies 27 high priority projects for funding, and an additional 14 projects which will proceed contingent on additional funding. An estimated $20 million to $35 million will be spent on AFRP restoration actions per year for 25 years ($500 million to $875 million estimated total), most of which will be closely integrated with funding for habitat restoration activities as part of the CALFED Bay-Delta program.

During 1996 and 1997, the AFRP implemented several fish flow and habitat restoration actions using the CVPIA provisions. Specific actions included limiting Delta water exports for fisheries protection, closing the Delta Cross Channel gates to minimize the diversion of juvenile chinook salmon from the Sacramento River into the Delta, and modifying the operation of water project facilities in the Delta to evaluate the benefits of actions taken to protect juvenile chinook salmon. NMFS expects that similar fisheries protection measures will be implemented in 1998 depending on actual hydrological conditions.

The second and very ambitious initiative that benefits Central Valley spring and fall/late-fall chinook salmon is the CALFED Bay-Delta Program. In June 1994, state and Federal agencies signed a framework agreement that pledged all agencies to work together to formulate water quality standards to protect the Bay-Delta, coordinate state and Federal water project operations, and develop a long-term Bay-Delta restoration program. In December 1994, a diverse group of State and Federal agencies, water agencies and environmental organizations signed The Bay-Delta Accord which set out specific interim (3-year) measures for environmental protection, including protection for Central Valley chinook stocks. The CALFED Bay-Delta Program, which began in June, 1995, is charged with developing the long-term Bay-Delta solution and restoration program.

Three types of environmental protection and restoration measures are detailed in the 1994 Bay-Delta Accord: (1) The control of freshwater outflow in the Delta to improve estuarine conditions in the shallow-water habitat of the Bay-Delta estuary (Category I measures), (2) the regulation of water project operations and flows to minimize harmful environmental impacts of water exports (Category II measures), and (3) the funding and implementation of projects to address non-flow related factors affecting the Bay-Delta ecosystem such as unscreened diversions, physical habitat degradation, and pollution (Category III measures). Many of the Category I and II measures identified in the agreement were implemented by a Water Quality Control Plan that was adopted by the State Water Resources Control Board in 1995. Efforts were also initiated to implement Category III non-flow projects beginning in 1995 and these have continued to the present.

In 1995 and 1996, the Category III program approved a total of $21.1 million in funding for a large number of habitat restoration, fish screening, land acquisition, research and monitoring, watershed planning, and fish passage projects distributed throughout the Sacramento/San Joaquin River basins, their tributaries and the Bay-Delta system. Additional funding was provided for most of these projects from the CVPIA or other funding sources, and many constitute specific restoration actions identified in the draft Ecosystem Restoration Program Plan (ERPP) that is being developed as part of the comprehensive long-term CALFED Bay-Delta program. The total funding obligation for these projects exceeded $40 million. A description of these projects, the project proponent, the funding commitments, and the project status are described in a March 1997 summary document. In 1997, the CALFED Bay-Delta program announced its intention to fund a total of 51 additional projects using nearly $61 million in Category III funding. Additional funding of nearly $40 million was also available as a cost share for other projects if additional high priority projects could be identified. The selection of these 51 projects were intended to address specific stressors or factors for decline that were identified in the planning process leading to development of the ERPP. The vast majority of these funds (nearly 77 percent) were allocated to projects addressing floodplain/marsh plain changes and changes in river channel form. An additional 10 percent was targeted at entrainment problems, while 8 percent addressed water quality problems. Of the total funds committed to new projects, 87 percent will be expended for implementation projects, with the balance expended for watershed planning, monitoring, and research.

Central Valley spring and fall/late-fall chinook salmon have benefited from the expenditure of these restoration program funds through the placement of new fish screens, modifications of barriers to fish passage, and habitat restoration projects, and additional benefits are expected to accrue to these populations in the future as new projects are implemented. In the long-term, NMFS is hopeful that the CVPIA and CALFED Bay-Delta conservation programs described above can be focused and implemented to provide a comprehensive conservation response to the extensive habitat problems facing chinook salmon and other species in the Central Valley. To date, however, projects funded by these programs have focused on addressing habitat problems facing these and other species, and have placed an emphasis on problems associated with freshwater and ocean harvest or hatchery management practices. The CALFED Bay-Delta Program's draft ERPP acknowledges that current hatchery practices and freshwater and ocean harvest management practices are stressors (or risk factors) that are adversely affecting natural chinook salmon populations in the Central Valley. It also identifies general changes that may be needed to reduce the impacts of these stressors, and incorporates the need for improved harvest and hatchery management in its programmatic implementation plan. However, no Category III funding has been targeted at these problems to date, and a focused plan with both a near- and long-term implementation strategy to deal with these problems still needs to be developed. Many habitat restoration projects or activities identified in the ERPP have been funded and are in the process of being implemented as discussed above. Other components of the restoration plan will be carried out as part of its long-term implementation. NMFS is encouraged by the ecosystem planning and restoration strategy developed for chinook salmon in Central Valley and Bay-Delta ecosystem. However, several risk factors that have been identified by NMFS as adversely affecting chinook salmon in the Central Valley have not been adequately addressed, and plans for their implementation needs to be developed. These risk factors include large hatchery programs and practices that are adversely affecting natural populations of spring and fall/late-fall chinook salmon, and masking our ability to confidently assess the status of naturally spawning populations; and ocean and freshwater harvest rates on natural stocks of spring and fall/late-fall chinook salmon stocks (hatchery and natural) that may exceed the basin's ability to naturally sustain these ESUs.

Because the full scope and implementation strategy for the CALFED Bay-Delta Program's long-term restoration program have yet to be finalized and a focused strategy to address impacts from harvest and hatchery practices has yet to be adequately developed, NMFS believes that the conservation benefits provided for by the CALFED restoration program and other complementary programs are not currently sufficient to reduce the substantial risks facing Central Valley spring-run and fall/late fall-run chinook salmon. NMFS is committed to working closely with the State and the CALFED Bay-Delta Program to build on the draft ERPP and its implementation strategy to ensure that all risks to spring-run and fall/late fall-run chinook salmon, including those resulting from current hatchery and harvest practices, are properly addressed in the future.

State of Oregon Conservation Measures

In April 1996, the Governor of Oregon completed and submitted to NMFS a comprehensive conservation plan directed specifically at coho salmon stocks on the Coast of Oregon. This plan, termed the Oregon Plan for Salmon and Watersheds (OPSW) (formerly known as the Oregon Coastal Salmon Restoration Initiative) has recently been expanded to include conservation measures for coastal steelhead stocks (Oregon, 1998). For a detailed description of the OPSW, refer to the May 6, 1997, listing determination for Southern Oregon/ Northern California coho salmon (62 FR 24602–24606). The essential features of the OPSW include the following:

1. Identifies and addresses all factors for decline of coastal coho and steelhead, most notably, those factors relating to harvest, habitat, and hatchery activities.

2. State agencies whose activities affect salmon are held accountable for coordinating their programs in a manner that conserves and restores the species and their habitat.

3. Developed a framework for prioritizing conservation and restoration efforts.

4. Developed a comprehensive monitoring plan that coordinates Federal, state, and local efforts to improve current knowledge of freshwater and marine conditions, determine populations trends, evaluate the effects of artificial propagation, and rate the OPSW's success or failure in restoring the salmon.

5. Actions to conserve and restore salmon must be worked out by communities and landowners—those who possess local knowledge of problems and who have a genuine stake in the outcome.

6. The principle of adaptive management coordinates the prioritization, monitoring and implementation elements of this conservation plan. Through this process, there is an explicit mechanism for learning from experience, evaluating alternative approaches, and making needed changes in the programs and measures.

7. The Independent Multidisciplinary Science Team (IMST) provides an independent audit of the OPSW's strengths and weaknesses. The IMST assists the adaptive management process by compiling new information into an annual review of goals, objectives, and strategies, and by recommending changes.

8. The annual report made to the Governor, the legislature, and the public will help the agencies make the adjustments described for the adaptive management process.

While NMFS recognizes that many of the ongoing protective efforts are likely to promote the conservation of chinook and other salmonids, in the aggregate, they have not yet achieved chinook salmon conservation at a scale that is adequate to protect and conserve the eight ESUs proposed for listing (seven newly defined ESUs and one redefined ESU). NMFS believes that most existing efforts lack some of the critical elements needed to provide a high degree of certainty that the efforts will be successful. These elements include: (1) identification of specific factors for decline; (2) immediate measures required to protect the best remaining populations and habitats and priorities for restoration activities; (3) explicit and quantifiable objectives and time lines; (4) adequate and reliable funding; and (5) monitoring programs to determine the effectiveness of actions, including methods to measure whether recovery objectives are being met (NMFS Coastal Salmon Conservation: Working Guidance For Comprehensive Salmon Restoration Initiatives on the Pacific Coast, September 15, 1996).

The best available scientific information on the biological status of the species supports a proposed listing of eight chinook salmon ESUs under the ESA (see Proposed Determination). NMFS concludes that existing protective efforts at this time are inadequate to alter the proposed determination of threatened or endangered for these eight chinook salmon ESUs. However, during the period between publication of this proposed rule and publication of a final rule, NMFS will continue to solicit information regarding existing protective efforts (see Public Comments Solicited). NMFS also will work with Federal, state and tribal fisheries managers to evaluate and enhance the efficacy of the various salmonid conservation efforts.

Proposed Determination

The ESA defines an endangered species as any species in danger of extinction throughout all or a significant portion of its range, and a threatened species as any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. § 1532(6) and (20)). Section 4(b)(1) of the ESA requires that the listing determination be based solely on the best scientific and commercial data available, after conducting a review of the status of the species and after taking into account those efforts, if any, being made to protect such species.

Based on results from its coastwide assessment, NMFS has concluded that on the west coast of the United States, there are 15 ESUs of chinook salmon which constitute ''species'' under the ESA, including 12 newly identified ESUs. After evaluating the status of these 12 ESUs, NMFS has determined that two ESUs (Central Valley spring-run and the Upper Columbia River spring-run ESUs) are in danger of extinction throughout all or a significant portion of their ranges. NMFS has also determined that five ESUs (Central Valley fall/late fall-run, Southern Oregon and California Coastal, Puget Sound, Lower Columbia River, Upper Willamette River ESUs) are likely to become an endangered species within the foreseeable future throughout all or a significant portion of their range. NMFS proposes to list these ESUs as such at this time.

The listed Snake River fall-run chinook salmon ESU is proposed to be redefined to include additional fall-run chinook populations from the Deschutes River. NMFS has determined this redefined ESU is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. This proposed reclassification of the Snake River fall-run chinook salmon ESU does not affect the threatened status of the currently defined ESU (see 63 FR 1807, January 12, 1998).

NMFS has also renamed one ESU which was previously reviewed for listing. The Middle Columbia summer and fall-run ESU is renamed the Upper Columbia River summer and fall-run ESU to reflect the inclusion of the fall-run chinook salmon populations from the Columbia River above The Dalles Dam in the newly configured Snake River fall-run ESU. The geographic boundaries for these ESUs (i.e., the watersheds within which the members of the ESU spend their freshwater residence) are described under ''ESU Determinations.''

NMFS also proposes to designate critical habitat for each of the proposed chinook salmon ESUs, as described in the following section entitled Critical Habitat for Pacific Coast Chinook Salmon. Proposed critical habitat for each chinook salmon ESU proposed for listing has been characterized in that section, as well as in tables attached to this notice. Existing critical habitat for Snake River fall-run chinook salmon is proposed to be revised to include the geographic areas of the redefined Snake River fall-run ESU.

Only naturally spawned chinook salmon are being proposed for listing as threatened or endangered species in each of the 8 ESUs. Prior to the final listing determination, NMFS will examine the relationship between hatchery and natural chinook salmon populations in these ESUs, and assess whether any hatchery populations are essential for their recovery. This may result in the inclusion of specific hatchery populations as part of a listed ESU in NMFS' final determination.

Conservation Measures

Conservation measures that may apply to listed species as endangered or threatened under the ESA include conservation measures by tribes, states, local governments, and private organizations, Federal, tribal, and state recovery actions, Federal agency consultation requirements, prohibitions on taking, and recognition. Recognition through listing promotes public awareness and conservation actions by Federal, state, tribal, and local agencies, private organizations, and individuals.

Based on information presented in this proposed rule, general protective measures that could be implemented to help conserve the species are listed below. This list does not constitute NMFS' interpretation of a recovery plan under section 4(f) of the ESA.

1. Measures could be taken to promote land management practices that protect and restore chinook salmon habitat. Land management practices affecting chinook salmon habitat include timber harvest, road building, agriculture, livestock grazing, and urban development.

2. Evaluation of existing harvest regulations could identify any changes necessary to protect chinook salmon populations.

3. Artificial propagation programs could be required to incorporate practices that minimize adverse impacts upon native populations of chinook salmon.

4. Efforts could be made to ensure that existing and proposed dam facilities are designed and operated in a manner that will not adversely affect chinook salmon populations. For example, NMFS could require that fish passage facilities at dams effectively pass migrating juvenile and adult chinook salmon.

5. Water diversions could have adequate headgate and staff gauge structures installed to control and monitor water usage accurately. Water rights could be enforced to prevent irrigators from exceeding the amount of water to which they are legally entitled.

6. Irrigation diversions affecting downstream migrating chinook salmon could be screened. A thorough review of the impact of irrigation diversions on chinook salmon could be conducted.

NMFS recognizes that, to be successful, protective regulations and recovery programs for chinook salmon will need to be developed in the context of conserving aquatic ecosystem health. NMFS believes in some cases, Federal lands and Federal activities may bear a preponderance of the burden in preserving proposed populations and the ecosystems upon which they depend. However, throughout the range of the eight ESUs proposed for listing, chinook salmon habitat occurs and is affected by activities on state, tribal or private land. Agricultural, timber, and urban management activities on nonfederal land could and should be conducted in a manner that avoids adverse effects to chinook salmon habitat.

NMFS encourages nonfederal landowners to assess the impacts of their actions on potentially threatened or endangered salmonids. In particular, NMFS encourages the formulation of watershed partnerships to promote conservation in accordance with ecosystem principles. These partnerships will be successful only if state, tribal, and local governments, landowner representatives, conservationists, and Federal and nonfederal biologists all participate and share the goal of restoring chinook salmon to the watersheds.

Several conservation efforts are underway that may reverse the decline of west coast chinook salmon and other salmonids. These include the Northwest Forest Plan (on Federal lands within the range of the northern spotted owl), PACFISH (on all additional Federal lands with anadromous salmonid populations), Oregon's Plan for Salmon and Watersheds focussing on coho salmon and steelhead, Washington's Wild Stock Restoration Initiative, the Central Valley Project Improvement Act and the CALFED Bay-Delta Program (a joint effort by California and several Federal agencies to restore the Sacramento and San Joaquin River estuary), Wy-Kam-Ush-Mi Wa-Kish-Wit (The Spirit of the Salmon): The Columbia River Anadromous Fish Restoration Plan from the four Native American treaty tribes that configure the Columbia River Inter-tribal Fish Commission (CRITFC) (CRITFC, 1996), and NMFS'' Proposed Recovery Plan for Snake River Salmon, and a Draft Recovery Plan for Sacramento winter-run Chinook Salmon.

State of California Conservation Measures

As discussed in the section entitled Efforts Being Made to Protect West Coast Chinook Salmon above, the CALFED Bay-Delta program is developing a comprehensive long-term restoration plan and implementation strategy that is intended to restore the ecosystem health and improve water management for the beneficial uses of the Bay-Delta ecosystem. This planning effort is focused on addressing four critical resource areas: ecosystem quality, water quality, system integrity, and water supply reliability. In addition, substantial planning has been directed at developing alternatives for water conveyance and storage that are consistent with the objectives of the long-term plan. A draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) is under development by the CALFED Bay-Delta Program that will assess the impacts of the entire CALFED Bay-Delta long-term plan and provide additional public opportunity for comment. The DEIS/EIR is expected to be released during the spring of 1998.

A major component of the long-term CALFED Bay-Delta Program is the Ecosystem Restoration Program Plan (ERPP) which is being developed to address the ecosystem quality element of the long-term plan. The draft ERPP is comprised of three components. The first component, Visions for Ecosystem Elements (CALFED Bay-Delta Program, ERPP Volume I, June 1997), presents the visions for ecological processes and functions, fish and wildlife habitats, and stressors that impair the health of the processes, habitats, and species. The second component, Visions for Ecological Zones (CALFED Bay-Delta Program, ERPP Volume II, July 1997), presents the visions for the 14 ecological zones and their respective ecological units throughout the Sacramento-San Joaquin River basins and Delta and contains implementation objectives, targets, and programmatic actions. The third component, Vision for Adaptive Management (CALFED Bay-Delta Program, ERPP Volume III, August 1997) provides the ERPP approach to adaptive management and contains the proposed plans to address indicators of ecological health, a monitoring program to acquire and evaluate the data needed regarding indicators, a program of focused research to acquire additional data needed to evaluate program alternatives and options, and the approach to phasing the implementation of the ERPP over its 25 year time span.

The draft ERPP addresses the Sacramento and San Joaquin Rivers, their upper watersheds, and the Bay-Delta ecosystem. Within this large geographic area, the ERPP identifies 14 ecological zones where the majority of restoration actions will occur. Ecosystem functions that are important to anadromous salmonids and that are addressed in the ERPP include: the quantity and quality of Central Valley streamflow and temperatures, natural sediment supply, stream meander corridor, natural floodplain, flood and watershed processes, Bay-Delta hydraulics and aquatic food chain, tidal and nontidal perennial aquatic habitat, sloughs, quantity and quality of estuarine, wetland, riverine, and riparian habitats. Environmental stressors, or risk factors, that are identified and addressed in the ERPP include: water diversions, quality and quantity of water, habitat blockages due to dams and other manmade structures, dredging and sediment disposal, gravel mining, encroachment of nonendemic species, predation and competition, contaminants, legal and illegal harvest, artificial fish propagation, and land disturbance.

The total cost for implementing the ERPP has been estimated at $1.5 billion, of which about half should be available through state Proposition 204 bonds and expected federal appropriations. These funds will be used to provide the initial infusion of funding to move the implementation of the ERPP forward. The ERPP implementation assumes that the $390 million identified in Proposition 204 will become available for expenditure after the CALFED Bay-Delta Program long-term restoration plan is formally adopted by the CALFED agencies through filing of a Record of Decision for the Federal EIS and certification of the EIR by the California Resources Agency by late 1998. The ERPP assumes that these funds will be encumbered and expended during the 25 year period of implementation which provides for a pro-rated availability of $15 million per year. Category III funding is assumed to complete the expenditure of $180 million during the first five years on actions identified for early implementation. Other sources of funding are expected to be available through Federal appropriations and through the CVPIA.

NMFS intends to continue working closely with the State of California through the CALFED Bay-Delta Program in their efforts to formulate a long-term restoration plan and an associated implementation strategy for the Bay-Delta ecosystem restoration. This habitat-focused conservation effort, if combined with State efforts addressing hatchery and harvest reform (i.e., reductions in hatchery production, increased marking of hatchery fish, changes in release practices to reduce straying, improved monitoring of escapement and stray rates, and reductions in ocean and freshwater harvest rates) could ameliorate the risks facing fall/late-fall chinook salmon stocks in the Central Valley. The degree to which these conservation efforts provide reliable, measurable and predictable reductions in the identified factors for decline, may provide NMFS with direct and substantial information pertinent to making final listing determinations for Central Valley chinook stocks.

In the San Joaquin River Basin, collaboration between water interests and State/Federal resources agencies has led to a scientifically-based adaptive fisheries management plan known as the Vernalis Adaptive Management Plan (VAMP). The VAMP proposes to use current knowledge to provide interim protections for San Joaquin fall-run chinook salmon smolts; to gather scientific information on the effects of various San Joaquin River flows and Delta water export rates on the survival of salmon smolts through the Delta; and to provide environmental benefits in the San Joaquin River tributaries, lower San Joaquin River, and Delta. This 12-year plan will be implemented through experimental flows in the San Joaquin Basin and operational changes at the Delta pumping plants during the peak salmon smolt outmigration period, approximately April 15 to May 15. Additional attraction flows for adult fall-run chinook upstream passage are targeted for October. In coordination with VAMP, the California Department of Water Resources will be installing and operating a barrier at the Head of Old River to improve the survival of juvenile chinook emigrating from the lower San Joaquin River. Although initial implementation of the VAMP is scheduled for spring 1998, negotiations regarding some aspects of the program continue. Although the VAMP does address flow conditions in the lower San Joaquin River during the spring smolt outmigration period, water quality concerns in the San Joaquin Basin still remain. NMFS expects that additional information regarding the long-term commitment of all participating parties to fully implement the plan will be available to prior to the final listing determination for Central Valley fall/late-fall chinook salmon.

State of California Conservation Measures for Coastal Chinook

In 1997, the California State legislature introduced and passed Senate Bill (SB) 271 which initiated a north coast salmonid habitat restoration program in California. This program is expected to provide significant benefits for coastal chinook salmon populations, in addition to other coastal salmonids beginning this year. SB 271 specifically created the Salmon and Steelhead Trout Restoration Account, and directed the California Department of Fish and Game (CDFG) to expend these funds on a wide range of watershed planning, on-the-ground habitat restoration projects, and other restoration-related efforts for the purpose of restoring anadromous salmonid populations in California's coastal watersheds, primarily north of San Francisco. SB 271 immediately transferred $3 million to the Account for CDFG to expend on the program in 1997 and 1998, and directed that $8 million be transferred to the Account annually for five years (beginning in fiscal year

1998–99 and continuing through fiscal year 2002–03) to continue funding this program. In total, SB 271 will provide $43 million in funding for north coast restoration projects over this six year period.

SB 271 requires that nearly 90 percent of the $43 million in funding be spent on project grants issued through CDFG's existing Fishery Restoration Grants Program, and allows CDFG to use the remaining funds for project contract administration activities and biological support staff necessary to achieve the restoration objectives of the legislation. SB 271 specifies that: (1) funded projects emphasize the development of coordinated watershed improvement activities, (2) the highest priority be given to funding projects that restore habitat for salmon and/or steelhead that are eligible for protection as listed or candidate species under the State or Federal ESA, and (3) funded projects treat causes of fish habitat degradation and be designed to restore the structure and function of fish habitat. In addition, SB 271 specifically allocates: (1) at least 65 percent of all Account funding for salmonid habitat protection and restoration projects, with at least 75 percent of that funding used for upslope watershed and riparian area protection and restoration activities, and (2) up to 35 percent of the Account funding for projects such as watershed evaluation, assessment, and planning, project monitoring and evaluations, support to watershed organizations, project maintenance and monitoring, private sector training, and watershed/fishery education.

In July 1997, California's Governor also signed Executive Order W–159–97 that created a Watershed Restoration and Protection Council (WPRC) that was charged with: (1) providing oversight of State activities aimed at watershed protection and enhancement including the conservation and restoration of anadromous salmonids in California, and (2) directing the development of a Watershed Protection Program which provides for anadromous salmonid conservation. In furtherance of implementing the Governor's Executive Order and the development of a Watershed Protection Program for anadromous salmonids, CDFG established and began implementing its own Watershed Initiative in 1997 and 1998. As described above, CDFG received $3 million in funding from SB 271 in 1997–98 which was used to fund its Watershed Initiative for coastal anadromous salmonids. These funds are currently in the process of being dispersed, together with a relatively limited amount of funds from other sources (e.g. Proposition 70, Proposition 99, Commercial Salmon Stamp Account, Steelhead Catch-Restoration Card, and Wildlife Conservation Board), in the form of grants through CDFG's Fishery Restoration Grants Program.

CDFG expects to allocate these grant funds as follows: (1) at least $1.3 million for watershed and riparian habitat restoration, (2) up to $425,000 for instream habitat restoration, and (3) up to $900,000 for watershed evaluation, assessment, planning, restoration project maintenance and monitoring, and a wide range of other activities. Other State agencies that have responsibilities as a result of the Governor's Executive Order are modifying existing budgets and preparing budget proposals for the upcoming fiscal year (1998–99) to assist in implementing the State's coastal watershed initiative. For fiscal year 1998–99, CDFG has submitted a Budget Change Proposal for its Watershed Initiative which calls for the expenditure of $8.0 million in SB 271 funds for: (1) eight new positions to assist in watershed planning efforts and grant proposal development ($1.0 million), and (2) habitat restoration and watershed planning projects in the form of grants ($7.0 million). CDFG anticipates that SB 271 funding will be expended in a similar manner and level through fiscal year 2002–03 to support the new staff resources created in the current year. The funding of these current and near term watershed planning and habitat restoration efforts is expected to provide significant benefits to chinook salmon stocks in California's coastal watersheds and in the Klamath/Trinity Basin. Over the next year, NMFS expects to work with the State in the development of its Watershed Protection Program and the implementation of its Watershed Initiative. NMFS is encouraged by their efforts and will consider them in its final listing determination for the Southern Oregon and California Coastal ESU.

State of Washington Conservation Measures

The State of Washington is currently in the process of developing a statewide strategy to protect and restore wild steelhead and other salmon and trout species. In May of 1997, Governor Gary Locke and other State officials signed a Memorandum of Agreement creating the Joint Natural Resources Cabinet (Joint Cabinet). This body is comprised of State agency directors or their equivalents from a wide variety of agencies whose activities and constituents influence Washington's natural resources. The goal of the Joint Cabinet is to restore healthy salmon, steelhead and trout populations by improving those habitats on which the fish rely. The Joint Cabinet's current activities include development of the Lower Columbia Steelhead Conservation Initiative (LCSCI), which is intended to comprehensively address protection and recovery of steelhead in the lower Columbia River area.

The scope of the LCSCI includes Washington's steelhead stocks in two transboundary ESUs that are shared by both Washington and Oregon. The initiative area includes all of Washington's stocks in the Lower Columbia River ESU (Cowlitz to Wind rivers) and the portion of the Southwest Washington ESU in the Columbia River (Grays River to Germany Creek). When completed, conservation and restoration efforts in the LCSCI area will form a comprehensive, coordinated, and timely protection and rebuilding framework. Benefits to steelhead and other fish species in the LCSCI area will also accrue due to the growing bi-state partnership with Oregon.

Advance work on the Initiative was performed by the Washington Department of Fish and Wildlife (WDFW). That work emphasized harvest and hatchery issues and related conservation measures. Consistent with creation of the Joint Cabinet, conservation planning has recently been expanded to include major involvement by other state agencies and stakeholders, and to address habitat and tributary dam/hydropower components.

The utility of the LCSCI is to provide a framework to describe concepts, strategies, opportunities, and commitments that will be critically needed to maintain the diversity and long term productivity of steelhead in the lower Columbia River for future generations. The initiative does not represent a formal watershed planning process; rather, it is intended to be complementary to such processes as they may occur in the future. The LCSCI details a range of concerns including natural production and genetic conservation, recreational harvest and opportunity, hatchery strategies, habitat protection and restoration goals, monitoring of stock status and habitat health, evaluation of the effectiveness of specific conservation actions, and an adaptive management structure to implement and modify the plan's trajectory as time progresses. It also addresses improved enforcement of habitat and fishery regulations, and strategies for outreach and education.

The LCSCI is currently a ''work-in-progress'' and will evolve and change over time as new information becomes available. Input will be obtained through continuing outreach efforts by local governments and stakeholders. Further refinements to strategies, actions, and commitments will occur using public and stakeholder review and input, and continued interaction with the State of Oregon, tribes, and other government entities, including NMFS. The LCSCI will be subjected to independent technical review. In sum, these input and coordination processes will play a key role in determining the extent to which the eventual conservation package will benefit wild steelhead.

NMFS intends to continue working with the State of Washington and stakeholders involved in the formulation of the LCSCI. Ultimately, when completed, this conservation effort may ameliorate risks facing many salmonid species in this region. In the near term, for steelhead and other listed species, individual components of the conservation effort may be utilized in promulgating protective regulations under section 4(d) of the ESA.

State of Oregon Conservation Measures

As discussed in the section entitled Efforts Being Made to Protect West Coast Chinook Salmon, the Governor of Oregon completed and submitted to NMFS a comprehensive conservation plan directed specifically at coho salmon and steelhead stocks on the Coast of Oregon. The OPSW contains conservation elements that may apply to the needs of chinook salmon in Oregon streams.

The elements of the OPSW most likely to benefit chinook salmon conservation include: (1) a framework for prioritizing conservation and restoration efforts; (2) a comprehensive monitoring plan that coordinates Federal, state, and local efforts to improve current knowledge of freshwater and marine conditions, determine populations trends, evaluate the effects of artificial propagation, and evaluate the OPSW's success or failure in restoring chinook salmon; (3) a recognition that actions to conserve and restore salmon must be worked out by communities and landowners—those who possess local knowledge of problems and who have a genuine stake in the outcome. Watershed councils, soil and water conservation districts, and other grassroots efforts are the vehicles for getting this work done; (4) an explicit mechanism for learning from experience, evaluating alternative approaches, and making needed changes in the programs and measures; (5) the IMST whose purpose is to provide an independent audit of the OPSW's strengths and weaknesses; and (6) a yearly report be made to the Governor, the legislature, and the public. This will help the agencies make the adjustments prescribed for the adaptive management process.

Native American Tribal Conservation Efforts

A comprehensive salmon restoration plan for Columbia Basin salmon was prepared by the Nez Perce, Warm Springs, Umatilla and Yakama Indian Nations. This plan, Wy-Kan-Ush-Mi Wa-Kish-Wit (The Spirit of the Salmon)(CRITFC, 1996) is more comprehensive than past draft recovery plans for Columbia River basin salmon in that it proposes actions to protect salmon not currently listed under the ESA. The tribal plan sets goals and objectives to meet the restoration needs of the fish, as well as some of the multiple needs of these sovereign nations. The plan also provides some guidance for management of tribal lands within the range of anadromous salmon. NMFS will work closely with the four tribes as conservation measures related to at-risk Columbia Basin salmonids are further developed and implemented.

NMFS is encouraged by these efforts and believes they may constitute significant strides in regional efforts to develop a scientifically well grounded conservation plan for these stocks, and for chinook salmon. NMFS intends to support and work closely with these efforts. The degree to which these conservation efforts are able to provide reliable, scientifically well grounded improvements through a variety of measures to provide for the conservation of these stocks may have a direct and substantial effect on any final listing determination of NMFS.

Prohibitions and Protective Measures

Section 4(d) of the ESA requires NMFS to issue regulations it finds necessary and advisable to provide for the conservation of a listed species. Section 9 of the ESA prohibits violations of protective regulations for threatened species promulgated under section 4(d). The 4(d) protective regulations may prohibit, with respect to threatened species, some or all of the acts which section 9(a) of the ESA prohibits with respect to endangered species. These 9(a) prohibitions and 4(d) regulations apply to all individuals, organizations, and agencies subject to U.S. jurisdiction. NMFS intends to have final 4(d) protective regulations in effect at the time of final listing determinations for eight proposed west coast chinook salmon ESUs. The process for completing the 4(d) rule will provide the opportunity for public comment on the proposed protective regulations.

In the case of threatened species, NMFS also has flexibility under section 4(d) to tailor protective regulations based on the contents of available conservation measures. Even though, in several ESUs, existing conservation efforts and plans are not sufficient to preclude the need for listings at this time, they are nevertheless valuable for improving watershed health and restoring fishery resources. In those cases where well-developed, reliable conservation plans exist, NMFS may choose to incorporate them into the recovery planning process, starting with the protective regulations. NMFS has already adopted 4(d) rules that exempt a limited range of activities from take prohibitions. For example, the interim 4(d) rule for the Southern Oregon/ Northern California coho (62 FR 24588, May 7, 1997) exempts habitat restoration activities conducted in accordance with approved plans and fisheries conducted in accordance with an approved state management plan. In the future, 4(d) rules may contain limited take prohibitions applicable to activities such as forestry, agriculture, and road construction when such activities are conducted in accordance with approved conservation plans.

These are all examples where NMFS may apply take prohibitions in light of the protections provided in a strong conservation program. There may be other circumstances as well in which NMFS would use the flexibility of section 4(d). For example, in some cases there may be a healthy population of salmon or steelhead within an overall ESU that is listed. In such a case, it may not be necessary to apply the full range of prohibitions available in section 9. NMFS intends to use the flexibility of the ESA to respond appropriately to the biological condition of each ESU and to the strength of programs to protect them.

Section 7(a)(4) of the ESA requires that Federal agencies confer with NMFS on any actions likely to jeopardize the continued existence of a species proposed for listing and on actions likely to result in the destruction or adverse modification of proposed critical habitat. For listed species, section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or conduct are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with NMFS.

Examples of Federal actions likely to affect chinook salmon include authorized land management activities of the USFS and BLM, as well as operation of hydroelectric and storage projects of the BOR and COE. Such activities include timber sales and harvest, permitting livestock grazing, hydroelectric power generation, and flood control. Federal actions, including the COE section 404 permitting activities under the CWA, COE permitting activities under the River and Harbors Act, FERC licenses for non-Federal development and operation of hydropower, and Federal salmon hatcheries, may also require consultation.

Sections 10(a)(1)(A) and 10(a)(1)(B) of the ESA provide NMFS with authority to grant exceptions to the ESA's ''taking'' prohibitions. Section 10(a)(1)(A) scientific research and enhancement permits may be issued to entities (Federal and non-Federal) conducting research that involves a directed take of listed species. A directed take refers to the intentional take of listed species. NMFS has issued section 10(a)(1)(A) research/enhancement permits for currently listed chinook salmon (e.g., Snake River chinook salmon and Sacramento River winter-run chinook salmon) for a number of activities, including trapping and tagging, electroshocking to determine population presence and abundance, removal of fish from irrigation ditches, and collection of adult fish for artificial propagation programs.

Section 10(a)(1)(B) incidental take permits may be issued to non-Federal entities performing activities which may incidentally take listed species. The types of activities potentially requiring a section 10(a)(1)(B) incidental take permit include the operation and release of artificially propagated fish by state or privately operated and funded hatcheries, state or academic research not receiving Federal authorization or funding, the implementation of state fishing regulations, logging, road building, grazing, and diverting water into private lands.

NMFS Policies on Endangered and Threatened Fish and Wildlife

On July 1, 1994, NMFS, jointly with the U.S. Fish and Wildlife Service, published a series of policies regarding listings under the ESA, including a policy for peer review of scientific data (59 FR 34270) and a policy to identify, to the maximum extent possible, those activities that would or would not constitute a violation of section 9 of the ESA (59 FR 34272).

Role of Peer Review

The intent of the peer review policy is to ensure that listings are based on the best scientific and commercial data available. Prior to a final listing, NMFS will solicit the expert opinions of at least three qualified specialists, concurrent with the public comment period. Independent peer reviewers will be selected from the academic and scientific community, Native American tribal groups, Federal and state agencies, and the private sector.

Identification of Those Activities That Would Constitute a Violation of Section 9 of the ESA

NMFS and the FWS published in the **Federal Register** on July 1, 1994 (59 FR 34272), a policy that NMFS shall identify, to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the ESA. The intent of this policy is to increase public awareness of the effect of this listing on proposed and ongoing activities within the species' range. At the time of the final rule, NMFS will identify to the extent known specific activities that will not be considered likely to result in violation of section 9, as well as activities that will be considered likely to result in violation. NMFS believes that, based on the best available information, the following actions will not result in a violation of section 9:

1. Possession of chinook salmon from any chinook salmon ESU listed as threatened which are acquired lawfully by permit issued by NMFS pursuant to section 10 of the ESA, or by the terms of an incidental take statement pursuant to section 7 of the ESA.
2. Federally funded or approved projects that involve activities such as silviculture, grazing, mining, road construction, dam construction and operation, discharge of fill material, stream channelization or diversion for which section 7 consultation has been completed, and when activities are conducted in accordance with any terms and conditions provided by NMFS in an incidental take statement accompanying a biological opinion.

Activities that NMFS believes could potentially harm chinook salmon in any of the proposed ESUs, and result in a violation of the section 9 take prohibition include, but are not limited to:

1. Land-use activities that adversely affect chinook salmon habitat in any proposed ESU (e.g., logging, grazing, farming, urban development, road construction in riparian areas and areas susceptible to mass wasting and surface erosion).
2. Destruction/alteration of the chinook salmon habitat in any proposed ESU, such as removal of large woody debris and ''sinker logs'' or riparian shade canopy, dredging, discharge of fill material, draining, ditching, diverting, blocking, or altering stream channels or surface or ground water flow.
3. Discharges or dumping of toxic chemicals or other pollutants (e.g., sewage, oil, gasoline) into waters or riparian areas supporting the chinook salmon in any proposed ESU.
4. Violation of discharge permits.
5. Pesticide applications.
6. Interstate and foreign commerce of chinook salmon from any of the proposed ESUs and import/export of chinook salmon from any ESU without a threatened or endangered species permit.
7. Collecting or handling of chinook salmon from any of the proposed ESUs. Permits to conduct these activities are available for purposes of scientific research or to enhance the propagation or survival of the species.
8. Introduction of non-native species likely to prey on chinook salmon in any proposed ESU or displace them from their habitat.

These lists are not exhaustive. They are intended to provide some examples of the types of activities that might or might not be considered by NMFS as constituting a take of chinook salmon in any of the proposed ESUs under the ESA and its regulations. Questions regarding whether specific activities will constitute a violation of the section 9 take prohibition, and general inquiries regarding prohibitions and permits, should be directed to NMFS (see **ADDRESSES**).

Critical Habitat

Section 4(a)(3)(A) of the ESA requires that, to the maximum extent prudent and determinable, NMFS designate critical habitat concurrently with a determination that a species is endangered or threatened. NMFS has determined that sufficient information exists to propose designating critical habitat for the seven proposed chinook salmon ESUs. NMFS will consider all available information and data in finalizing this proposal.

Use of the term ''essential habitat'' within this Notice refers to critical habitat as defined by the ESA and should not be confused with the requirement to describe and identify Essential Fish Habitat (EFH) pursuant to the Magnuson-Stevens Fishery

Conservation and Management Act, 16 U.S.C. 1801 *et seq.*

Definition of Critical Habitat

Critical habitat is defined in section 3(5)(A) of the ESA as ''(i) the specific areas within the geographical area occupied by the species * * * 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 * * * upon a determination by the Secretary of Commerce (Secretary) that such areas are essential for the conservation of the species.'' (see 16 U.S.C. 1532(5)(A)). The term ''conservation,'' as defined in section 3(3) of the ESA, means '' * * * to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary.'' (see 16 U.S.C. 1532(3)).

In proposing to designate critical habitat, NMFS considers the following requirements of the species: (1) Space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing of offspring; and, generally, (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species (see 50 CFR 424.12(b)). In addition to these factors, NMFS also focuses on the known physical and biological features (primary constituent elements) within the designated area that are essential to the conservation of the species and may require special management considerations or protection. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation (see 50 CFR 424.12(b)).

Consideration of Economic and Other Factors

The economic and other impacts of a critical habitat designation will be considered and evaluated in this proposed rulemaking. NMFS will identify present and anticipated activities that may adversely modify the area(s) being considered or be affected by a designation. An area may be excluded from a critical habitat designation if NMFS determines that the overall benefits of exclusion outweigh the benefits of designation, unless the exclusion will result in the extinction of the species (see 16 U.S.C. 1533(b)(2)).

The impacts considered in this analysis are only those incremental impacts specifically resulting from a critical habitat designation, above the economic and other impacts attributable to listing the species or resulting from other laws and regulations. Since listing a species under the ESA provides significant protection to a species' habitat, the economic and other impacts resulting from the critical habitat designation, over and above the impacts of the listing itself, are minimal. In general, the designation of critical habitat highlights geographical areas of concern and reinforces the substantive protection resulting from the listing itself.

Impacts attributable to listing include those resulting from the ''take'' prohibitions contained in section 9 of the ESA and associated regulations. ''Take,'' as defined in the ESA, means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (see 16 U.S.C. 1532(19)). Harm can occur through destruction or modification of habitat (whether or not designated as critical) that significantly impairs essential behaviors, including breeding, feeding, rearing, or migration.

Significance of Designating Critical Habitat

The designation of critical habitat does not, in and of itself, restrict human activities within an area or mandate any specific management or recovery actions. A critical habitat designation contributes to species conservation primarily by identifying important areas and by describing the features within those areas that are essential to the species, thus alerting public and private entities to the area's importance. Under the ESA, the only regulatory impact of a critical habitat designation is through the provisions of section 7. Section 7 applies only to actions with Federal involvement (e.g., authorized, funded, or conducted by a Federal agency) and does not affect exclusively state or private activities.

Under the section 7 provisions, a designation of critical habitat would require Federal agencies to ensure that any action they authorize, fund, or carry out is not likely to destroy or adversely modify designated critical habitat. Activities that destroy or adversely modify critical habitat are defined as those actions that ''appreciably diminish the value of critical habitat for both the survival and recovery'' of the species (see 50 CFR 402.02). Regardless of a critical habitat designation, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of the proposed species. Activities that jeopardize a species are defined as those actions that ''reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery'' of the species (see 50 CFR 402.02). Using these definitions, activities that would destroy or adversely modify critical habitat would also be likely to jeopardize the species. Therefore, the protection provided by a critical habitat designation generally duplicates the protection provided under the section 7 jeopardy provision. Critical habitat may provide additional benefits to a species in cases where areas outside the species' current range have been designated. When actions may affect these areas, Federal agencies are required to consult with NMFS under section 7 (see 50 CFR 402.14(a)), a requirement which may not have been recognized but for the critical habitat designation.

A designation of critical habitat provides a clear indication to Federal agencies as to when section 7 consultation is required, particularly in cases where the action would not result in immediate mortality, injury, or harm to individuals of a listed species (e.g., an action occurring within the critical area when a migratory species is not present). The critical habitat designation, describing the essential features of the habitat, also assists in determining which activities conducted outside the designated area are subject to section 7 (i.e., activities that may affect essential features of the designated area).

A critical habitat designation will also assist Federal agencies in planning future actions, since the designation establishes, in advance, those habitats that will be given special consideration in section 7 consultations. With a designation of critical habitat, potential conflicts between Federal actions and endangered or threatened species can be identified and possibly avoided early in the agency's planning process.

Another indirect benefit of a critical habitat designation is that it helps focus Federal, state, and private conservation and management efforts in such areas. Management efforts may address special considerations needed in critical habitat areas, including conservation regulations to restrict private as well as Federal activities. The economic and other impacts of these actions would be considered at the time of those proposed regulations and, therefore, are not considered in the critical habitat designation process. Other Federal, state, tribal and local management programs, such as zoning or wetlands and riparian lands protection, may also provide special protection for critical habitat areas.

Process for Designating Critical Habitat

Developing a proposed critical habitat designation involves three main considerations. First, the biological needs of the species are evaluated and habitat areas and features that are essential to the conservation of the species are identified. If alternative areas exist that would provide for the conservation of the species, such alternatives are also identified. Second, the need for special management considerations or protection of the area(s) or features is evaluated. Finally, the probable economic and other impacts of designating these essential areas as ''critical habitat'' are evaluated. After considering the requirements of the species, the need for special management, and the impacts of the designation, the proposed critical habitat is published in the **Federal Register** for comment. The final critical habitat designation, considering comments on the proposal and impacts assessment, is typically published within one year of the proposed rule. Final critical habitat designations may be revised, using the same process, as new information becomes available.

A description of the critical habitat, need for special management, impacts of designating critical habitat, and the proposed action are described in the following sections.

Critical Habitat of Pacific Coast Chinook Salmon

Biological information for proposed chinook salmon can be found in NMFS species' status reviews (Myers *et al.*, 1998; Waknitz *et al.*, 1995; Waples *et al.*, 1991); species life history summaries (Ricker, 1972; Taylor, 1991; Healey, 1991; Burgner, 1991); and in **Federal Register** notices of proposed and final listing determinations (55 FR 102260, March 20, 1990; 56 FR 29542 and 29544, June 27, 1991; 57 FR 36626, August 14, 1992; 57 FR 57051, December 2, 1992; 59 FR 42529, August 18, 1994; 59 FR 48855, September 23, 1994; 59 FR 66784, December 28, 1994; 63 FR 1807, January 12, 1998).

The current geographic range of chinook salmon from California, Oregon, Washington, and Idaho includes vast areas of the North Pacific Ocean, nearshore marine zone, and extensive estuarine and riverine areas. The marine distribution for stream-type chinook salmon includes extensive areas far from the coast in the central North Pacific. Ocean-type chinook salmon typically migrate along coastal waters. Coastal chinook populations originating from south of Cape Blanco tend to migrate south, while those chinook salmon populations originating in coastal streams north of Cape Blanco tend to migrate northerly (Bakun 1973, 1975; Nicholas and Hankin, 1988; Healey 1983 and 1991; Myers *et al.*, 1984).

In California, major estuaries and bays known to support Central Valley chinook salmon include San Francisco Bay, San Pablo Bay, and Suisun Bay. Within the Central Valley spring-run chinook salmon ESU, major rivers and estuaries known to support chinook salmon include the Sacramento River, American River, Feather River, Yuba River, and Deer, Mill, Butte, Clear and Antelope Creeks. Within California's Central Valley fall/late fall-run chinook salmon ESU, major rivers and estuaries known to support chinook salmon include the Sacramento River; its tributaries including but not limited to the American River, Feather River, Yuba River, and Deer, Mill, Battle and Clear Creeks; as well as the San Joaquin River and its tributaries, including but not limited to the Mokelumne, Consumnes, Stanislaus, Tuolumne and Merced Rivers. Within the California portion of the Southern Oregon and California Coastal chinook salmon ESU, major rivers, estuaries, and bays known to support chinook salmon include the Smith River, lower Klamath River, Mad River, Redwood Creek, Humboldt Bay, Eel River, Mattole River, and the Russian River. Many smaller streams in the California portion of this ESU also contain chinook salmon.

In Oregon, major rivers, estuaries, and bays known to support chinook salmon within the Oregon portion of the Southern Oregon and California Coastal chinook salmon ESU include the Rogue River and several of its tributaries, and the Pistol, Chetco and Winchuck Rivers. Within the range of the Oregon portion of the lower Columbia River chinook salmon ESU, major rivers, estuaries, and bays known to support chinook salmon include Youngs Bay, Klaskanine River, and the Clackamas, Sandy and Hood Rivers. Major rivers known to support chinook salmon within the upper Willamette River ESU include the Mollala River, North Santiam River and McKenzie River. Major rivers known to support chinook salmon within the Oregon portion of the Snake River fall-run chinook salmon ESU include the Deschutes River, the lower Grande Ronde River, the Imnaha River, and the Oregon portion of the Columbia and Snake Rivers.

In Washington, major rivers, estuaries, and bays known to support chinook salmon within the lower Columbia River ESU include the Grays River, Elochoman River, Kalama River, Lewis River, Washougal River and White Salmon River. Major rivers, estuaries, and bays known to support chinook salmon within the Puget Sound ESU include the Nooksack River, Skagit River and many of its tributaries, the Stilliguamish River, Snohomish River, Duwamish River, Puyallup River, and the Elwha River. Major estuarine, bay and marine areas known to support chinook salmon within the Puget Sound ESU also include the South Sound, Hood Canal, Elliott Bay, Possession Sound, Admiralty Inlet, Saratoga Passage, Rosario Strait, Strait of Georgia, Haro Strait, and the Strait of Juan De Fuca. Major rivers known to support chinook salmon within the upper Columbia River spring-run ESU include the Wenatchee River, Entiat River, and Methow River.

In parts of Oregon, Washington and Idaho, major rivers known to support chinook salmon within the Snake River fall-run ESU include the lower Grande Ronde River, the Columbia River, the Snake River, the lower Salmon River, and the lower Clearwater River below its confluence with Lolo Creek.

Many smaller rivers and streams in each ESU also provide essential spawning, rearing and estuarine habitat for chinook salmon, but use and access can be constrained by seasonal fluctuations in hydrologic conditions.

Defining specific river reaches that are critical for chinook salmon is difficult because of the current low abundance of the species and of our imperfect understanding of the species' freshwater distribution, both current and historical. This is due, in large part, to the lack of comprehensive sampling effort dedicated to monitoring the species.

In California, Oregon, Washington and Idaho, several recent efforts have been made to characterize the species' distribution (Healey, 1983 and 1991, Bryant and Olson, in prep.; The Wilderness Society (TWS), 1993; Bryant, 1994; McPhail and Lindsey 1970; Yoshiyama et al., 1996; Myers et al., 1998) or to identify watersheds important to at-risk populations of salmonids and resident fishes (FEMAT, 1993). However, the limited data across the range of all ESUs, as well as dissimilarities in data types within the ESUs, make it difficult to define this species' distribution at a fine scale. Chinook salmon, though considerably reduced in population size, are still distributed or have the potential for distribution throughout nearly all watersheds within the geographic range of each ESU. Notable exceptions are areas above several impassable dams (see Barriers Within the Species' Range).

Any attempt to describe the current distribution of chinook salmon must take into account the fact that existing populations and densities are a small fraction of historical levels. Many chinook salmon stocks are extremely depressed relative to past abundance and there are limited data to assess population numbers or trends. Several of these stocks are heavily influenced by hatcheries and apparently have little natural production in mainstem reaches.

Within the range of all chinook salmon ESUs, the species' life cycle can be separated into five essential habitat types: (1) Juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. Areas 1 and 5 are often located in small headwater streams, while areas 2 and 4 include these tributaries as well as mainstem reaches and estuarine zones. Growth and development to adulthood (area 3) occurs primarily in near- and off-shore marine waters, although final maturation takes place in freshwater tributaries when the adults return to spawn. Within all of these areas, essential features of chinook salmon critical habitat include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions. Given the vast geographic range occupied by each of these chinook salmon ESUs and the diverse habitat types used by the various life stages, it is not practical to describe specific values or conditions for each of these essential habitat features. However, good summaries of these environmental parameters and freshwater factors that have contributed to the decline of this and other salmonids can be found in reviews by CDFG, 1965; CACSST, 1988; Brown and Moyle, 1991; Bjornn and Reiser, 1991; Nehlsen *et al.*, 1991; Higgins *et al.*, 1992; California State Lands Commission (CSLC), 1993; Botkin *et al.*, 1995; NMFS, 1996; and Spence *et al.*, 1996.

At the time of this proposed rule, NMFS believes that chinook salmon's current freshwater, estuarine, and certain marine range encompasses all essential habitat features and is adequate to ensure the species' conservation. Therefore, designation of habitat areas outside the species' current range is not indicated. Habitat quality in this current range is intrinsically related to the quality of upland areas and of inaccessible headwater or intermittent streams which provide key habitat elements (e.g., large woody debris, gravel, water quality) crucial for chinook salmon in downstream reaches. NMFS recognizes that estuarine habitats are important for rearing and migrating chinook salmon and has included them in this designation. Marine habitats (i.e., oceanic or nearshore areas seaward of the mouth of coastal rivers) are also vital to the species, and ocean conditions are believed to have a major influence on chinook salmon survival (see review in Pearcy, 1992). In most cases, NMFS believes there is no need for special management consideration or protection of this habitat. In the case of the Puget Sound ESU, due to the unique combination of geographic features, proximity to a large number of rivers and streams supporting chinook salmon, and wide range of human activities occurring within Puget Sound's marine area, it appears to be necessary to include the marine areas described above. NMFS is not proposing to designate other critical habitat in marine areas at this time. If additional information becomes available that supports the inclusion of such areas, NMFS may revise this designation.

Based on consideration of the best available information regarding the species' current distribution, NMFS believes that the preferred approach to identifying the freshwater and estuarine portion of critical habitat is to designate all areas (and their adjacent riparian zones) accessible to the species within the range of each ESU. NMFS has taken this approach in previous critical habitat designations for other species (e.g., Snake River salmon, Umpqua River cutthroat trout, and proposed for two coho salmon ESUs) which inhabit a wide range of freshwater habitats, in particular small tributary streams (58 FR 68543, December 28, 1993; 63 FR 1388, January 9, 1998; 62 FR 62741, November 25, 1997). NMFS believes that adopting a more inclusive, watershed-based description of critical habitat is appropriate because it (1) recognizes the species' use of diverse habitats and underscores the need to account for all of the habitat types supporting the species' freshwater and estuarine life stages, from small headwater streams to migration corridors and estuarine rearing areas; (2) takes into account the natural variability in habitat use (e.g., some streams may have fish present only in years with plentiful rainfall) that makes precise mapping difficult; and (3) reinforces the important linkage between aquatic areas and adjacent riparian/upslope areas.

An array of management issues encompasses these habitats and their features, and special management considerations will be needed, especially on lands and streams under Federal ownership (see Activities that May Affect Critical Habitat and Need for Special Management Considerations or Protection sections). While marine areas are also a critical link in this cycle, NMFS does not believe that special management considerations are needed to conserve the habitat features in these areas. Hence, except for the Puget Sound ESU, only the freshwater and estuarine areas are being proposed for critical habitat at this time.

Barriers Within the Species' Range

Within the range of all threatened and endangered ESUs, chinook salmon face a multitude of barriers that limit the access of juvenile and adult fish to essential freshwater habitats. While some of these are natural barriers (e.g., waterfalls or high-gradient velocity barriers) that have been in existence for hundreds or thousands of years, more significant are the manmade barriers that have been created in the past century (CACSST, 1988; FEMAT, 1993; Botkin *et al.*, 1995; National Research Council, 1996). The extent of such barriers as culverts and road crossing structures that impede or block fish passage appears to be substantial. For example, of 532 fish presence surveys conducted in Oregon coastal basins during the 1995 survey season, nearly 15 percent of the confirmed ''end of fish use'' were due to human barriers, principally road culverts (OCSRI, 1997). Pushup dams/diversions and irrigation withdrawals also present significant barriers or lethal conditions (e.g., high water temperatures) to chinook salmon in California, Oregon, Washington and Idaho. However, because these manmade barriers can, under certain flow conditions, be surmounted by fish or present only a temporary/seasonal barrier, NMFS does not consider them to delineate the upstream extent of critical habitat.

Since these man-made impassible barriers are widely distributed throughout the range of each ESU, they can have a major downstream influence on chinook salmon. Such impacts can include the following: Depletion and storage of natural flows, which can drastically alter natural hydrological cycles; increase juvenile and adult mortality due to migration delays resulting from insufficient flows or habitat blockages; stranding of fish resulting from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions; and increased mortality resulting from increased water temperatures (CACSST, 1988; Bergren and Filardo, 1991; CDFG, 1991; Reynolds *et al.*, 1993; Chapman *et al.*, 1994; Cramer *et al.*, 1995; NMFS, 1996). In addition to these factors, reduced flows negatively affect fish habitats due to increased deposition of fine sediments in spawning gravels, decreased recruitment of large woody debris and spawning gravels, and encroachment of riparian and non-endemic vegetation into spawning and rearing areas, resulting in reduced available habitat (CACSST, 1988; FEMAT, 1993; Botkin *et al.*, 1995; NMFS, 1996). These dam-related factors will be effectively addressed through section 7 consultations and the recovery planning process.

Numerous hydropower and water storage projects have been built which block access to former spawning and rearing habitats used by chinook salmon, or alter the timing and quantity of waterflow to downstream river reaches. NMFS has identified a total of 44 dams within the range of the ESUs that currently block upstream or downstream passage for chinook salmon (see Hydrolic Unit Tables 10–17). Blocked habitat can constitute as much as 90 percent of the historic range of each ESU. While these blocked areas are proportionally significant in certain basins (e.g., California's Central Valley and the Snake River), NMFS concludes at this time that currently available habitat may be sufficient for the conservation of the affected chinook salmon ESUs. NMFS solicits comments and scientific information on this issue and will consider such information prior to issuing any final critical habitat designation. This may result in the inclusion of areas above some man-made impassible barriers in a future critical habitat designation. NMFS may also re-evaluate this conclusion during the recovery planning process and in section 7 consultations.

Need for Special Management Considerations or Protection

In order to assure that the essential areas and features are maintained or restored, special management may be needed. Activities that may require special management considerations for freshwater, estuarine, and marine life stages of proposed chinook salmon include, but are not limited to (1) land management; (2) timber harvest; (3) point and non-point water pollution; (4) livestock grazing; (5) habitat restoration; (6) irrigation water withdrawals and returns; (7) mining; (8) road construction; (9) dam operation and maintenance; and (10) dredge and fill activities. Not all of these activities are necessarily of current concern within every watershed, estuary, or marine area; however, they indicate the potential types of activities that will require consultation in the future. No special management considerations have been identified for proposed chinook salmon while they are residing in the ocean environment, except as noted for the Puget Sound ESU.

Activities That May Affect Critical Habitat

A wide range of activities may affect the essential habitat requirements of proposed chinook salmon (see Summary of Factors for Decline section above for a more in-depth discussion). These activities include water and land management actions of Federal agencies, including the USFS, BLM, COE, BOR, the Federal Highway Administration (FHA), the EPA, and the Federal Energy Regulatory Commission (FERC) and related or similar actions of other federally regulated projects and lands, including livestock grazing allocations by the USFS and BLM; hydropower sites licensed by the FERC; dams built or operated by the COE or BOR; timber sales conducted by the USFS and BLM; road building activities authorized by the FHA, USFS, and BLM; and mining and road building activities authorized by the states of California, Oregon, Washington, and Idaho. Other actions of concern include dredge and fill, mining, and bank stabilization activities authorized or conducted by the COE. Additionally, actions of concern could include approval of water quality standards and pesticide labeling and use restrictions administered by the EPA.

The Federal agencies that will most likely be affected by this critical habitat designation include the USFS, BLM, BOR, COE, FHA, EPA, and FERC. This designation will provide these agencies, private entities, and the public with clear notification of critical habitat designated for proposed chinook salmon and the boundaries of the habitat and protection provided for that habitat by the section 7 consultation process. This designation will also assist these agencies and others in evaluating the potential effects of their activities on proposed chinook salmon and their critical habitat and in determining when consultation with NMFS is appropriate.

Expected Economic Impacts

The economic impacts to be considered in a critical habitat designation are the incremental effects of critical habitat designation above the economic impacts attributable to either listing or to laws and regulations other than the ESA (see Consideration of Economic and Other Factors section of this notice). Incremental impacts result from special management activities in areas outside the present distribution of the proposed species that have been determined to be essential to the conservation of the species. However, NMFS has determined that the species' present freshwater, estuarine, as well as certain marine areas within the species' range, contains sufficient habitat for conservation of the species. Therefore, the economic impacts associated with this critical habitat designation are expected to be minimal.

USFS, BLM, BOR, and the COE manage areas of proposed critical habitat for the proposed chinook salmon ESUs. The COE and other Federal agencies that may be involved with funding or permits for projects in critical habitat areas may also be affected by this designation. Because NMFS believes that virtually all ''adverse modification'' determinations pertaining to critical habitat would also result in ''jeopardy'' conclusions, designation of critical habitat is not expected to result in significant incremental restrictions on Federal agency activities. Critical habitat designation will, therefore, result in few, if any, additional economic effects beyond those that may have been caused by listing and by other statutes.

Public Comments Solicited

NMFS has exercised its best professional judgement in developing this proposal to list eight chinook salmon ESUs and designate their critical habitat under the ESA. To ensure that the final action resulting from this proposal will be as accurate and effective as possible, NMFS is soliciting comments and suggestions from the public, other governmental agencies, the scientific community, industry, and any other interested parties. NMFS will appreciate any additional information regarding, in particular: (1) the biological or other relevant data concerning any threat to chinook salmon; (2) the range, distribution, and population size of chinook salmon in all identified ESUs; (3) current or planned activities in the subject areas and their possible impact on this species; (4) chinook salmon escapement, particularly escapement data partitioned into natural and hatchery components; (5) the proportion of naturally-reproducing fish that were reared as juveniles in a hatchery; (6) homing and straying of natural and hatchery fish; (7) the reproductive success of naturally-reproducing hatchery fish (i.e., hatchery-produced fish that spawn in natural habitat) and their relationship to the identified ESUs; (8) efforts being made to protect native, naturally-reproducing populations of chinook salmon in Washington, Oregon, Idaho and California; and (9) suggestions for specific regulations under section 4(d) of the ESA that should apply to threatened chinook salmon ESUs. Suggested regulations may address activities, plans, or guidelines that, despite their potential to result in the take of listed fish, will ultimately promote the conservation and recovery of threatened chinook salmon.

NMFS is also requesting quantitative evaluations describing the quality and extent of freshwater, estuarine, and marine habitats for juvenile and adult chinook salmon as well as information on areas that may qualify as critical habitat in Washington, Oregon, Idaho, and California for the proposed ESUs. Areas that include the physical and biological features essential to the recovery of the species should be identified. NMFS recognizes that there are areas within the proposed boundaries of some ESUs that historically constituted chinook salmon habitat, but may not be currently occupied by chinook salmon. NMFS is requesting information about chinook salmon in these currently unoccupied areas (in particular) and whether these habitats should be considered essential to the recovery of the species, or else be excluded from designation. Essential features include, but are not limited to: (1) Habitat for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for reproduction and rearing of offspring; and (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of the species.

For areas potentially qualifying as critical habitat, NMFS is requesting information describing: (1) The activities that affect the area or could be affected by the designation, and (2) the economic costs and benefits of additional requirements of management measures likely to result from the designation.

The economic cost to be considered in the critical habitat designation under the ESA is the probable economic impact ''of the [critical habitat] designation upon proposed or ongoing activities'' (50 CFR 424.19). NMFS must consider the incremental costs specifically resulting from a critical habitat designation that are above the economic effects attributable to listing the species. Economic effects attributable to listing include actions resulting from section 7 consultations under the ESA to avoid jeopardy to the species and from the taking prohibitions under section 9 of the ESA. Comments concerning economic impacts should distinguish the costs of listing from the incremental costs that can be attributed to the designation of specific areas as critical habitat.

NMFS will review all public comments and any additional information regarding the status of the chinook salmon ESUs described herein and, as required under the ESA, will complete a final rule within 1 year of this proposed rule. The availability of new information may cause NMFS to reassess the status of chinook salmon ESUs, or to reassess the geographic extent of critical habitat.

Joint Commerce-Interior ESA implementing regulations state that the Secretary ''shall promptly hold at least one public hearing if any person so requests within 45 days of publication of a proposed regulation to list * * * or to designate or revise critical habitat.'' (see 50 CFR 424.16(c)(3)). Public hearings on the proposed rule will be scheduled and announced in a forthcoming **Federal Register** Notice. These hearings will provide the opportunity for the public to give comments and to permit an exchange of information and opinion among interested parties. NMFS encourages the public's involvement in such ESA matters. Written comments on the proposed rule may also be submitted to Garth Griffin (see **ADDRESSES** and **DATES**).

References

A complete list of all cited references is available upon request (see **ADDRESSES**).

Classification

The 1982 amendments to the ESA, in section 4(b)(1)(A), restrict the information that may be considered when assessing species for listing. Based on this limitation of criteria for a listing decision and the opinion in *Pacific Legal Foundation* v. *Andrus*, 675 F. 2d 825 (6th Cir. 1981), NMFS has categorically excluded all ESA listing actions from environmental assessment requirements of the National Environmental Policy Act under NOAA Administrative Order 216–6.

NMFS has also determined that an Environmental Assessment or an Environmental Impact Statement, as defined under the authority of the National Environmental Policy Act of 1969, need not be prepared for this critical habitat designation. See *Douglas County* v. *Babbitt*, 48 F.3D 1495 (9th Cir. 1995), cert. denied, 116 S.Ct. 698 (1996).

The Assistant Administrator for Fisheries, NOAA (AA), has determined that this rule is not significant for purposes of E.O. 12866.

NMFS is proposing to designating only the current range of this species as critical habitat. The current range encompasses a wide range of habitats, including small tributary reaches, as well as mainstem, off-channel, estuarine and marine areas. Areas excluded from this proposed designation include historically occupied areas above impassible dams, and headwater areas above impassable natural barriers (e.g., long-standing, natural waterfalls). NMFS has concluded that at the time of this proposal, currently inhabited areas within the range of west coast chinook salmon are the minimum habitat necessary to ensure conservation and recovery of the species.

Since NMFS is designating the current range of the listed species as critical habitat, this designation will not impose any additional requirements or economic effects upon small entities, beyond those which may accrue from section 7 of the ESA. Section 7 requires Federal agencies to ensure that any action they carry out, authorize, or fund is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat (16 U.S.C. Sec. 1536(a)(2)). The consultation requirements of section 7 are nondiscretionary and are effective at the time of species' listing. Therefore, Federal agencies must consult with NMFS and ensure their actions do not jeopardize a species once it is listed, regardless of whether critical habitat is designated.

In the future, if NMFS determines that designation of habitat areas outside the species' current range is necessary for conservation and recovery, NMFS will analyze the incremental costs of that action and assess its potential impacts on small entities, as required by the Regulatory Flexibility Act. Until that time, a more detailed analysis would be premature and would not reflect the true economic impacts of the proposed action on local businesses, organizations, and governments.

Accordingly, the Assistant General Counsel for Legislation and Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that the proposed rule, if adopted, would not have a significant economic impact of a substantial number of small entities, as described in the Regulatory Flexibility Act.

This rule does not contain a collection-of-information requirement for purposes of the Paperwork Reduction Act.

At this time NMFS is not promulgating protective regulations pursuant to ESA section 4(d). In the future, prior to finalizing its 4(d) regulations for these threatened ESUs, NMFS will comply with all relevant NEPA and RFA requirements.

The AA has determined that the proposed listing and designation is consistent, to the maximum extent practicable, with the approved Coastal Zone Management Program of the States of California, Oregon, and Washington. This determination has been submitted for review by the responsible state agencies under section 307 of the Coastal Zone Management Act.

List of Subjects

50 CFR Part 222

Administrative practice and procedure, Endangered and threatened wildlife, Exports, Imports, Reporting and record-keeping requirements, Transportation.

50 CFR Part 226

Endangered and threatened species.

50 CFR Part 227

Endangered and threatened species, Exports, Imports, Marine mammals, Transportation.

Dated: February 26, 1998.

Rolland A. Schmitten,

Assistant Administrator for Fisheries, National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR parts 222, 226, and 227 are amended to read as follows:

PART 222—ENDANGERED FISH OR WILDLIFE

1. The authority citation of part 222 continues to read as follows:

Authority: 16 U.S.C. 1531–1543; subpart D, § 222.32 also issued under 16 U.S.C. 1361 *et seq.*

2. In § 222.23, paragraph (a) is amended by removing the second sentence and by adding five sentences in its place to read as follows:

§ 222.23 Permits for scientific purposes or to enhance the propagation or survival of the affected endangered species.

(a) * * * The species listed as endangered under either the Endangered Species Conservation Act of 1969 or the Endangered Species Act of 1973 and currently under the jurisdiction of the Secretary of Commerce are: Shortnose sturgeon (*Acipenser brevirostrum*); Totoaba (*Cynoscian macdonaldi*), Snake River sockeye salmon (*Oncorhynchus nerka*), Umpqua River cutthroat trout (*Oncorhynchus clarki clarki*); Southern California steelhead (*Oncorhynchus mykiss*), which includes all naturally spawned populations of steelhead (and their progeny) in streams from the Santa Maria River, San Luis Obispo County, California (inclusive) to Malibu Creek, Los Angeles County, California (inclusive); Upper Columbia River steelhead (*Oncorhynchus mykiss*), which includes the Wells Hatchery stock and all naturally spawned populations of steelhead (and their progeny) in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the United States—Canada Border; Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*), which includes all naturally spawned populations of chinook (and their progeny) in the Sacramento River and its tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas above specific dams identified in Table 10 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years); Upper Columbia River spring-run chinook salmon (*Oncorhynchus tshawytscha*), which includes all naturally spawned populations of chinook (and their progeny) in all river reaches accessible to chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. Also included are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington. Excluded are areas above specific dams identified in Table 16 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years); Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*); Western North Pacific (Korean) gray whale (*Eschrichtius robustus*), Blue whale (*Balaenoptera musculus*), Humpback whale (*Megaptera novaeangliae*), Bowhead whale (*Balaena mysticetus*), Right whales (*Eubalaena* spp.), Fin or finback whale (*Balaenoptera physalus*), Sei whale (*Balaenoptera borealis*), Sperm whale (*Physeter catodon*); Cochito (*Phocoena Sinus*), Chinese river dolphin (*Lipotes vexillifer*); Indus River dolphin (*Platanista minor*); Caribbean monk seal (*Monachus tropicalis*); Hawaiian monk seal (*Monachus schauinslandi*); Mediterranean monk seal (*Monachus monachus*); Saimaa seal (*Phoca hispida saimensis*); Steller sea lion (*Eumetopias jubatus*), western population, which consists of Steller sea lions from breeding colonies located west of 144° W. long.; Leatherback sea turtle (*Dermochelys coriacea*); Pacific hawksbill sea turtle (*Eretmochelys imbricata bissa*); Atlantic hawksbill sea turtle (*Eretmochelys imbricata imbricata*); and Atlantic ridley sea turtle (*Lepidochelys kempii*). * * *

* * * * *

PART 226—DESIGNATED CRITICAL HABITAT

3. The authority citation for part 226 continues to read as follows:

Authority: 16 U.S.C. 1533.

4. Section 226.28 is added to subpart C to read as follows:

§ 226.28 Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*), Central Valley fall/late fall-run chinook salmon (*Oncorhynchus tshawytscha*), Southern Oregon and California coastal chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette River chinook salmon (*Oncorhynchus tshawytscha*), Upper Columbia River spring-run chinook salmon (*Oncorhynchus tshawytscha*), Snake River fall-run chinook salmon (*Oncorhynchus tshawytscha*).

Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches, as well as some marine areas, in hydrologic units and counties identified in Tables 10 through 17 of this part for all of the chinook salmon ESUs listed above. Accessible reaches are those within the historical range of the ESUs that can still be occupied by any life stage of chinook salmon. Inaccessible reaches are those above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU identified in Tables 10 through 17 of this part. Adjacent riparian zones are defined as those areas within a slope distance of 300 ft (91.4 m) from the normal line of high water of a stream channel or adjacent off-channel habitats (600 ft or 182.8 m, when both sides of the channel are included). Hydrologic units are those defined by the Department of the Interior (DOI), U.S. Geological Survey (USGS) publication, ''Hydrologic Unit Maps, Water Supply Paper 2294, 1986,'' and the following DOI, USGS, 1:500,000 scale hydrologic unit maps: State of California (1978), State of Idaho (1981), State of Oregon (1974), and State of Washington (1974) which are incorporated by reference. This incorporation by reference was approved by the Director of the Office of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies of the USGS publication and maps may be obtained from the USGS, Map Sales, Box 25286, Denver, CO 80225. Copies may be inspected at NMFS, Protected Resources Division, 525 NE Oregon St., Suite 500, Portland, OR 97232–2737, or NMFS, Office of Protected Resources, 1315 East-West Highway, Silver Spring, MD 20910, or at the Office of the Federal Register, 800 North Capitol Street, NW., Suite 700, Washington, DC.

(a) *Central Valley Spring-run chinook salmon (Oncorhynchus tshawytscha) geographic boundaries.* Critical habitat is designated to include all river reaches accessible to chinook salmon in the Sacramento River and its tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas above specific dams identified in Table 10 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

(b) *Central Valley Fall/Late Fall-run chinook salmon (Oncorhynchus tshawytscha) geographic boundaries.* Critical habitat is designated to include all river reaches accessible to chinook salmon in the Sacramento and San Joaquin Rivers and their tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge. Excluded are areas upstream of the Merced River and areas above specific dams identified in Table 11 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

(c) *Southern Oregon and California Coastal chinook salmon (Oncorhynchus tshawytscha) geographic boundaries.* Critical habitat is designated to include all river reaches and estuarine areas accessible to chinook salmon in the drainages of San Francisco and San Pablo Bays, westward to the Golden Gate Bridge, and includes all estuarine and river reaches accessible to proposed chinook salmon on the California and southern Oregon coast to Cape Blanco (inclusive). Excluded are the Klamath and Trinity Rivers upstream of their confluence. Also excluded are areas above specific dams identified in Table 12 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

(d) *Pudget Sound chinook salmon (Oncorhynchus tshawytscha) geographic boundaries.* Critical habitat is designated to include all marine, estuarine and river reaches accessible to chinook salmon in Puget Sound. Puget Sound marine areas include South Sound, Hood Canal, and North Sound to the international boundary at the outer extent of the Strait of Georgia, Haro Strait and the Straits of Juan De Fuca to a straight line extending north from the west end of Freshway Bay, inclusive. Excluded are areas above specific dams identified in Table 13 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

(e) *Lower Columbia River Chinook Salmon (Oncorhynchus tshawytscha) Geographic boundaries.* Critical habitat is designated to include all river reaches accessible to chinook salmon in Columbia River tributaries between the Grays and White Salmon Rivers in Washington and the Willamette and Hood Rivers in Oregon, inclusive. Also included are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to The Dalles Dam. Excluded are areas above specific dams identified in Table 14 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

(f) *Upper Willamette River chinook salmon (Oncorhynchus tshawytscha) geographic boundaries.* Critical habitat is designated to include all river reaches accessible to chinook salmon in the Willamette River and its tributaries above Willamette Falls. Also included are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to and including the Willamette River in Oregon. Excluded are areas above specific dams identified in Table 15 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

(g) *Upper Columbia River Spring-run Chinook salmon (Oncorhynchus tshawytscha) Geographic boundaries.* Critical habitat is designated to include all river reaches accessible to chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. Also included are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington. Excluded are areas above specific dams identified in Table 16 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

(h) *Snake River Fall-run Chinook Salmon (Oncorhynchus tshawytscha) Geographic boundaries.* Critical habitat is designated to include all river reaches accessible to chinook salmon in the Columbia River from The Dalles Dam upstream to the confluence with the Snake River in Washington (inclusive). Critical habitat in the Snake River includes its tributaries in Idaho, Oregon, and Washington (exclusive of the upper Grande Ronde River and the Wallowa

River in Oregon, the Clearwater River above its confluence with Lolo Creek in Idaho, and the Salmon River upstream of its confluence with French Creek in Idaho). Also included are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to The Dalles Dam. Excluded are areas above specific dams identified in Table 17 of this part or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

5. Tables 10 through 17 are added to part 226 to read as follows:

TABLE 10 TO PART 226.—HYDROLOGIC UNITS AND COUNTIES[1] Containing Critical Habitat for Endangered Central Valley, California Spring-Run Chinook Salmon, and Dams/Reservoirs Representing the Upstream Extent of Critical Habitat

Hydrologic unit name	Hydrologic unit No.	Counties contained in hydrologic unit and within range of ESU	Dams (reservoirs)
San Pablo Bay	18050002	San Mateo, CA, Alameda (CA), Contra Costa (CA), Marin (CA), Somona (CA), Napa (CA), Solano (CA).	San Pablo Reservoir.
San Francisco Bay	18050004	Santa Clara (CA), San Mateo (CA), Alameda (CA), Contra Costa (CA), Marin (CA).	
Coyote	18050003	Santa Clara (CA), San Mateo (CA), Alameda (CA)	Calavera Reservoir.
Suisun Bay	18050001	Contra Costa (CA), Solano (CA), Napa (CA)	
Lower Sacramento	18020109	Solano (CA), Sacramento (CA), Yolo (CA), Placer (CA), Sutter (CA).	
Lower American	18020111	Sacramento (CA), El Dorado (CA), Placer (CA)	Nimbus Dam.
Upper Coon-Upper Auburn	18020127	Placer (CA)	
Lower Bear	18020108	Placer (CA), Sutter (CA), Yuba (CA)	Camp Far West Dam.
Lower Feather	18020106	Sutter (CA), Yuba (CA), Butte (CA)	Oroville Dam.
Lower Yuba	18020107	Yuba (CA)	Englebright Dam.
Lower Butte	18020105	Sutter (CA), Butte (CA), Colusa (CA), Glenn (CA)	
Sacramento-Stone Corral	18020104	Yolo (CA), Colusa (CA), Sutter (CA), Glenn (CA), Butte (CA).	
Upper Butte	18020120	Butte (CA), Tehama (CA)	
Sacramento-Lower Thomes	18020103	Glenn (CA), Butte (CA), Tehama (CA)	Black Butte Dam.
Mill-Big Chico	18020119	Butte (CA), Tehama (CA), Shasta (CA)	
Upper Elder-Upper Thomes	18020114	Tehama (CA)	
Cottonwood Headwaters	18020113	Tehama (CA), Shasta (CA)	
Lower Cottonwood	18020102	Tehama (CA), Shasta (CA).	
Sacramento-Lower Cow-Lower Clear	18020101	Tehama (CA), Shasta (CA)	Keswick Dam, Shasta Dam.
Upper Cow-Battle	18020118	Tehama (CA), Shasta (CA)	Whiskeytown Dam.
Sacramento-Upper Clear	18020112	Shasta (CA)	

[1] Some counties have very limited overlap with estuarine, riverine and riparian habitats indentified as critical habitat for this ESU. Consult USGS hydrologic unit maps (available from USGS) to determine specific county and basin boundaries.

TABLE 11 TO PART 226.—HYDROLOGIC UNITS AND COUNTIES[1] CONTAINING CRITICAL HABITAT FOR THREATENED CENTRAL VALLEY, CALIFORNIA FALL-RUN CHINOOK SALMON, AND DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT

Hydrologic unit name	Hydrologic unit No.	Counties within hydrologic unit and within range of ESU	Dams (reservoirs)
San Pablo Bay	18050002	San Mateo, CA, Alameda (CA), Contra Costa (CA), Marin (CA), Somona (CA), Napa (CA), Solano (CA).	San Pablo Reservoir.
San Francisco Bay	18050004	Santa Clara (CA), San Mateo (CA), Alameda (CA), Contra Costa (CA), Marin (CA).	
Coyote	18050003	Santa Clara (CA), San Mateo (CA), Alameda (CA)	Calavera Reservoir.
Suisun Bay	18050001	Contra Costa (CA), Solano (CA), Napa (CA)	
San Joaquin Delta	18040003	Stanislaus (CA), San Joaquin (CA), Alameda (CA), Contra Costa (CA), Sacramento (CA).	
Middle San Joaquin-Lower Merced-Lower Stanislaus.	18040002	Merced (CA), Stanislaus (CA), San Joaquin (CA)	Crocker Diversion La Grange.
Lower Calaveras-Mormon Slough	18040004	Stanislaus (CA), San Joaquin (CA), Calaveras (CA)	New Hogan.
Lower Consumnes-Lower Mokelumne	18040005	San Joaquin (CA), Calaveras (CA), Amador (CA), Sacramento (CA), El Dorado (CA).	Camanche.
Upper Consumnes	18040013	Sacramento (CA), Amador, (CA), El Dorado (CA)	
Lower Sacramento	18020109	Solano (CA), Sacramento (CA), Yolo (CA), Placer (CA), Sutter (CA).	
Lower American	18020111	Sacramento (CA), El Dorado (CA), Placer (CA)	Nimbus.
Upper Coon-Upper Auburn	18020127	Placer (CA).	
Lower Bear	18020108	Placer (CA), Sutter (CA), Yuba (CA)	Camp Far West.
Lower Feather	18020106	Sutter (CA), Yuba (CA), Butte (CA)	Oroville.
Lower Yuba	18020107	Yuba (CA)	Englebright.
Lower Butte	18020105	Sutter (CA), Butte (CA), Colusa (CA), Glenn (CA)	

TABLE 11 TO PART 226.—HYDROLOGIC UNITS AND COUNTIES [1] CONTAINING CRITICAL HABITAT FOR THREATENED CENTRAL VALLEY, CALIFORNIA FALL-RUN CHINOOK SALMON, AND DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT

Hydrologic unit name	Hydrologic unit No.	Counties within hydrologic unit and within range of ESU	Dams (reservoirs)
Sacramento-Stone Corral	18020104	Yolo (CA), Colusa (CA), Sutter (CA), Glenn (CA), Butte (CA).	
Upper Butte	18020120	Butte (CA), Tehama (CA).	
Sacramento-Lower Thomes	18020103	Glenn (CA), Butte (CA), Tehama (CA)	Black Butte.
Mill-Big Chico	18020119	Butte (CA), Tehama (CA), Shasta (CA)	
Upper Elder-Upper Thomes	18020114	Tehama (CA).	
Cottonwood Headwaters	18020113	Tehama (CA), Shasta (CA).	
Lower Cottonwood	18020102	Tehama (CA), Shasta (CA).	
Sacramento-Lower Cow-Lower Clear	18020101	Tehama (CA), Shasta (CA).	Keswick Dam Shasta.
Upper Cow-Battle	18020118	Tehama (CA), Shasta (CA)	Whiskeytown.
Sacramento-Upper Clear	18020112	Shasta (CA).	

[1] Some counties have very limited overlap with estuarine, riverine and riparian habitats indentified as critical habitat for this ESU. Consult USGS hydrologic unit maps (available from USGS) to determine specific county and basin boundaries.

TABLE 12 TO PART 226.—HYDROLOGIC UNITS AND COUNTIES [1] CONTAINING CRITICAL HABITAT FOR THREATENED SOUTHERN OREGON AND CALIFORNIA COASTAL CHINOOK SALMON; DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT

Hydrologic unit name	Hydrologic unit No.	Counties contained in hydrologic unit and within range of ESU	Dams (reservoirs)
Tomales-Drakes Bay	18050005	Marin (CA), Somona (CA)	Kent Lake Dam Nicasio Reservoir.
Bodega Bay	18010111	Marin (CA), Sonoma (CA).	
Russian	18010110	Somona (CA), Mendocino (CA)	Lake Mendocino.
Gualala-Salmon	18010109	Somona (CA), Mendocino (CA).	
Big-Navarro-Garcia	18010108	Mendocino (CA).	
Upper Eel	18010103	Mendocino (CA), Lake (CA), Glenn (CA), Trnity (CA).	
Middle Fork Eel	18010104	Mendocino (CA), Trinity (CA), Humboldt (CA)	Lake Pillsbury.
Lower Eel	18010105	Mendocino (CA), Humboldt (CA).	
South Fork Eel	18010106	Mendocino (CA), Humboldt (CA).	
Mattole	18010107	Lake (CA), Mendocino (CA).	
Mad-Redwood	18010102	Humboldt (CA), Trinity (CA).	
Lower Klamath	18010209	Humboldt, (CA), Del Norte (CA), Siskiyou (CA).	
Smith	18010101	Del Norte (CA), Curry (OR).	
Chetco	17100312	Curry (OR), Del Norte (CA).	
Sixes	17100306	Curry (OR), Coos (OR).	
Illinois	17100311	Josephine (OR), Del Norte (CA).	
Lower Rogue	17100310	Curry (OR), Josephine (OR) Jackson (OR).	
Applegate	17100309	Josephine (OR), Jackson (OR) Del Norte (CA)	Applegate Dam.
Middle Rogue	17100308	Jackson (OR), Douglas (OR)	Savage Rapids Dam.
Upper Rogue	17100307	Jackson (OR), Klamath (OR)	Lost Creek Dam.

[1] Some counties have very limited overlap with estuarine, riverine and riparian habitats indentified as critical habitat for this ESU. Consult USGS hydrologic unit maps (available from USGS) to determine specific county and basin boundaries.

TABLE 13 TO PART 226—HYDROLOGIC UNITS AND COUNTIES[1] CONTAINING CRITICAL HABITAT FOR THREATENED PUGET SOUND CHINOOK SALMON, AND DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT

Hydrologic unit name	Hydrologic unit No.	Counties contained in hydrologic unit and within range of ESU	Dams (reservoirs)
Nisqually	17110015	Pierce (WA), Thurston (WA).	
Deschutes	17110016	Thurston (WA), Lewis (WA).	
Puyallup	17110014	Pierce (WA), King (WA).	
Duwamish	17110013	King (WA), Pierce (WA)	Howard Hanson.
Lake Washington	17110012	King (WA), Snohomish (WA)	Cedar Falls Dam.
Puget Sound	17110019	Thurston (WA), Mason (WA), Kitsap (WA), Pierce (WA), King (WA), Snohomish (WA), Jefferson (WA), Skagit (WA).	
Skokomish	17110017	Mason (WA), Jefferson (WA), Grays Harbor (WA)	Cushman Dam.
Hood Canal	17110018	Mason (WA), Jefferson (WA), Kitsap (WA).	
Snoqualmie	17110010	King (WA), Snohomish (WA)	Tolt Dam.
Skyhomish	17110009	King (WA), Snohomish (WA).	
Snohomish	17110011	Snohomish (WA).	
Stillaguamish	17110008	Snohomish (WA), Skagit (WA).	

TABLE 13 TO PART 226—HYDROLOGIC UNITS AND COUNTIES[1] CONTAINING CRITICAL HABITAT FOR THREATENED PUGET SOUND CHINOOK SALMON, AND DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT—Continued

Hydrologic unit name	Hydrologic unit No.	Counties contained in hydrologic unit and within range of ESU	Dams (reservoirs)
Sauk	17110006	Snohomish (WA), Skagit (WA).	
Upper Skagit	17110005	Skagit (WA), Whatcom (WA).	
Lower Skagit	17110007	Skagit (WA), Snohomish (WA).	
Nooksack	17110004	Skagit (WA), Whatcom (WA).	
Fraser	17110001	Whatcom (WA).	
Strait of Georgia	17110002	Skagit (WA), Whatcom (WA).	
San Juan Islands	17110003	San Juan (WA).	
Dungeness-Elwha	17110020	Jefferson (WA), Clallam (WA)	Elwha Dam.
Crescent-Hoko	17110021	Clallam (WA).	

[1] Some counties have very limited overlap with estuarine, riverine and riparian habitats indentified as critical habitat for this ESU. Consult USGS hydrologic unit maps (available from USGS) to determine specific county and basin boundaries.

TABLE 14 TO PART 226.—HYDROLOGIC UNITS AND COUNTIES [1] CONTAINING CRITICAL HABITAT FOR THREATENED LOWER COLUMBIA RIVER CHINOOK SALMON, AND DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT

Hydrologic unit name	Hydrologic unit No.	Counties within hydrologic unit and within range of ESU	Dams (reservoirs)
Lower Columbia	17080006	Pacific (WA), Wahkiakum (WA), Clatsop (OR).	
Lower Columbia-Clatskanie	17080003	Wahkiakum (WA), Cowlitz (WA), Skamania (WA), Clatsop (OR), Columbia (OR).	
Lower Cowlitz	17080005	Cowlitz (WA), Lewis (WA), Skamania (WA)	Mayfield Dam.
Lewis	17080002	Cowlitz (WA), Clark (WA), Skamania (WA), Klickitat (WA).	Merwin Dam, Yale Dam Cougar Dam.
Lower Columbia-Sandy	17080001	Clark (WA), Skamania (WA), Multnomah (OR), Clackamas (OR).	Bull Run Dam.
Lower Willamette	17090012	Columbia (OR), Multnomah (OR), Clackamas (OR).	
Clackamas	17090011	Clackamas (OR), Marion (OR)	Oak Grove Dam.
Middle Columbia—Hood	17070105	Hood River (OR), Wasco (OR), Klickitat (WA), Skamania (WA).	Condit Dam.

[1] Some counties have very limited overlap with estuarine, riverine and riparian habitats indentified as critical habitat for this ESU. Consult USGS hydrologic unit maps (available from USGS) to determine specific county and basin boundaries.

TABLE 15 TO PART 226.—HYDROLOGIC UNITS AND COUNTIES[1] CONTAINING CRITICAL HABITAT FOR THREATENED UPPER WILLAMETTE RIVER CHINOOK SALMON, AND DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT

Hydrologic unit name	Hydrologic unit No.	Counties within hydrologic unit and within range of ESU	Dams (reservoirs)
Lower Columbia	17080006	Pacific (WA), Wahkiakum (WA), Clatsop (OR).	
Lower Columbia-Clatskanie	17080003	Wahkiakum (WA), Cowlitz (WA), Skamania (WA), Clatsop (OR), Columbia (OR).	
Lower Columbia-Sandy	17080001	Clark (WA), Skamania (WA), Multnomah (OR), Clackamas (OR).	
Lower Willamette	17090012	Columbia (OR), Multnomah (OR), Clackamas (OR).	
Tualatin	17090010	Yamhill (OR), Washington (OR), Tillamook (OR), Clakamas (OR), Multnomah (OR), Columbia (OR).	
Middle Willamette	17090007	Polk (OR), Marion (OR), Yamhill (OR), Washington (OR), Clakamas (OR).	
Yamhill	17090008	Lincoln (OR), Polk (OR), Yamhill (OR), Tillamook (OR), Washington (OR).	
Molalla-Pudding	17090009	Marion (OR), Clakamas (OR).	
North Santiam	17090005	Marion (OR), Linn (OR).	
Upper Willamette	17090003	Polk (OR), Benton (OR), Lane (OR), Linn (OR), Lincoln (OR).	
South Santiam	17090006	Linn (OR)	Green Peter Dam, Foster Dam.
McKenzie	17090004	Lane (OR), Linn (OR)	Cougar Dam.
Middle Fork Willamette	17090001	Lane (OR), Douglas (OR)	Dexter Dam.
Coast Fork Willamette	17090002	Lane (OR), Douglas (OR).	

[1] Some counties have very limited overlap with estuarine, riverine and riparian habitats indentified as critical habitat for this ESU. Consult USGS hydrologic unit maps (available from USGS) to determine specific county and basin boundaries.

TABLE 16 TO PART 226—HYDROLOGIC UNITS AND COUNTIES[1] CONTAINING CRITICAL HABITAT FOR ENDANGERED UPPER COLUMBIA RIVER SPRING-RUN CHINOOK SALMON, AND DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT

Hydrologic unit name	Hydrologic unit No.	Counties contained in hydrologic unit and within range of ESU	Dams (reservoirs)
Lower Columbia	17080006	Pacific (WA), Wahkiakum (WA), Clatsop (OR)	
Lower Columbia-Clatskanie	17080003	Wahkiakum (WA), Cowlitz (WA), Skamania (WA), Clatsop (OR), Columbia (OR).	
Lower Columbia-Sandy	17080001	Clark (WA), Skamania (WA), Multnomah (OR), Clackamas (OR).	Bull Run Dam.
Middle Columbia-Hood	17070105	Hood River (OR), Wasco (OR), Klickitat (WA), Skamania (WA).	Condit Dam.
Middle Columbia-Lake Wallula	17070101	Gilliam (OR), Morrow (OR), Sherman (OR), Umatilla (OR), Benton (A), Klickitat (WA), Walla Walla (WA).	
Upper Columbia-Priest Rapids	17020016	Benton (WA), Franklin (WA), Grant (WA)	
Upper Columbia—Entiat	17020010	Chelan (WA), Douglas (WA), Grant (WA), Kittias (WA)	
Wenatchee	17020011	Chelan (WA).	
Chief Joseph	17020005	Chelan (WA), Douglas (WA), Okanogan (WA)	Chief Joseph.
Methow	17020008	Okanogan (WA).	
Okanogan	17020006	Okanogan (WA).	
Similkameen	17020007	Okanogan (WA).	

[1] Some counties have very limited overlap with estuarine, riverine and riparian habitats indentified as critical habitat for this ESU. Consult USGS hydrologic unit maps (available from USGS) to determine specific county and basin boundaries.

TABLE 17 TO PART 226—HYDROLOGIC UNITS AND COUNTIES[1] CONTAINING CRITICAL HABITAT FOR THREATENED SNAKE RIVER FALL-RUN CHINOOK SALMON, AND DAMS/RESERVOIRS REPRESENTING THE UPSTREAM EXTENT OF CRITICAL HABITAT

Hydrologic unit name	Hydrologic unit No.	Counties contained in hydrologic unit and within range of ESU	Dams (reservoirs)
Lower Columbia	17080006	Pacific (WA), Wahkiakum (WA), Clatsop (OR).	
Lower Columbia-Clatskanie	17080003	Wahkiakum (WA), Cowlitz (WA), Skamania (WA), Clatsop (OR), Columbia (OR).	
Lower Columbia-Sandy	17080001	Clark (WA), Skamania (WA), Multnomah (OR), Clackamas (OR).	Bull Run Dam.
Middle Columbia-Hood	17070105	Hood River (OR), Wasco (OR) Klickitat (WA), Skamania (WA).	Condit Dam.
Middle Columbia-Lake Wallula	17070101	Gilliam (OR), Morrow (OR), Sherman (OR), Umatilla (OR), Benton (A), Klickitat (WA), Walla Walla (WA).	
Lower Deschutes	17070306	Jefferson (OR), Wasco (OR), Sherman (OR)	Pelton Dam Round Butte.
Trout	17070307	Crook (OR), Jefferson (OR), Wasco (OR)	
Lower John Day	17070204	Crook (OR), Wheeler (OR), Jefferson (OR), Grant (OR), Gilliam (OR), Morrow (OR) Sherman (OR), Wasco (OR).	
Upper John Day	17070201	Wheeler (OR), Grant (OR), Harney (OR)	
North Fork—John Day	17070202	Grant (OR), Wheeler (OR), Morrow (OR), Umatilla (OR).	
Middle Fork—John Day	17070203	Grant (OR).	
Willow	17070104	Morrow (OR), Gilliam (OR).	
Umatilla	17070103	Morrow (OR), Umatilla (OR).	
Walla Walla	17070102	Umatilla (OR), Wallowa (OR), Walla Walla (WA), Columbia (WA).	
Lower Snake	17060110	Franklin (WA), Columbia (WA), Walla Walla (WA)	
Lower Snake-Tucannon	7060107	Columbia (WA), Whitman (WA) Garfield (WA), Asotin (WA).	
Lower Snake—Asotin	17060103	Wallowa (OR), Garfield (WA), Asotin (WA) Nez Perce (ID).	
Lower Salmon	17060209	Valley (ID), Idaho (ID), Lewis (ID), Nez Perce (ID)	
Clearwater	17060306	Nez Perce (ID), Lewis (ID), Clearwater (ID) Latah (ID).	
Lower Grande Ronde	17060106	Union (OR), Wallowa (OR), Columbia (WA), Garfield (WA), Asotin (WA).	
Imnaha	17060102	Baker (OR), Union (OR), Wallowa (OR), Columbia (WA), Walla Walla (WA).	
Hells Canyon	17060101	Wallowa (OR), Idaho (ID)	Hells Canyon, Oxbow Dam Brownlee.

[1] Some counties have very limited overlap with estuarine, riverine and riparian habitats indentified as critical habitat for this ESU. Consult USGS hydrologic unit maps (available from USGS) to determine specific county and basin boundaries.

PART 227—THREATENED FISH AND WILDLIFE

6. The authority citation for part 227 continues to read as follows:

Authority: 16 U.S.C. 1531–1543; subpart B, § 227.12 also issued under 16 U.S.C. 1361 *et seq.*

7. In § 227.4, paragraph (g) is revised, paragraph (p) is added and reserved, and paragraphs (q) through (u) are added to read as follows:

§ 227.4 Enumeration of threatened species.

* * * * *

(g) Snake River fall-run chinook salmon (*Oncorhynchus tshawytscha*). Includes all naturally spawned populations of chinook salmon (and their progeny) from the Columbia River and its tributaries upstream from a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, to its confluence with the Snake River, and also includes the Snake River and its tributaries upstream to Hells Canyon Dam. These tributaries include the lower Grande Ronde, Imnaha, lower Salmon and lower Clearwater Rivers in parts of Oregon, Washington and Idaho.

* * * * *

(p) [Reserved]

(q) Central Valley fall/late fall-run chinook salmon (*Oncorhynchus tshawytscha*). Includes all naturally spawned populations of chinook salmon (and their progeny) in the Sacramento and San Joaquin River Basins and their tributaries, east of Carquinez Strait, California.

(r) Southern Oregon and California coastal chinook salmon (*Oncorhynchus tshawytscha*). Includes all naturally spawned populations of chinook salmon (and their progeny) from rivers and streams between Cape Blanco, Oregon south to the northern entrance of San Francisco Bay, California.

(s) Puget Sound chinook salmon (*Oncorhynchus tshawytscha*). Includes all naturally spawned populations of chinook salmon (and their progeny) from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington.

(t) Lower Columbia River chinook salmon (*Oncorhynchus tshawytscha*). Includes all naturally spawned populations of chinook salmon (and their progeny) from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, and includes the Willamette River to Willamette Falls, Oregon.

(u) Upper Willamette River chinook salmon (*Oncorhynchus tshawytscha*). Includes all naturally spawned spring-run populations of chinook salmon (and their progeny) in the Willamette River, and its tributaries, above Willamette Falls, Oregon.

[FR Doc. 98–5484 Filed 3–2–98; 2:49 pm]
BILLING CODE 3510–22–P