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Part II

Department of Commerce

National Oceanic and Atmospheric Administration

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50 CFR Parts 222, 226, and 227

Endangered and Threatened Species: West Coast Chinook Salmon; Listing

Status Change; Proposed Rule

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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

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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 Sec. 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

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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,

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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 \1/3\ 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

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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

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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

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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. Sec. 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

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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

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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.

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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, Sec. 222.32 also issued under 16 U.S.C. 1361 et seq.

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

Sec. 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 deg. 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:

Sec. 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

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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<SUP>1 Containing Critical Habitat for Endangered Central Valley, California Spring-Run Chinook Salmon, and Dams/Reservoirs Representing the Upstream Extent of Critical Habitat

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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).............

....

<SUP>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

Counties within
Hydrologic unit name Hydrologic hydrologic unit
and Dams (reservoirs)
unit No. within range of ESU

San Pablo Bay................... 18050002 San Mateo, CA, Alameda
San Pablo Reservoir.
(CA), Contra Costa (CA),
Marin (CA), Somona (CA),
Napa (CA), Solano (CA).
San Francisco Bay............... 18050004 Santa Clara (CA), San

....
Mateo (CA), Alameda
(CA), Contra Costa (CA),
Marin (CA).
Coyote.......................... 18050003 Santa Clara (CA), San
Calavera Reservoir.
Mateo (CA), Alameda (CA).
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- 18040002 Merced (CA), Stanislaus
Crocker Diversion La Grange.
Lower Stanislaus. (CA), San Joaquin (CA).

Lower Calaveras-Mormon Slough.... 18040004 Stanislaus (CA), San
New Hogan.
Joaquin (CA), Calaveras
(CA).
Lower Consumnes-Lower Mokelumne.. 18040005 San Joaquin (CA),
Camanche.
Calaveras (CA), Amador
(CA), Sacramento (CA),
El Dorado (CA).
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
Nimbus.
Dorado (CA), Placer (CA).
Upper Coon-Upper Auburn.......... 18020127 Placer (CA).
....
Lower Bear....................... 18020108 Placer (CA), Sutter (CA),
Camp Far West.
Yuba (CA).
Lower Feather.................... 18020106 Sutter (CA), Yuba (CA),
Oroville.
Butte (CA).
Lower Yuba....................... 18020107 Yuba (CA)
Englebright.
Lower Butte...................... 18020105 Sutter (CA), Butte (CA),
....
Colusa (CA), Glenn (CA).

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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),
Black Butte.
Tehama (CA).
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

Counties contained in
Hydrologic unit name Hydrologic hydrologic unit
and Dams (reservoirs)
unit No. within range of ESU

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
Lake Mendocino.
(CA).
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
Lake Pillsbury.
(CA), Humboldt (CA).
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
Applegate Dam.
(OR) Del Norte (CA).
Middle Rogue..................... 17100308 Jackson (OR), Douglas
Savage Rapids Dam.
(OR).
Upper Rogue...................... 17100307 Jackson (OR), Klamath
Lost Creek Dam.
(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 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

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Counties contained in
Hydrologic unit name Hydrologic hydrologic unit
and Dams (reservoirs)
unit No. within range of ESU

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
Cushman Dam.
(WA), Grays Harbor (WA).
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).

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
Oak Grove Dam.
(OR).
Middle Columbia--Hood........... 17070105 Hood River (OR), Wasco
Condit Dam.
(OR), Klickitat (WA),
Skamania (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 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

Counties within
Hydrologic unit name Hydrologic hydrologic unit
and Dams (reservoirs)
unit No. within range of ESU

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.

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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

Counties contained in
Hydrologic unit name Hydrologic hydrologic unit
and Dams (reservoirs)
unit No. within range of ESU

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
Bull Run Dam.
(WA), Multnomah (OR),
Clackamas (OR).
Middle Columbia-Hood............ 17070105 Hood River (OR), Wasco
Condit Dam.
(OR), Klickitat (WA),
Skamania (WA).
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
Chief Joseph.
(WA), Okanogan (WA).
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
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Counties contained in
Hydrologic unit name Hydrologic hydrologic unit
and Dams (reservoirs)
unit No. within range of ESU

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
Bull Run Dam.
(WA), Multnomah (OR),
Clackamas (OR).
Middle Columbia-Hood............ 17070105 Hood River (OR), Wasco
Condit Dam.
(OR) Klickitat (WA),
Skamania (WA).
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
Pelton Dam Round Butte.
(OR), Sherman (OR).
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 identified 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, Sec. 227.12 also issued under 16 U.S.C. 1361 et seq.

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

Sec. 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.

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RECORD TYPE: FEDERAL (NOTES MAIL)

CREATOR: envsubset@epamail.epa.gov (envsubset@epamail.epa.gov [UNKNOWN])

CREATION DATE/TIME:10-JUN-1998 16:44:29.00

SUBJECT: Endangered and Threatened Wildlife and Plants; Determination

TO: Multiple recipients of list <epa-species@valley.rtpnc.epa.gov> (Multiple recipients of list <epa-species@valley.rtpnc.epa.gov> [UNKNOWN])
READ:UNKNOWN

TEXT:
[Federal Register: June 10, 1998 (Volume 63, Number 111)]
[Rules and Regulations]
[Page 31647-31674]
>From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr10jn98-30]

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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018-AB94

Endangered and Threatened Wildlife and Plants; Determination of
Threatened Status for the Klamath River and Columbia River Distinct
Population Segments of Bull Trout

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The Fish and Wildlife Service (Service) determines threatened status for the Klamath River and the Columbia River distinct population segments of bull trout (Salvelinus confluentus), with special rules, pursuant to the Endangered Species Act of 1973, as amended (Act). The Klamath River population segment is limited to seven geographically isolated stream areas representing a fraction of the historical habitat. The distribution and numbers of bull trout have declined in the Klamath River basin due to habitat isolation, loss of migratory corridors, poor water quality, and the introduction of non-native species. The Columbia River population segment is represented by relatively widespread subpopulations that have declined in overall range and numbers of fish. A majority of Columbia River bull trout

occur in isolated, fragmented habitats that support low numbers of fish and are inaccessible to migratory bull trout. The few remaining bull trout ``strongholds" in the Columbia River basin tend to be found in large areas of contiguous habitats in the Snake River basin of central Idaho mountains, upper Clark Fork and Flathead Rivers in Montana, and several streams in the Blue Mountains in Washington and Oregon. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, and the introduction of non-native species. The special rules allow the take of bull trout in the Columbia River and Klamath River population segments if in accordance with applicable State and Native American Tribal fish and wildlife conservation laws and regulations and conservation plans approved by the Service.

The listing proposal was restricted by court order to information contained in the 1994 administrative record. This final determination was based on the best available scientific and commercial information including current data and new information received during the comment period. As a result, the threatened listing status for the Columbia River population segment has been retained, however, the listing status for the Klamath River population segment is changed from endangered to threatened. This listing status change occurred because bull trout interagency management and recovery efforts for the Klamath River basin are being implemented and, consequently, threats have been reduced. This rule implements the protection and conservation provisions afforded by the Act for the Klamath River and Columbia River population segments of bull trout.

DATES: Effective July 10, 1998.

ADDRESSES: The complete file for this rule is available for inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Snake River Basin Field Office, 1387 S. Vinnell Way, Room 368, Boise, Idaho 83709.

FOR FURTHER INFORMATION CONTACT: Robert Ruesink, Supervisor, Snake River Basin Office (see ADDRESSES section) (telephone 208-378-5243, facsimile 208-378-5262).

SUPPLEMENTARY INFORMATION:

Background

Bull trout (Salvelinus confluentus), members of the family Salmonidae, are char native to the Pacific northwest and western Canada. Bull trout historically occurred in major river drainages in the Pacific Northwest from about 41 deg. N to 60 deg. N latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in Northwest Territories, Canada (Cavender 1978; Bond 1992). To the west, bull trout range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout are wide-spread throughout tributaries of the Columbia River basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978; Brewin and Brewin 1997).

Bull trout were first described as Salmo spectabilis by Girard in 1856 from a specimen collected on the lower Columbia River, and subsequently described under a number of names such as Salmo confluentus and Salvelinus malma (Cavender 1978). Bull trout and Dolly Varden (Salvelinus malma) were previously considered a single species (Cavender 1978; Bond 1992). Cavender (1978) presented morphometric (measurement), meristic (geometrical relation), osteological (bone structure), and distributional evidence to document specific distinctions between Dolly Varden and bull trout. Bull trout and Dolly Varden were formally recognized as separate species by the American Fisheries Society in 1980 (Robins et al. 1980). Although bull trout and Dolly Varden co-occur in several northwestern Washington river drainages, there is little evidence of introgression (Haas and McPhail 1991) and the two species appear to be maintaining distinct genomes (Leary et al. 1993; Williams et al. 1995; Kanda et al. 1997; Spruell and Allendorf 1997).

Bull trout exhibit resident and migratory life-history strategies through much of the current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear from one to four years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, to saltwater (anadromous), where maturity is reached in one of the three habitats (Fraley and Shepard 1989; Goetz 1989). Resident and migratory forms may be found together and it is suspected that bull trout give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993).

Bull trout have more specific habitat requirements compared to other salmonids (Rieman and McIntyre 1993). Habitat components that appear to influence bull trout distribution and

abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors (Oliver 1979; Pratt 1984, 1992; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear, and that the characteristics are not necessarily ubiquitous throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), the fish should not be expected to simultaneously occupy all available habitats (Rieman et al. in press).

Bull trout are found primarily in colder streams, although individual fish are found in larger river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. in press). Water temperature above 15 deg. C (59 deg. F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. in press). For example, the only stream with substantial bull trout spawning in the upper Blackfoot River in Montana was Copper Creek, which had maximum water temperatures less than 15 deg. C (59 deg. F) (Hillman and Chapman 1996). Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8 deg. C (44 to 46 deg. F) and optimum water temperatures for egg incubation of 2 to 4 deg. C (35 to 39 deg. F). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 to 9 deg. C (46 to 48 deg. F) within a temperature gradient of 8 to 15 deg. C (46 to 60 deg. F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Oliver 1979; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Maintaining bull trout habitat requires stream channel and flow stability (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period and channel instability may decrease survival of eggs and young juveniles in the gravel during winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993).

Preferred spawning habitat consists of low gradient streams with loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 5 to 9 deg. C (41 to 48 deg. F) in late summer to early fall (Goetz 1989). Pratt (1992) indicated that increases in fine sediments reduce egg survival and emergence. High juvenile densities were observed in Swan River, Montana, and tributaries with diverse cobble substrate and low percentage of fine sediments (Shepard et al. 1984). Juvenile bull trout in four streams in central Washington occupied slow-moving water less than 0.5 m/sec (1.6 ft/sec) over a variety of sand to boulder size substrates (Sexauer and James 1997).

The size and age of bull trout at maturity depends upon life-history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Fraley and Shepard 1989; Goetz 1989). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Repeat and alternate year spawning has been reported, although repeat spawning frequency and post-spawning mortality are not well known (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. However, migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 kilometers (km) (155 miles (mi)) to spawning grounds (Fraley and Shepard 1989). In the Blackfoot River, Montana, bull trout began migrations to spawning areas in response to increasing temperatures (Swanberg 1996). Temperatures during spawning generally range from 4 to 10 deg. C (39 to 51 deg. F), with redds often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Bull trout require spawning substrate consisting of loose, clean gravel relatively free of fine sediments (Fraley and Shepard 1989). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Growth varies depending upon life-history strategy. Resident adults range from 150 to 300 millimeters (mm) (6 to 12 inches (in)) total length and migratory adults commonly reach 600 mm (24 in) or more (Pratt 1985; Goetz 1989). The largest verified bull trout is a 14.6 kilogram (kg) (32 pound) specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Bull trout are opportunistic feeders with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout are primarily piscivorous, known to feed on various fish species (Fraley and Shepard 1989; Donald and Alger 1993).

Bull trout evolved with, and, in some areas, co-occur with native cutthroat trout (Oncorhynchus clarki ssp.), resident (redband) and migratory rainbow trout (O. mykiss), chinook salmon (O. tshawytscha), sockeye salmon (O. nerka), mountain whitefish (Prosopium williamsoni), various sculpin (Cottus spp.), sucker (Catastomidae) and minnow species (Cyprinidae spp.) (Mauser et al. 1988; Rieman and McIntyre 1993). Bull trout habitat overlaps with the range of several fishes listed as threatened, endangered, proposed, and petitioned for listing under the Act, including the endangered Snake River sockeye salmon (November 20, 1991; 56 FR 58619); threatened Snake River spring and fall chinook salmon (April 22, 1992; 57 FR 14653); endangered Kootenai River white sturgeon (Acipenser transmontanus) (September 6, 1994, 59 FR 45989); threatened and endangered steelhead (August 18, 1997, 62 FR 43937); and westslope cutthroat trout (O. c. lewisi) (petitioned for listing in July 1997). Widespread introductions of non-native fishes, including brook trout

(S. fontinalis), lake trout (S. namaycush) (west of the Continental Divide), and brown trout (Salmo trutta), have also occurred across the range of bull trout. These non-native fish have caused local bull trout declines and extirpations (Bond 1992; Ziller 1992; Donald and Alger 1993; Leary et al. 1993; Montana Bull Trout Scientific Group (MBTSG) 1996h).

Bull trout habitat in the coterminous United States is composed of a complex mosaic of land ownership, including Federal lands administered by the U.S. Forest Service (USFS), U.S. Bureau of Land Management (BLM), U.S. National Park Service (NPS), and Department ofDefense (DOD); numerous Indian tribal lands; State land in Montana, Idaho, Oregon, Washington and Nevada; and private lands. It is estimated that as much as half of present bull trout habitat is bordered by non-Federal lands.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989) and resident bull trout move to overwinter in downstream pools in tributaries of the Bitterroot River (Jakober 1995). The ability to migrate is important to the persistence of local bull trout subpopulations (Rieman and McIntyre 1993; M. Gilpin, University of California, in litt. 1997; Rieman et al. in press). Migrations facilitate gene flow among local subpopulations because individuals from different subpopulations interbreed when some stray and return to non-natal streams. Subpopulations that are extirpated by catastrophic events may also become reestablished in this manner.

Metapopulation concepts of conservation biology theory are applicable to the distribution and characteristics of bull trout (Rieman and McIntyre 1993). A metapopulation is an interacting network of local subpopulations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994). Local subpopulations may become extinct, but can be reestablished by individuals from other subpopulations. Metapopulations provide a mechanism for spreading risk because the simultaneous loss of all subpopulations is unlikely. Habitat alteration, primarily through the construction of impoundments, dams, and water diversions that create unsuitable conditions, has fragmented habitats, eliminated migratory corridors, and isolated bull trout often in the headwaters of tributaries (Rieman et al. in press).

Though wide-ranging in parts of Oregon, Washington, Idaho and Montana, bull trout in the interior Columbia River basin presently occur in only about 44 to 45 percent of the historical range (Quigley and Arbelbide 1997; Rieman et al. in press). Declining trends and associated habitat loss and fragmentation have been documented rangewide (Bond 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993; Newton and Pribyl 1994; Idaho Department of Fish and Game (IDFG), in litt. 1995; McPhail and Baxter 1996). Several local extirpations have been reported, beginning in the 1950s (Rode 1990; Ratliff and Howell 1992; Donald and Alger 1993; Goetz 1994; Newton and Pribyl 1994; Berg and Priest 1995; Light et al. 1996; Buchanan et al. 1997; Washington Department of Fish and Wildlife (WDFW) 1997). For example, bull trout were apparently extirpated around 1975 from the McCloud River, California, the southernmost range (Moyle 1976; Rode 1990).

Distinct Population Segments

The Service's June 13, 1997, proposal to list the Klamath River and the Columbia River population segments of bull trout (62 FR 32268) was based on the 1994 administrative record, as required by the court. The Service's original June 10, 1994 (59 FR 30254), 12-month petition finding found that listing the bull trout was warranted but precluded throughout the coterminous United States. As explained in the proposed rule, the approach to break the range of bull trout into distinct population segments in the reanalysis of the 1994 petition finding was undertaken because the fish occurs in widespread, but fragmented habitats and has several life-history patterns. In addition, the threats to bull trout are diverse, and the quality and quantity of information regarding the population status and trends varies greatly throughout the range. By examining bull trout distinct population segments, the Service was better able to evaluate proposed listing of those segments, based on the 1994 administrative record, that were a priority in need of Federal protection. Future listing actions could, thereby, be based on best available rather than outdated scientific information.

In the process of making this final listing determination, the Service reexamined the appropriateness of applying the bull trout distinct population segments (DPSs) for the purposes of listing. The joint National Marine Fisheries Service (NMFS) and Service policy regarding the recognition of distinct vertebrate populations published February 7, 1996 (61 FR 4722), was the basis for this reexamination. Three elements are considered in the decision on whether a population segment could be treated as threatened or endangered under the Act--discreteness, significance, and conservation status in relation to the standards for listing. Discreteness refers to the isolation of a population from other members of the species and is based on two criteria--(1) marked separation from other populations of the same taxon resulting from physical, physiological, ecological, or behavioral factors, including genetic discontinuity; and (2) populations delimited by international boundaries. Significance is determined either by the importance or contribution, or both, of a discrete population to the species throughout its range. Four criteria were used to determine significance--(1) persistence of the discrete population segment in an ecological setting unusual or unique for the taxon; (2) evidence that loss of the discrete population segment would result in a significant gap in the range of the taxon; (3) evidence that the discrete population segment represents the only surviving natural occurrence of the taxon that may be more abundant elsewhere as an introduced population outside its historic range; and (4) evidence that the discrete population segment differs markedly from other populations of the taxon in its genetic characteristics. If a population segment is discrete and significant, its evaluation for endangered or threatened status is based on the Act's standards.

Based on the best available information, numerous bull trout subpopulations are isolated from each other by either unsuitable habitat or impassible dams and diversions, or both. Although many subpopulations could be considered discrete, few meet the ``significance'' criteria. For example, although some genetic differences were identified among subpopulations of bull trout in specific watersheds of the Columbia River basin, the subpopulations did not differ markedly and they inhabit similar habitats. The best available current information supports designating five DPSs in the coterminous United States--(1) Klamath River, (2) Columbia River, (3) Coastal-Puget Sound, (4) Jarbidge River, and (5) St. Mary-Belly River. For purpose of this final determination only the Klamath River and Columbia River DPSs will be addressed. The three remaining DPSs are the subject of a proposed rule published concurrently.

Although the range of bull trout extends into Canada and Alaska, subpopulations outside the coterminous United States are not being considered in this rulemaking. In accordance with the distinct vertebrate population policy, the Service may determine a population to be discrete at an international border where there are significant differences in the control of exploitation, management of habitat, conservation status, or regulatory mechanisms. Bull trout management and conservation strategy in Canada differs from the United States and such activities are beyond the regulatory scope of the Act. The best available information also disclosed uncertainty regarding the status of bull trout in Canada. Throughout British Columbia and Alberta, data on bull trout status, distribution, and the presence of ongoing threats is incomplete and covers only a portion of the species' range within the provinces. The status of bull trout in Alaska is unknown.

Within the coterminous United States, bull trout distribution is highly fragmented and many subpopulations are geographically isolated. The best available information indicates that bull trout in the coterminous United States, although still wide-ranging, have suffered a significant reduction in range. In addition, bull trout are faced with varying degrees of ongoing threats. The Service now determines that listing bull trout distinct population segments only within the coterminous United States is warranted at this time.

Klamath River

The Klamath River originates in south central Oregon near Crater Lake National Park, and flows southwest into northern California where it meets the Trinity River and empties into the Pacific Ocean. Bull trout in this drainage are discrete because of physical isolation from other bull trout by the Pacific Ocean and several small mountain ranges in central Oregon. Leary et. al. (1991) determined genetic characteristics of bull trout in the Klamath River and Columbia River drainages using protein electrophoresis. They concluded that these two groups of fish were reproductively isolated and evolutionarily distinct. In addition, Williams et al. (1995) separated bull trout in the Klamath and Columbia Rivers into different clades (i.e., groups derived from different lineages) based on genetic diversity patterns. As a result, the Klamath River DPS is significant because it differs markedly in genetic characteristics from bull trout in the Columbia River basin.

Columbia River

The Columbia River DPS occurs throughout the entire Columbia River basin within the United States and its tributaries, excluding bull trout found in the Jarbidge River, Nevada. Although Williams et al. (1995) identified two distinct clades in the Columbia River basin (upper and lower Columbia River) based on genetic diversity patterns, a discrete geographical boundary between the two clades was not documented. The Columbia River DPS is significant because the overall range of the species would be substantially reduced if this discrete population were lost.

Status and Distribution

The Service evaluated the status and distribution of bull trout for each subpopulation in the Klamath River and Columbia River population segments. The complete review of this evaluation is found in a status summary compiled by the Service (Service status summary 1998). A synopsis of the summary is presented in this rule.

To facilitate evaluation of current bull trout distribution and abundance for both the Klamath River and Columbia River population segments, the Service analyzed data on bull trout relative to subpopulations because fragmentation and barriers have isolated bull trout throughout their current range. A subpopulation is considered a reproductively isolated group of bull trout that spawns within a particular area of a river system. In areas where two groups of bull trout are separated by a barrier (e.g., an impassable dam or waterfall, or reaches of unsuitable habitat) that allows only individuals upstream access to those downstream (i.e., one-way passage), both groups were considered subpopulations. In addition, subpopulations were considered at risk of extirpation from naturally occurring events if they were--(1) unlikely to be reestablished by individuals from another subpopulation (i.e., functionally or geographically isolated from other subpopulations); (2) limited to a single spawning area (i.e., spatially restricted); and either (3) characterized by low individual or spawner numbers; or (4) primarily of a single life-history form. For example, a subpopulation of resident fish isolated upstream of an impassable waterfall would be considered at risk of extirpation from naturally occurring events if the subpopulation had low numbers of fish that spawn in a restricted area. In such cases, a natural event such as a fire or flood affecting the spawning area could eliminate the subpopulation, and reestablishment from fish downstream would be prevented by the impassable waterfall. However, a subpopulation residing downstream of the waterfall would not be considered at risk of extirpation from naturally occurring events because there would be establishment potential by fish from the subpopulation upstream. Because resident bull trout may exhibit limited downstream movement (Nelson 1996), the Service's determination of subpopulations at risk of extirpation from naturally occurring events may overestimate the number of subpopulations that are likely to be reestablished.

The status of subpopulations was based on modified criteria of Rieman et al. (in press), including the abundance, trends in abundance, and the presence of life-history forms of bull trout. The Service considered a subpopulation ``strong" if 5,000 individuals or 500 spawners likely occur in the subpopulation, abundance appears stable or increasing, and life-history forms were likely to persist; and ``depressed" if less than 5,000 individuals or 500 spawners likely occur in the subpopulation, abundance appears to be declining, or a life-history form historically present has been lost. If there was insufficient abundance, trend, and life-history information to classify the status of a subpopulation as either ``strong" or ``depressed," the status was considered ``unknown."

Based on abundance, trends in abundance, and the presence of life-history forms, bull trout were considered strong (i.e., 5,000 individuals or 500 spawners likely occur in the subwatershed or larger area, abundance is stable or increasing with at a minimum of half of historic abundance, and the presence of all life-history forms historically present) in 13 percent of the occupied range in the interior Columbia River basin (Quigley and Arbelbide 1997). Using various estimates of bull trout range, Rieman et al. (in press) estimated that bull trout were strong in 6 to 24 percent of the subwatersheds in the Columbia River basin. Bull trout declines have been attributed to the effects of land and water management activities, including forest management and road building, mining, agricultural practices, and livestock grazing (Furniss et al. 1991; Meehan 1991; Nehlsen et al. 1991; Craig and Wissmar 1993; Frissell 1993; McIntosh et al. 1994; Platts et al. 1995). Isolation and habitat fragmentation from dams and agricultural diversions (Rode 1990; Mongillo 1993; Jakober 1995),

fisheries management practices, poaching and the introduction of non-native species (Rode 1990; Bond 1992; Howell and Buchanan 1992; WDFW 1992; Donald and Alger 1993; Leary et al 1993; Pratt and Huston 1993; Rieman and McIntyre 1993; MBTSG 1996h; Palmisano and Kaczynski, Northwest Forest Resources Council (NFRC), in litt. 1997) also threaten bull trout populations.

Klamath River Population Segment

Historical records suggest that bull trout were once widely distributed and exhibited diverse life-history traits in the Klamath River basin (Gilbert and Evermann 1894; Dambacher et al. 1992; Ziller 1992; Oregon Chapter of the American Fisheries Society (OCAFS) 1993). The earliest records of bull trout in the basin are from Fort Creek (formerly Linn Creek), a tributary to the Wood River (L. Dunsmoor andC. Bienz, Klamath Tribe, in litt. 1997). Records from the late 1800s suggest that migratory fish (adfluvial) inhabited Klamath Lake (OCAFS 1993). Other migratory bull trout (i.e., fluvial) were evidently present in some of the larger streams in the basin as recently as the early 1970s (Ziller 1992). Bull trout are thought to have been extirpated from the Sycan River, the South Fork of the Sycan River, and four streams in the Klamath River basin (Cherry, Sevenmile, Coyote, and Callahan creeks) since the 1970s.

Currently, bull trout in the Klamath River basin occur only as resident forms isolated in higher elevation headwater streams (Goetz 1989) within three watersheds--Upper Klamath Lake, Sprague River, and Sycan River (Light et al. 1996). Factors contributing to isolation include habitat degradation, water diversion, and habitat fragmentation (OCAFS 1993; Light et al. 1996). In addition, long distances separate each isolated subpopulation (Schroeder and Weeks, in litt. 1997). According to Light et al. (1996), bull trout occupy approximately 38.2 km (22.9 mi) of streams in the Klamath River basin. More recently, Buchanan et al. (1997) indicated that bull trout occupy approximately 34.1 km (20.5 mi) of streams. The risk of extinction for Klamath River bull trout over the next 100 years was recently estimated at 70 to 90 percent (K. Schroeder and H. Weeks, OCAFS, in litt. 1997). The Service identified seven bull trout subpopulations in three watersheds (number of subpopulations in each watershed)--Upper Klamath Lake (2), Sycan River (1), and Sprague River (4). The Service considers six of the subpopulations at risk of extirpation caused by naturally occurring events due to their isolation, single life-history form and spawning area, and low abundance (Service status summary 1997).

Columbia River Population Segment

The Columbia River DPS includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60% of the Columbia River Basin, and presently occur in 45% of the estimated historical range (Quigley and Arbelbide 1997). The Columbia River population segment is composed of 141 subpopulations. For discussion and analysis, the Service considered four geographic areas of the Columbia River basin--(1) lower Columbia River (downstream of the Snake River confluence), (2) mid-Columbia River (Snake River confluence to Chief Joseph Dam), (3) upper Columbia River (upstream from Chief Joseph Dam), and (4) Snake River and its tributaries (including the Lost River drainage).

Lower Columbia River Geographical Area

The lower Columbia River area includes all tributaries in Oregon and Washington downstream of the Snake River confluence near the town of Pasco, Washington. The Service identified 20 subpopulations in watersheds of nine major tributaries of the lower Columbia River (number of subpopulations in each watershed)--the Lewis River (2), Willamette River (3), White Salmon River (1), Klickitat River (1), Hood River (2), Deschutes River (3), John Day River (3), Umatilla River (2), and Walla Walla River (3). The present distribution of bull trout in the lower Columbia River basin is less than the historic range (Buchanan et al. 1997; Oregon Department of Fish and Wildlife (ODFW) 1993). Bull trout are thought to be extirpated from several tributaries in five river systems in Oregon--the Middle Fork Willamette River, the North and South Forks of the Santiam River, the Clackamas River, the upper Deschutes River (upstream of Bend, Oregon) and the Crooked River (tributary to the Deschutes River) (Buchanan et al. 1997).

Hydroelectric facilities and large expanses of unsuitable, fragmented habitat have isolated these subpopulations. Large dams, such as McNary, John Day, The Dalles, and Bonneville, separate four reaches of the lower Columbia River. Although fish may pass each facility in both upstream and downstream directions, the extent to which bull trout use the Columbia River is unknown. In addition, the nine major tributaries have numerous facilities, many of which do not provide upstream passage.

Migratory bull trout are present with resident fish or exclusively in at least 13 of the 20 subpopulations in the lower Columbia River. Many migratory fish are adfluvial and inhabit reservoirs created by dams. However, this area includes the only extant adfluvial subpopulation in Oregon, which exists in Odell Lake in the Deschutes River basin (Ratliff and Howell 1992; Buchanan et al. 1997). The Metolius River-Lake Billy Chinook subpopulation is also found in the Deschutes River basin. It is the only subpopulation considered ``strong" and exhibits an increasing trend in abundance. The Service considers 5 of the 20 subpopulations at risk of extirpation caused by naturally occurring events exacerbated by isolation, single life-history form and spawning area, and low abundance.

Mid-Columbia River Geographical Area

The mid-Columbia River area includes watersheds of four major tributaries of the Columbia River in Washington, between the confluence of the Snake River and Chief Joseph Dam. The Service identified 16 bull trout subpopulations in the four watersheds (number of subpopulations in each watershed)--Yakima River (8), Wenatchee River (3), Entiat River (1), and Methow River (4). Historically, bull trout occurred in larger areas of the four tributaries and Columbia River. Bull trout are thought to have been extirpated in 10 streams within the area--Satus Creek, Nile Creek, Orr Creek, Little Wenatchee River, Napecqua River, Lake Chelan, Okanogan River, Eightmile Creek, South Fork Beaver Creek, and the Hanford Reach of the Columbia River. Most bull trout in the mid-Columbia River geographic area are isolated by dams or unsuitable habitat created by water diversions.

Bull trout in the mid-Columbia River area are most abundant in Rimrock Lake of the Yakima River basin and Lake Wenatchee of the Wenatchee River basin. Both subpopulations are considered ``strong'' and increasing or stable. The remaining 14 subpopulations are relatively low in abundance, exhibit ``depressed'' or unknown trends, and primarily have a single life-history form. The Service considers 10 of the 16 subpopulations at risk of extirpation because of naturally occurring events due to isolation, single life-history form and spawning area, and low abundance.

Upper Columbia River Geographic Area

The upper Columbia River geographic area includes the mainstem Columbia River and all tributaries upstream of Chief Joseph Dam in Washington, Idaho, and Montana. Bull trout are found in two large basins, the Kootenai River and Pend Oreille River, which include the Clark Fork River. Historically, bull trout were found in larger portions of the area. Numerous dams and degraded habitat have fragmented bull trout habitat and isolated fish into 71 subpopulations in 9 major river basins (number of subpopulations in each basin)--Spokane River (1), Pend Oreille River (3), Kootenai River (5), Flathead River (24), South Fork Flathead River (3), Swan River (3), Clark Fork River (4), Bitterroot River (27), and Blackfoot River (1). Bull trout are thought to be extirpated in 64 streams and lakes of various sizes--Nespelam, Sanpoil, and Kettle rivers; Barnaby, Hall, Stranger, and Wilmont creeks; 8 tributaries to Lake Pend Oreille; 5 tributaries to Pend Oreille River below Albeni Falls Dam; Lower Stillwater Lake; Arrow Lake (Montana); upper Clark Fork River, 12 streams in the Coeur d'Alene River basin; and approximately 25 streams in the St. Joe River basin (e.g., IDFG, in litt. 1995).

The upper Columbia River area contains ``strongholds'' for bull trout. Bull trout are considered ``strong'' in Hungry Horse Reservoir and Swan Lake. Trends in abundance are stable in Hungry Horse Reservoir, and increasing in Swan Lake. Although high numbers of bull trout are found in Lake Pend Oreille and the upper Kootenai River, trends in abundance are either negative or unknown. The high number of subpopulations (27) in the Bitterroot River basin, Montana, indicates a high degree of habitat fragmentation where numerous groups of resident bull trout are restricted primarily to headwaters. The Service considers 47 of the 71 subpopulations at risk of extirpation because of naturally occurring events due to isolation, single life-history form and spawning area, and low abundance.

Snake River Geographical Area

Bull trout occupy portions of 14 major tributaries in the Snake River basin of Idaho, Oregon, and Washington. The Service identified 34 bull trout subpopulations in the Snake River basin. The area consists of two primary portions separated by Hells Canyon Dam. Downstream of Hells Canyon Dam, major tributaries that support bull trout include (number of subpopulations in each tributary)--Tucannon River (2), Clearwater River (3), Asotin Creek (2), Grande Ronde River (1), Imnaha River (4), and Salmon River (2). Upstream of Hells Canyon Dam, major tributaries that support bull trout include--Pine Creek (4), Powder River (3), Malheur River (2), Payette River (4), Weiser River (2), and Boise River (2). Although bull trout distribution upstream of Hells Canyon Dam is limited primarily to the basin downstream of Shoshone Falls in southern Idaho, three geographically isolated bull trout subpopulations occur upstream of Shoshone Falls in the Little Lost River drainage. Bull trout subpopulations upstream of Hells Canyon Dam are generally low in abundance, fragmented, and isolated. The current distribution of bull trout in the Snake River basin is less than historically (Ratliff and Howell 1992; Batt 1996; Buchanan et al. 1997; Quigley and Arbelbide 1997), with recent extirpations documented in Eagle Creek (Powder River basin) and Wallowa Lake (Grande Ronde River basin) (Ratliff and Howell 1992; Batt 1996; Buchanan et al. 1997); and possibly in South Fork Asotin Creek (WDFW 1997). Numerous impassable dams and large expanses of unsuitable habitat have isolated subpopulations within the historic range. Isolation is most prominent upstream of Hells Canyon Dam (southwest Idaho and southeast Oregon). The basin downstream of Hells Canyon Dam is relatively intact, and connectivity among bull trout subpopulations may still occur.

Bull trout occupy large areas of contiguous habitat in the Snake River basin downstream of Hell's Canyon Dam, such as in the Clearwater River and Salmon River basins. High numbers of bull trout have been observed in the Tucannon River, Imnaha River, Clearwater River, Salmon River, and Malheur River subpopulations, however, trends in abundance are largely unknown or declining. The Service considers 9 of the 34 subpopulations at risk of extirpation because of naturally occurring events due to isolation, single life-history form and spawning area, and low abundance.

In summary, the Columbia River population segment of bull trout has declined in overall range and numbers of fish. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. In Idaho, for example, bull trout have been extirpated from 119 reaches in 28 streams (IDFG in litt. 1995) . The population segment is composed of 141 subpopulations indicating habitat fragmentation, isolation, and barriers that limit bull trout distribution and migration within the basin. Although some strongholds still exist, bull trout, generally, occur as isolated subpopulations in headwater lakes or tributaries where migratory fish have been lost.

Previous Federal Action

On September 18, 1985, the Service published an animal notice of review in the Federal Register (50 FR 37958) designating the bull trout a category 2 candidate for listing in the coterminous United States. Category 2 taxa were those for which conclusive data on biological vulnerability and threats were not currently available to support proposed rules. The Service published updated notices of review for animals on January 6, 1989 (54 FR 554), and November 21, 1991 (56 FR 58804), reconfirming the bull trout category 2 status. The Service elevated bull trout in the coterminous United States to category 1 for Federal listing on November 15, 1994 (59 FR 58982). Category 1 taxa were those for which the Service had on file substantial information on biological vulnerability and threats to support preparation of listing proposals. Upon publication of the February 28, 1996, notice of review (61 FR 7596), the Service ceased using category designations and included the bull trout as a candidate species. Candidate species are those which the Service has on file sufficient information on biological vulnerability and threats to support proposals to list the species as threatened or endangered.

On October 30, 1992, the Service received a petition to list the bull trout as an endangered species throughout its range from the following conservation organizations in Montana--Alliance for the Wild Rockies, Inc., Friends of the Wild Swan, and Swan View Coalition (petitioners). The petitioners also requested an emergency listing and concurrent critical habitat designation for bull trout populations in select aquatic ecosystems where the biological information indicated that the species was in imminent threat of extinction. A 90-day finding, published on May 17, 1993 (58 FR 28849), determined that the petitioners had provided substantial information indicating that listing of the species may be warranted. The Service initiated a rangewide status review of the species concurrent with publication of the 90-day finding.

On June 6, 1994, the Service concluded in the original finding that listing of bull trout throughout its range was not warranted due to unavailable or insufficient data regarding threats to, and status and population trends of, the species within Canada and Alaska. However, the Service determined that

sufficient information on the biological vulnerability and threats to the species was available to support a warranted finding to list bull trout within the coterminous United States. Because the Service concluded that the threats were imminent and moderate to this population segment, the Service gave the bull trout within the coterminous United States a listing priority number of 9. As a result, the Service found that listing a distinct vertebrate population segment of bull trout residing in the coterminous United States was warranted but precluded due to higher priority listing actions.

On November 1, 1994, Friends of the Wild Swan, Inc. and Alliance for the Wild Rockies, Inc. (plaintiffs) filed suit in the U.S. District Court of Oregon (Court) arguing that the warranted but precluded finding was arbitrary and capricious. After the Service issued a ``recycled'' 12-month finding for the coterminous population of bull trout on June 12, 1995, the Court issued an order declaring the plaintiffs' challenge to the original finding moot. The plaintiffsdeclined to amend their complaint and appealed to the Ninth Circuit Court of Appeals, which found that the plaintiffs' challenge fell ``within the exception to the mootness doctrine for claims that are capable of repetition yet evading review.'' On April 2, 1996, the circuit court remanded the case back to the district court. On November 13, 1996, the Court issued an order and opinion remanding the original finding to the Service for further consideration. Included in the instructions from the Court were requirements that the Service limit its review to the 1994 administrative record, and incorporate any emergency listings or high magnitude threat determinations into current listing priorities. In addition, reliance on other Federal agency plans and actions was precluded. The reconsidered 12-month finding based on the 1994 Administrative Record was delivered to the Court on March 13, 1997.

On March 24, 1997, the plaintiffs filed a motion for mandatory injunction to compel the Service to issue a proposed rule to list the Klamath River and Columbia River bull trout populations within 30 days based solely on the 1994 Administrative Record. In response to this motion, the Service ``concluded that the law of this case requires the publication of a proposed rule'' to list the two warranted populations. On April 4, 1997, the Service requested 60 days to prepare and review the proposed rule. In a stipulation between the Service and plaintiffs filed with the Court on April 11, 1997, the Service agreed to issue a proposed rule in 60 days to list the Klamath River population of bull trout as endangered and the Columbia River population of bull trout as threatened based solely on the 1994 record.

Based upon the Court agreement and stipulation, and information contained solely in the 1994 record, the Service proposed the Klamath River population of bull trout as endangered and Columbia River population of bull trout as threatened on June 13, 1997 (62 FR 32268). The proposal included a 60-day comment period and gave notice of five public hearings in Portland, Oregon; Spokane, Washington; Missoula, Montana; Klamath Falls, Oregon; and Boise, Idaho. The comment period on the proposal, which originally closed on August 12, 1997, was extended to October 17, 1997 (62 FR 42092), to provide the public with more time to compile information and submit comments.

On December 4, 1997, the Court ordered the Service to reconsider several aspects of the 1997 reconsidered finding. On February 2, 1998, the Court gave the Service until June 12, 1998, to respond. The final listing determination for the Klamath River and Columbia River population segments of bull trout and the concurrent proposed listing rule for the Coastal-Puget Sound, Jarbidge River, and St. Mary-Belly River DPSs constitute the Service's response.

The Service published Listing Priority Guidance for Fiscal Years 1998 and 1999 on May 8, 1998 (63 FR 25502). The guidance clarifies the order in which the Service will process rulemakings giving highest priority (Tier 1) to processing emergency rules to add species to the Lists of Endangered and Threatened Wildlife and Plants (Lists); second priority (Tier 2) to processing final determinations on proposals to add species to the Lists, processing new proposals to add species to the Lists, processing administrative findings on petitions (to add species to the Lists, delist species, or reclassify listed species), and processing a limited number of proposed or final rules to delist or reclassify species; and third priority (Tier 3) to processing proposed or final rules designating critical habitat. Processing of this proposed rule is a Tier 2 action.

Summary of Comments and Recommendations

In the June 13, 1997, proposed rule (62 FR 32268), all interested parties were requested to submit comments or information that might contribute to the final listing determination for bull trout. Announcements of the proposed rule and notice of public hearings were sent to at least 370 individuals, including Federal, State, county and city elected officials, State and Federal agencies, interested private citizens and local area newspapers and radio stations. Announcements of the proposed rule were also published in nine newspapers--the Oregonian, Portland, Oregon; the Spokesman Review, Spokane, Washington; the Yakima Herald, Yakima, Washington; the Missoulian, Missoula, Montana; the Kalispell Interlake, Kalispell, Montana; the Idaho Statesman, Boise, Idaho; the Lewiston Tribune, Lewiston, Idaho; the Post Register, Idaho Falls, Idaho; and the Herald and News, Klamath Falls, Oregon. Public hearings were held on July 1, 1997, in Portland, Oregon; July 8, 1997, in Spokane, Washington; July 10, 1997, in Missoula, Montana; July 15, 1997, in Klamath Falls, Oregon; and July 17, 1997, in Boise, Idaho. In response to numerous requests for additional time to complete compilation of information and meaningfully participate in the public comment process, the Service published a notice on August 5, 1997 (62 FR 42092), extending the comment period to October 17, 1997.

Eighty-four oral and 278 written (including electronic mail) comments were received on the proposed rule. These included comments from 7 Federal agencies, 9 State agencies, 6 counties in Oregon and Idaho, 2 Native American tribes, 6 private timber companies, and 20 industry or trade associations and bureaus. Comments were also received from the Idaho Congressional delegation, and Governors from the states of Montana, Idaho and Oregon.

The Service did not specifically solicit formal scientific peer review of the proposal as outlined in the Service's July 1, 1994, Interagency Cooperative Policy (59 FR 34270) because the proposal was based on the 1994 administrative record and not the best available scientific information. However, in the process of making this final listing determination, a number of professional fishery biologists were consulted and their comments and information were either incorporated into the listing decision as appropriate or are addressed below.

The Service considered all comments, including oral testimony at the five public hearings. A majority of comments supported the listing proposal and 65 comments were in opposition. Opposition was based on several concerns, including conflicts between ongoing State conservation efforts and Federal listing; possible economic impacts from listing the bull

trout; lack of solutions to the bull trout decline that would result from listing; and because the proposed rule was not peer-reviewed or based on the most current information. Seventy-three respondents provided new scientific information considered by the Service for this determination. The states of Idaho and Montana submitted conservation plans for bull trout for consideration by the Service in lieu of listing. The USFS (R. Joslin, USFS, in litt. 1997), BLM (A. Thomas, BLM, in litt. 1997) and U.S. Bureau of Reclamation (USBR) (M. McClendon, USBR, in litt. 1997) provided the Service with information on respective agency efforts to date to assess, evaluate, monitor, and conserve bull trout populations in habitats affected by each agency's management. Because multiple respondents offered similar comments in some cases, comments of a similar nature or point are grouped. These comments and the Service's response are discussed below--

Issue 1: Several respondents urged the Service to list bull trout throughout its entire range. Two respondents recommended that the Service include the Jarbidge River bull trout population as a threatened species. Another respondent stated that the proposal to list the entire Columbia River bull trout population was too broad and suggested that the area be analyzed for listing purposes by major river segments. Conversely, another respondent requested that the Service designate bull trout in the Clark Fork and Kootenai River basins as distinct population segments, citing geographic and historic isolation, and biological significance to the species as a whole as reasons. Additionally, several other commenters suggested that smaller, more manageable distinct population segments be established to avoid listing healthy populations so that conservation efforts can be applied to areas where restoration is truly needed. Other commenters, at the Federal, State and local level suggested other delineations for the distinct population segments, and questioned whether listing would afford protection of bull trout only in currently occupied habitat.

Service response: Based on the best available scientific and commercial information, and consistent with the distinct vertebrate population policy (61 FR 4722, February 7, 1997), the Service has determined that bull trout should be divided into five distinct vertebrate populations for listing purposes, but only in the coterminous United States (see Distinct Population Segment section). The Klamath River and the Columbia River population segments are the subject of this final rule and the remaining three population segments are addressed in an accompanying proposed rule.

In addressing the appropriateness in designating additional DPSs within the Columbia River basin, the Service reviewed new genetic and other biological data developed since 1994, and determined that there is insufficient information available to further divide this DPS. Although many bull trout groups in the Columbia River basin were discrete according to the DPS policy, they failed to meet criteria for significance (e.g. bull trout in the Little Lost River basin in Idaho and portions of the upper Columbia River basin). However, during the recovery process, further division of the Columbia River DPS into recovery units or zones including separation of the bull trout in the Kootenai River, Clark Fork-Pend Oreille River, Little Lost River, 17 potential genetic conservation groups (GCGs) in the State of Washington, and 8 additional GCGs in Oregon can be considered. For wide-ranging species, designation of recovery units can focus recovery objectives on the specific threats, status and habitat requirements within the defined geographic area. Although recovery units cannot be individually delisted without consideration of the entire listed entity (species or DPS), the Service can develop ``special rules" (under section 4(d) of the Act) for individual recovery units (see issue #6 below for more information on special rules).

Issue 2: Several respondents stated that because the proposed rule was based on information gathered prior to June 1994, listing should be deferred until new information is analyzed and updated. Comments that ``* * * quality of peer reviewed scientific data is noticeably lacking" were also received. Some respondents questioned why the bull trout is now being considered for listing when the Service's analysis in the proposed rule concluded that bull trout had a widespread range and threats to the fish were only moderate. Respondents also stated that conclusions in the proposed rule regarding population distribution and population trends were inaccurate.

Service response: The U.S. District Court of Oregon ordered the Service on November 13, 1996, to reconsider the original 1994 bull trout finding based only information available to the agency when it made the original 1994 finding. Therefore, the Service was mandated to move ahead with a listing proposal based on the information contained in the 1994 administrative record. In making this final listing determination, however, the Service has reviewed and considered new information regarding distribution and life history for the Klamath River and Columbia River population segments of bull trout. This includes, but is not limited to, new bull trout status, distribution, and threats information, and also descriptions of ongoing conservation actions, contained in reports and other written correspondence available since 1994 concerning bull trout in Idaho (Adams and Bjornn 1997; Batt 1996; Bonneau and Scarnecchia 1996; Corley 1997; Elle 1995; Espinoza et al. 1997; N. Horner, IDFG, in litt. 1997); Montana (Berg and Priest 1995; Hillman and Chapman 1996; Hansen and DosSantos 1997; Kanda et al. 1997; Long 1995, 1997; Mathieus 1996; McDowell et al 1997; MBTSG 1995a-e; MBTSG 1996a-h; Rich 1996; Swanberg 1996; Swanberg and Burns 1997); Oregon (Buchanan et al. 1997; Buchanan and Gregory 1997; Capruso 1997; Crabtree 1996; Germond et al. 1996a, b; Ratliff et al. 1996; Spruell and Allendorf 1997); Washington (Faler and Bair 1996; Northrop 1997; Raekes 1996; Sexauer and James 1997; WDFW 1997); the Klamath River basin (Buktenica 1997; Buktenica and Larson 1997; Light et al. 1996; ODFW 1996) and bull trout in the Columbia River basin (Platts et al. 1995; Quigley and Arbelbide 1997; Rieman et al in press; Rieman and McIntyre 1995, 1996; Watson and Hillman 1997; Williams et al 1995; R. Joslin, in litt, 1997; J. Kraft, Plum Creek, in litt. 1997; M. McClendon, in litt, 1997; Palmisano and Kacynski, in litt, 1997; Thomas, in litt, 1997).

Based on the best information currently available, bull trout in the Klamath River and Columbia River population segments are not more widespread or found in other areas of the Klamath or Columbia River basins than shown in the 1994 administrative record. Bull trout occur over a large geographic area in four states within the Columbia River drainage. However, bull trout display a generally patchy distribution (Rieman and McIntyre 1993). The best available information indicates that bull trout are in widespread decline across the historic range and restricted to numerous reproductively isolated subpopulations in the Columbia River basin with many recent local extirpations. The largest contiguous areas supporting bull trout are ``strongholds" in central Idaho and Montana, such as the upper Flathead River basin. Many remaining bull trout subpopulations are characterized by declining trends, low relative subpopulation size, loss of migratory

fish or the presence of a single life-history form, and isolated from other bull trout by large geographic separation(s). Habitat loss, fragmentation and other changes that have isolated and continue to impact bull trout subpopulations also increase their susceptibility to naturally occurring processes (both demographically and environmentally). Many remaining subpopulations in both the Klamath River and Columbia River population segments are at risk of extirpation from the combined effects of habitat loss and fragmentation, loss of migration corridors, and inability to reestablish extirpated subpopulations through emigration, and recovery actions are required to slow the rate of habitat loss and continued reductions in range. Existing regulations have not arrested the decline of bull trout and newly developed State and local conservation strategies are largely not implemented.

Issue 3: Several respondents opposed the Federal listing orbelieved it not necessary, and expressed support for various State and local conservation plans developed for bull trout. Two respondents stated that State forest practice rules and regulations are adequate to conserve and restore bull trout. In addition, others recommended that if the bull trout is eventually listed, the Service should defer to the States for management and recovery.

Service response: Section 4(b)(1)(A) of the Act, requires that listing decisions be made solely on the best scientific and commercial data available after conducting a review of the status of the species. The Act also instructs the Service to consider ``existing regulatory mechanisms, including taking into account those efforts by State, local and other entities to protect a species, including conservation plans or practices." However, several recent Federal court decisions have limited the extent to which the Service may rely upon land management plans, agreements and other documents that are under development and promise proposed future actions, as a basis for determining that listing is not warranted (Southwest Center for Biological Diversity v. Babbitt, 926 F. Supp. 920 (D. Ariz. 1996); Biodiversity Legal Foundation v. Babbitt, 943 F. Supp. 23 (D. D.C. 1996).

The Service has reviewed conservation plans developed by the States of Montana and Idaho, and other local conservation agencies for bull trout. These actions are encouraging for long term bull trout conservation and recovery. It is recognized that individual restoration projects have been undertaken by States (for instance, the Klamath River Basin Bull Trout Working Group has been implementing conservationactivities and planning efforts since 1993), and harvest regulations for bull trout have become more restricted. However, based on the best available information, the Service cannot determine or predict the effectiveness of the conservation actions in reducing threats to the bull trout in the Klamath River and Columbia River population segments to the extent that listing is unnecessary.

The Idaho Bull Trout Conservation Plan (Plan) (Batt 1996), approved in July 1996, addresses bull trout conservation in 59 key watersheds to provide for the conservation and recovery of bull trout statewide. The Plan emphasizes locally developed, site-specific programs with technical assistance from appropriate State and Federal agencies. Although the Plan establishes a mechanism for generating 59 conservation plans by the year 2008, it lacks any description of how specific practices that currently affect bull trout (e.g., timber harvest, mining, grazing, hydropower operations) will be modified. This specificity would provide a basis for the development of future conservation plans and help ensure adequate protection for bull trout. It must also be clear how Federal agencies and private landowners in key watersheds will be required to institute bull trout conservation measures. Given the extent of Federal lands in Idaho, implementation of bull trout conservation measures by the USFS and BLM are critical to the Plan. The Plan also cites hydropower and irrigation practices contributing to the decline of bull trout, but the Plan needs to address these practices in light of the existing Idaho water law, USBR water commitments, and existing Federal Energy Regulatory Commission (FERC) licenses. The Plan provides potential future benefits to bull trout conservation and recovery once adequate funding and full implementation occurs.

The Montana bull trout conservation effort was initiated in 1994. Since 1994, 11 basin-specific status reports and two technical, peer-reviewed papers have been completed. Local watershed groups are being established; however, few on-the-ground local efforts have been completed or are underway. The Service is a member of the Montana Bull Trout Restoration Team which has been formed as part of the State's Montana Bull Trout Plan. Although actions taken to date under the Montana Plan have provided some benefits, not all threats to bull trout have been addressed, partly by lack of State jurisdiction, except in a few local areas. The Service is encouraged by State of Montana's progress in implementing the Montana plan and developing appropriate strategies to remove threats and promote conservation and recovery of bull trout.

The Wallowa County-Nez Perce Tribe Salmon Recovery Plan (Wallowa County and Nez Perce Tribe, in litt. 1997) in Oregon is intended to primarily aid in the recovery of listed chinook salmon and steelhead. Twenty-six stream segments in the County have been identified for restoration, with two to five stream segments scheduled to be addressed each year over the next 15 years. By 2008, some positive steps towards improved land and water management in Wallowa County should occur; however, the limited scope of the plan will not benefit bull trout outside the County or necessarily address threats on Federal lands.

Bull trout conservation and planning efforts in the Klamath River basin were initiated earlier than similar State conservation efforts, and incorporated all land owners of occupied bull trout habitat. The Klamath River Basin Bull Trout Working Group (Working Group) functions under a Memorandum of Understanding, and has been actively implementing portions of the Klamath Basin Bull Trout Conservation Strategy (Light et al. 1996). These proactive interagency efforts to stabilize and expand bull trout in the Klamath River basin are unique in their early initiation and multi-entity approach. The Service supports and encourages the Working Group to continue implementing phases I and II of the Conservation Strategy and complete a formal implementation plan for conservation of bull trout in the Klamath River basin.

Bull trout have declined across much of their former range due to a variety of factors, including effects of dam construction, agricultural practices, introduced non-native fishes, and forest practices. A thorough discussion of the factors affecting bull trout is found in ``Summary of Factors Affecting the Species." Existing State law addressing forest practices is discussed under Factor D in the ``Summary of Factors Affecting the Species." Although State rules and regulations governing forested land management activities are improving, they are generally not adequate to conserve and recover bull trout or remedy the effects of past damage to bull trout habitats.

Issue 4: Several respondents opposed the proposed listing of bull trout because possible ``activity restrictions" and economic impacts might occur.

Service response: Section 4(b)(1)(A) of the Act, requires that a listing

determination be based solely on the best scientific and commercial information available. The legislative history of this provision clearly states the intent of Congress to ``ensure" that listing decisions are ``based solely on biological criteria and to prevent non-biological considerations from affecting such decisions" (H.R. Rep. No. 97-835, 97th Congress 2nd Session 19 (1982)). Because the Service is specifically prohibited from considering economic and other non-biological impacts of species listing, such impacts are not addressed in this final rule.

Issue 5: Some respondents suggested that bull trout listing and recovery may conflict with recovery of other listed fish, notably endangered Snake River salmon species.

Service response: Concerns regarding the possible adverse environmental and non-biological effects from implementing future recovery measures cannot be considered in a decision to list a species. However, these concerns are important in developing recovery measures that take into account environmental effects on other species, including listed Snake River salmon. The Service will fully evaluate the environmental effects and consequences of implementing future recovery measures for bull trout in the Columbia River and Klamath River basins. It should be noted that bull trout co-evolved with Snake River salmon and recovery actions that benefit one species may also benefit other native fishes.

Issue 6: The Service received several comments on the proposed special rule that would allow for take of bull trout within the Columbia River population segment when it is in accordance with applicable State fish and wildlife conservation laws and regulations. While some respondents supported the proposed special rule, others were opposed to the special rule in its current form. Various activities were cited that continue to threaten bull trout, including poaching, electrofishing, and mis-identification of bull trout by fisherman.

Service response: Based on comments received during the public comment period, the Service modified the special rule to address those concerns. The 4(d) special rule conditions in this final rule relate to existing State and Tribal conservation laws and harvest regulations pertaining to bull trout at the time of publication of this rule. The Service has determined that, as currently constituted, the applicable State and Tribal fishing regulations provide conservation of bull trout. In the event any of these laws and regulations are modified in a manner that is inconsistent with conservation of bull trout, the 4(d) rule would not allow the take of bull trout.

The Service also has discretion under section 4(d) of the Act to issue special regulations for activities other than harvest regulations for a threatened species that are deemed necessary and advisable for its conservation. The Service recognizes that on-going and future land-use activities will occur on non-Federal lands that may result in take of bull trout. In the future, the Service will consider issuing special rules that would define the conditions under which take associated with State permitted, or other activities deemed necessary and advisable for the species' conservation, would be authorized for bull trout. Special rules allow for more efficient management of threatened species, and encourage and enhance the conservation of species through the development of regulations the Service deems necessary and advisable to provide for conservation of the species. For example, conservation actions or other activities implemented as part of the Idaho Governor's bull trout plan, Wallowa County-Nez Perce Salmon Plan, Montana Bull Trout Recovery Plan, and Klamath Basin Bull Trout Conservation Strategy may qualify for consideration under a special rule. The Service will consider the development and approval of special rules that will lead to the conservation of bull trout, allowing certain specific land management activities that may allow take of bull trout to continue or occur, with certain restrictions. Under a special rule, this take of bull trout as a result of these activities would not be considered a violation of section 9 of the Act.

This process can provide non-Federal landowners with the flexibility to develop prescriptions or restrictions for their lands which would achieve the level of bull trout conservation consistent with the special rule.

Issue 7: Several respondents stated that since hatcheries will be relied on for bull trout restoration efforts, habitat threats would not be addressed and hatchery-reared fish could transmit and introduce disease to wild bull trout.

Service response: According to section 2(b) of the Act, one of the purposes of the Act is ``to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." Once a species becomes listed as threatened or endangered, section 4(f) of the Act directs the Service to develop and implement recovery plans for that species. Recovery means improvement in the status of a listed species to the point at which listing is no longer appropriate under the criteria provided in section 4 of the Act (50 CFR 402.02). Two goals of the recovery process are: (1) The maintenance of secure, self-sustaining wild populations of the species; and (2) restoration of the species to the point where it is a viable, self-sustaining component of its ecosystem.

The Service recognizes that captive propagation and hatchery supplementation can be valid conservation tools and assist in recovery efforts, but by themselves, do not contribute to secure, self-sustaining bull trout populations in the wild. For example, the Service agrees with the findings of the Montana Bull Trout Scientific Group that stocking or supplementation is a potential tool in the restoration of bull trout and should only be used if the actual cause(s) of local extirpations are identified and corrected first (MBTSG 1996g). Any such project ``* * * involving stocking must be appropriate in scope, judiciously applied, rigorously designed, and thoroughly monitored."

Issue 8: Several respondents stated that the introduction of exotic fishes, hybridization with brook trout, and past agency efforts to eradicate bull trout are the primary causes of decline.

Response: The Service agrees that the introduction of exotic fishes by fish management agencies, ongoing hybridization with brook trout, and past efforts to eradicate bull trout have contributed to the decline of the species. The significance of these threats, however, varies by subpopulation location and habitat characteristics (See Factors B, C and E of the ``Summary of Factors Affecting the Species" section).

Issue 9: Several respondents requested that the Service designate critical habitat as part of the final rulemaking process. A representative of the Oregon Cattlemen's Association, stated that ``* * * the delineation of critical habitat should be based on repeatable, verifiable scientific data followed by a common sense approach to economics."

Service response. A majority of the comments in this regard were standardized requests advocating critical habitat designation with special attention on roadless areas and riparian buffers. These comments included no sight-specific analysis and provided no information to aid the Service in delineation of critical habitat. The proposed rule included a ``not determinable" finding for designation of critical habitat based on the 1994 administrative record and solicited comments on whether any habitat

should be determined critical bull trout habitat. The Service received no substantial new information regarding critical habitat during the open comment period for the proposed rule. Therefore, based on the best scientific information currently available, the Service finds in this final rule that critical habitat designation is ``not determinable" (see Critical Habitat section).

Summary of Factors Affecting the Species

After a thorough review and consideration of all information available, the Service has determined that the Klamath River and Columbia River distinct population segments of bull trout should be classified as threatened. Procedures found at Section 4(a)(1) of the Act and regulations (50 CFR part 424) were followed. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). These factors and their application to the Klamath River and Columbia River population segments of bull trout (Salvelinus confluentus) are as follows--

A. The present or threatened destruction, modification, or curtailment of bull trout habitat or range. Land and water management activities that degrade and continue to threaten bull trout and its habitat include dams, forest management practices, livestock grazing, agriculture and agricultural diversions, roads, and mining (Beschta et al. 1987; Chamberlain et al. 1991; Furniss et al. 1991; Meehan 1991; Nehlsen et al. 1991; Sedell and Everest 1991; Craig and Wissmar 1993; Frissell 1993; U.S. Department of Agriculture (USDA) and U.S. Department of the Interior (USDI) 1995; Henjum et al. 1994; McIntosh et al. 1994; Wissmar et al. 1994; Light et al. 1996; MBTSG 1995a-e, 1996a-h; USDA and USDI 1996, 1997).

Dams

Dams affect bull trout by changing various biological and physical processes. Dams can alter habitats; flow, sediment, and temperature regimes; migration corridors; and interspecific interactions, especially between bull trout and introduced species (Rode 1990; Washington Department of Wildlife (WDW) 1992; Craig and Wissmar 1993; ODFW, in litt. 1993; Rieman and McIntyre 1993; Wissmar et al. 1994; T. Bodurtha, Service, in litt. 1995; USDA and USDI 1996, 1997). Impassable dams have caused declines of bull trout primarily by preventing access of migratory fish to spawning and rearing areas in headwaters andprecluding recolonization of areas where bull trout have been extirpated (Rieman and McIntyre 1993).

Existing dams can be passage and migratory barriers for bull trout and these structures may isolate bull trout subpopulations, eliminate individuals from subpopulations, reduce or eliminate genetic exchange, and separate spawning areas from productive overwintering and foraging areas (Ratliff and Howell 1992; Rieman and McIntyre 1993; MBTSG 1995a, 1996b,c). Dams have fragmented bull trout habitat and resulted in numerous isolated subpopulations. Within the Columbia River population segment, 66 percent of bull trout subpopulations are isolated by dams or indirectly by dam or water diversion operations that alter habitat conditions. Individuals that pass downstream over or through dams are often lost from the upstream subpopulations. Dams have converted historic rearing habitats for migratory fish in the larger river system to reservoirs with conditions that frequently are unsuitable for bull trout (MBTSG 1996b), especially where non-native salmonids occur.

Although the predominant effects of dams affect the long term viability of bull trout subpopulations (Rieman and McIntyre 1993; Gilpin, in litt. 1997), dams can benefit bull trout by preventing introduced non-native species access to upstream areas. For example, dams on the Swan River and South Fork Flathead River, Montana, have prevented lake trout from moving into these major river systems (MBTSG 1995e, 1996a). Dams may also increase the potential forage base for bull trout by creating reservoirs that support prey species (Faler and Bair 1991; Pratt 1992; ODFW, in litt. 1993).

The extirpation of bull trout in the McCloud River basin, California, has been attributed primarily to construction and operation of McCloud Dam, which began operation in 1965 (Rode 1990). McCloud Dam inundated bull trout spawning and rearing habitats, and isolated these fish from habitats used by migratory adults. The dam also altered the stream flow regime and elevated water temperature to levels detrimental to bull trout.

Klamath River Population Segment

Dams are not known to affect bull trout subpopulations in the Klamath River basin.

Columbia River Population Segment

Bull trout passage is prevented or inhibited at hydroelectric, flood-control, or irrigation dams in almost every major river in the Columbia River basin except the Salmon River in Idaho. For instance, six dams were constructed without fish passage in the Boise River, Idaho, and of these, Arrowrock and Anderson Ranch dams isolate bull trout subpopulations. Historically, bull trout in the Boise River likely functioned as a single subpopulation with migratory adults moving among areas that are now isolated (Rieman and McIntyre 1995). Similarly, bull trout were thought to have ranged throughout the Yakima River, Washington, prior to construction of several dams beginning in 1905 (WDFW 1997). Storage dams (Tieton, Bumping Lake, Keechelus Lake, Kachess Lake, and Cle Elum Lake dams) now isolate five of eight bull trout subpopulations in the Yakima River basin, with agricultural diversion dams isolating three additional bull trout subpopulations (WDFW 1997). Operation of irrigation diversion dams also disrupts annual migrations of fluvial bull trout in five of seven spawning streams in the Methow River basin, Washington (WDFW 1997). In the mainstem Methow River, up to 79 percent of the average flow is removed from a 64 km (40 mi) reach, occasionally stranding and killing bull trout (Mullan et al. 1992). Due primarily to temperature constraints in partially dewatered tributaries to the Methow River, 60 percent of the total spawning and rearing areas for bull trout has been lost (Mullan et al. 1992; WDFW, in litt. 1995). Also in Washington, bull trout in the North Fork Lewis River were separated into two subpopulations by the construction of Swift and Yale reservoirs, and the Condit Dam on the White Salmon River also isolated a subpopulation (WDFW 1997). In Oregon, bull trout were thought to have historically occurred throughout the Willamette River basin, but are presently found only in the McKenzie River basin. Dams in the basin (Trailbridge and Carmen) isolate bull trout into three subpopulations.

In the mainstem Clark Fork River, Idaho and Montana, bull trout moved and migrated freely from Lake Pend Oreille upstream to the headwaters of the Clark Fork and Flathead rivers prior to construction of five dams (Pratt and Huston 1993; MBTSG 1996b; Frissell 1997). The construction of Albeni Falls, Cabinet Gorge, Noxon Rapids, Thompson Falls, and Milltown dams isolated four bull trout subpopulations in the mainstem Clark Fork-Pend Oreille rivers. The uppermost dam, Milltown, isolates downstream fish from those in the upper Clark Fork River and prevents fish downstream of the dam from

moving into the Blackfoot River, a major tributary of the upper Clark Fork River. Annually, some bull trout congregate below Milltown Dam, attempting to move upstream. Radio-tagged bull trout collected below Milltown Dam and released above the dam moved into Rock Creek, a tributary to the upper Clark Fork system (Swanberg 1996). Movement of bull trout from the mainstem Clark Fork River to the Flathead Lake system is prevented by Kerr Dam on the lower Flathead River. Sport harvest of bull trout from Lake Pend Orielle, Idaho, abruptly declined more than 50 percent after Albeni Falls and Cabinet Gorge dams blocked access to historic spawning streams and reduced adult numbers (Ellis 1940; Pratt and Huston 1993).

Major tributaries of the Flathead River basin, Montana, were historically interconnected so that migratory bull trout were widely distributed throughout the drainage (MBTSG 1995d). Bull trout from the Flathead River system had access to the South Fork Flathead River drainage and the Swan River drainage. However, upstream passage from the Flathead River has been blocked by dams on the South Fork Flathead River (Hungry Horse Dam) and the Swan River (Bigfork Dam).

On the Kootenai River, Montana, Libby Dam is an upstream passage barrier to bull trout. The dam also has altered the flow regime, water temperature, and sediment load in the Kootenai River (MBTSG 1996e). Dam operation has typically reduced spring flows, which has made upstream passage over Kootenai Falls, located downstream of Libby Dam, impossible. Therefore, fish below the falls do not have the opportunity to interbreed with fish above (MBTSG 1996e).

An additional effect of dams on bull trout is the loss of individuals from a subpopulation. During a 7-month study in the Boise River, bull trout were marked in Arrowrock Reservoir and 5 percent of them were recaptured in Lucky Peak Reservoir (USBR, in litt. 1997). Lucky Peak Dam is downstream of the Arrowrock and Anderson Ranch subpopulations, and neither Lucky Peak Reservoir nor the reach downstream of the dam provide any known spawning habitat. Thus, fish entering Lucky Peak Reservoir are lost from the upstream subpopulations.

Forest Management Practices

Forest management activities, including timber extraction and road building, affect streams habitats by altering recruitment of large woody debris, erosion and sedimentation rates, runoff patterns, the magnitude of peak and low flows, and annual water yield (Cacek 1989; Furniss et al. 1991; Wissmar et al. 1994; Spence et al. 1996). Activities that promote excessive substrate movement lower bull trout production by increasing egg and juvenile mortality, and reduce or eliminate habitat important to later life-history stages, such as when pools are filled with substrates (Shepard et al. 1984; Fraley and Shepard 1989; Brown 1992). The length and timing of bull trout egg incubation and juvenile development (typically more than 200 days during winter and spring) and the strong association of juvenile fish with stream substrate make bull trout vulnerable to changes in peak flows and timing that affect channels and substrate (Shepard et al. 1984; Goetz 1989; Pratt 1992).

Logging and road building in riparian zones reduce stream shading and widen stream channels, allowing greater sunlight penetration, surface water warming, and winter anchor ice formation (Beschta et al. 1987; Chamberlain et al. 1991). Timber extraction in riparian areas that results in increased water temperatures in spawning and rearing areas may cause bull trout to decline (Goetz 1989; Pratt 1992; Rieman and McIntyre 1993). Logging in riparian areas reduces recruitment of large woody debris, thereby reducing stream habitat complexity. Loss of riparian vegetation destabilizes streambanks and increases erosion and sediment delivery to streams. Road construction that involves channelizing streams may cause reduced habitat complexity and increased sediment delivery.

Although bull trout occur in watersheds affected by past timber extraction, bull trout strongholds persist in a greater percentage of watersheds experiencing little or no past timber harvest, such as the wilderness areas of Central Idaho and the South Fork Flathead River drainage in Montana (Henjum et al. 1994; MBTSG 1995e; USDA and USDI 1997; Rieman et al. in press). One bull trout stronghold subject to extensive logging and road construction is in the Swan River basin (Watson and Hillman 1997). It is difficult to assess the overall effects of forestry practices on bull trout in parts of the basin because of the complex geomorphology and geology of the drainage (MBTSG 1996a). However, the Swan River tributaries also drain large areas of contiguous roadless lands that provide important protected bull trout habitat.

Timber harvest has occurred throughout the Columbia River (Henjum et al. 1994; USDA and USDI 1996, 1997) and Klamath River basins (Light et al. 1996; USDA and USDI 1996, 1997). The effects of timber harvest on streams are long lasting, and recovery is slow (Furniss et al. 1991; Henjum et al. 1994). The MBTSG ranked forestry, especially the legacy left by past forestry practices, as a limitation to bull trout restoration in all major watersheds in Montana (MBTSG 1995a-e, 1996a-f).

Klamath River Population Segment

Much of the forest in the Klamath River basin has been managed for timber production, with substantial activity beginning in 1940. Extensive harvesting, including partial cutting with overstory removal, clearcutting, and selective logging for old-growth pine occurred on private lands, and low intensity harvest occurred on some of the USFS lands. Past forest management activities in the Klamath River basin have temporarily reduced riparian vegetative cover and increased water temperature in some streams, including Threemile Creek (Light et al. 1996). Roads were built in the basin for access to timber, causing increased sedimentation and substrate embeddedness. Sediment from existing roads continues to degrade stream habitat (Light et al. 1996). Weyerhauser Timber Company began an improved road maintenance program in 1994 to reduce sediment inputs from roads on its lands adjacent to occupied bull trout stream reaches in the Klamath River basin, and U.S. Timberlands is presently continuing the practice (B. Johnson, pers. comm. 1997). Two recent timber harvest activities occurred on U.S. Timberlands property along Boulder Creek in 1994 and Long Creek in 1995 (Johnson, U.S. Timberlands, pers. comm. 1997). A review of the activities concluded that leaving buffer strips and obliterating existing roads left the riparian habitat in better condition than before the timber harvest (B. Johnson, pers. comm. 1997). No timber harvests are currently planned for areas adjacent to streams occupied by bull trout. Six of the seven bull trout subpopulations identified in the Klamath River basin have been affected by past forest management practices.

Columbia River Population Segment

Perhaps the greatest threat to bull trout involving forest practices and roads stems from the ongoing and latent adverse effects caused by over a century of logging. Latent threats are illustrated by approximately 2,300 land slides correlated with high logging road density on national forest lands in the Clearwater and Spokane rivers basins during high runoff events in 1995 and

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1996 (L. McLaud, Idaho Conservation League, in litt. 1997; R. Patten, Panhandle National Forest, in litt. 1997). The same runoff events also triggered an estimated 2,000 land slides on adjacent non-Federal timber lands in the Clearwater River basin (McLaud, in litt. 1997). On over half of the non-wilderness lands within National Forests across northern Idaho and western Montana, the environmental effects of past forest practices now constrain forest management (USFS map, in litt. 1994). For example, 70 percent of stream miles on the Wallowa-Whitman National Forest are degraded beyond Land and Resource Management Plan (LRMP) standards for fine sediment and temperature parameters on the forest (Wissmar et al. 1994). On the Panhandle National Forest, Idaho, pool volumes, quality and frequency in managed watersheds (mainly watersheds with past timber extraction and road construction) were reduced compared to non-managed watersheds. Further, decreases in pool volume and frequency were correlated with decreases in the distribution and abundance of bull trout (Cross and Everest 1995). In the Lake Pend Oreille and Priest River basins, 31 percent of streams in National Forest lands are degraded beyond LRMP standards, and 51 percent of streams are in the most degraded category (B. Kasun, USFS, in litt. 1993). Streams in the most degraded category generally do not support bull trout because of stream morphology changes, increased cobble embeddedness and high summer temperatures. Jones and Espinosa (1992) determined that 71 percent of the stream or watershed areas in the managed portion of the Clearwater National Forest did not meet LRMP standards, and that streams in poor condition generally did not support bull trout. Similarly, 67 percent of the non-wilderness portion of the Nez Perce National Forest did not meet LRMP standards, and streams in the most degraded category increased 12 percent over a five year period between 1987 and 1992 (Gloss and Gerhardt 1992).

In the Wenatchee National Forest, Washington, bull trout spawning and rearing is correlated with streams not subject to past timber harvest (Brown 1992). Timber harvest activities were responsible in the decline and isolation of bull trout in Pataha Creek, Washington (WDFW 1997), a tributary in the Tucannon River drainage. In the North Fork Boise River basin, Idaho, the majority of bull trout spawning and rearing habitat for the Arrowrock Reservoir subpopulation exists in the roadless headwaters of the Crooked, Bear, and North Fork Boise rivers (Boise National Forest, in litt. 1995).

The long-lasting effects of past timber management activities on aquatic habitats is illustrated by conditions in the 3,289 km² (1,270 mi²) South Fork Salmon Riverwatershed, Idaho. The watershed was first logged in the 1940's and logging activity peaked in 1961 (Chapman et al. 1991). Sedimentation in the South Fork Salmon River increased approximately 350 percent above pre-logging levels (Chapman et al. 1991). Resident and anadromous salmonids, including bull trout, declined after timber extraction and associated road building. Despite a 25-year logging moratorium in the watershed, fish habitat has not returned to pre-logging quality, and salmon production has not recovered (Chapman et al. 1991).

A relationship between forest management, watershed conditions, aquatic habitat degradation, and loss of occupied bull trout range has been documented in the Spokane River basin, Idaho. Streambed aggradation and loss of pool habitat are attributed to forest management and associated roads in the basin (G. Kappesser, Panhandle National Forest, in litt. 1993). The loss of pool habitat correlates to reductions in bull trout range and abundance in managed watersheds (Cross and Everest 1995). Sixty-one percent of the basin's managed watersheds do not meet forest plan standards (B. Kasum, Panhandle National Forest, in litt. 1992). The Nez Perce National Forest, Idaho, provides an example of the rate of watershed degradation. Significantly degraded watersheds with forest management increased by 12 percent in only 5 years; 40 percent of all non-wilderness land were in degraded condition (Gloss and Gearhardt 1992).

The USFS classified watersheds in the Bitterroot National Forest, Montana, into three categories, ``healthy,'' ``sensitive,'' and ``high risk'' based on sediment yield from road construction and increased water yield and peak flow from timber harvest (Decker 1991 in MBTSG 1995b). About one third of all watersheds were assigned to each of the three categories. Bull trout with estimable numbers were found only in watersheds rated as ``healthy'' or ``sensitive drainages'' (Clancy 1993). The effects of past forest practices, including road construction, continue to affect Bitterroot tributaries (MBTSG 1995b). Generally, bull trout numbers were higher where stream substrates were larger, but numbers tended to be lower in areas high in fine sediments (Clancy 1993). In contrast, habitat where brook trout were found were characteristic of areas degraded by land use activities (Rich 1996). Eighty-five percent of the drainages classified as ``high risk'' supported brook trout (Clancy 1993) (see Factor E).

Extensive logging activity has impaired water quality in many tributaries of the Blackfoot River, Montana, including the North Fork Blackfoot River (Montana Department of Health and Environmental Sciences (MDHES) 1994). Wide-spread canopy removal, alterations to riparian vegetation, and water irrigation returns have increased the historic temperature regime of the Blackfoot River (MBTSG 1995c; Pierce et al. 1997). Water temperatures in the mainstem Blackfoot frequently exceeded the bull trout preferred range of 15 deg.C (60 deg.F) in 1994, 1995 and 1996, making coldwater refuges during this time critical for bull trout (Pierce et al. 1997). The effect of forest practices was considered a limitation to bull trout restoration in the Blackfoot River drainage (MBTSG 1995c).

Timber management is the dominant land use in the Kootenai River watershed, Montana. Extensive road construction to support forestry activities exists throughout the watershed. Many reaches of streams in the Kootenai drainage have impaired water quality as a result of silviculture activities (MDHES 1994). As a result of salvage logging in 1996, the number of timber sales and clearcuts have substantially increased over the past three years (Kootenai National Forest 1997).

Past forest practices, including road construction, log skidding, riparian tree harvest, clearcutting, and splash dams, are considered a cause in the historic decline of bull trout and have limited restoration opportunities in the Flathead Lake basin (MBTSG 1995d). This basin supports over 30 subpopulations in wilderness, national park, national forest, and private lands of Montana. Because bull trout are sensitive to habitat and water quality degradation, Fraley and Shepard (1989) considered timber harvest and road construction in both the North and Middle Fork Flathead River drainages to be threats to bull trout spawning and rearing habitat. Although forest practices have improved, effects of past activities still affect bull trout because the existing road systems continue to erode, cause sedimentation, and increase water yield to streams. Silvicultural activities have contributed to 323.2 km (202 mi) in 17 streams being classified as water quality impaired in the Flathead basin (MDHES 1994). Existing roads in two National Forests of Idaho (Boise and Payette)

created slides and slumps during 1997, a high water year. In some areas of Montana and Idaho, culverts, that are passage barriers for bull trout, are being replaced at road crossings (P. Batt, Governor of Idaho, in litt. 1997, P. Graham, Montana Fish and Wildlife and Parks (MFWP), and B. Clinch, Montana Department of Natural Resources and Conservation (MDNRC), in litt. 1997).

Future proposed timber harvests also threaten bull trout. For instance, in Oregon, the Malheur National Forest proposes to salvage trees and build roads in a roadless area containing bull trout, site of the 1996 Summit Fire in the John Day River watershed, and a designated riparian habitat conservation area in the Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH) (USDA 1995). The project has not been completed, but it would likely degrade bull trout habitat if implemented as presently planned.

In summary, forestry activities that adversely affect bull trout and its habitat are primarily timber extraction and road construction, especially when impacting riparian areas. These activities, when conducted without adequate protective measures, alter bull trout habitat by increasing sedimentation, reducing habitat complexity, increasing water temperature, and promoting channel instability. Although certain forestry practices have been prohibited or altered in recent years to improve protection of aquatic habitats, the consequences of past activities continue to affect bull trout and their habitat. Within the Columbia River population segment, approximately 74 percent of bull trout subpopulations are threatened by forestry management practices.

Livestock Grazing

Livestock grazing degrades aquatic habitat by removing riparian vegetation, destabilizing streambanks, widening stream channels, promoting incised channels and lowering water tables, reducing pool frequency, increasing soil erosion, and altering water quality (Platts 1981; Kauffman and Krueger 1984; Henjum et al. 1994; Overton et al.

1993). These effects increase summer water temperatures, promote formation of anchor ice in winter, and increase sediment into spawning and rearing habitats. Cover for bull trout is reduced. Occupied bull trout habitat is also negatively affected by livestock grazing (Howell and Buchanan 1992; Mullan et al. 1992; Platts et al. 1993; R. Uberuaga, Payette National Forest, in litt. 1993; Henjum et al. 1994; MBTSG 1995a,b,c; USDA and USDI 1996,1997).

Livestock grazing impacts on bull trout habitat maybe minimized if grazing is managed appropriately for conditions at a specific site. Practices generally compatible with the preservation and restoration of bull trout habitat may include fences to exclude livestock from riparian areas, rotation schemes to avoid overuse of areas, and stock tanks so that livestock would concentrate outside of riparian areas for water.

Klamath River Population Segment

Intensive livestock grazing historically occurred throughout most of the Klamath River basin, and continues to be widespread (Light et al. 1996). Livestock grazing is a major land use within the Sprague River drainage, mostly in the lowland meadows and to a lesser extent in some forested areas. Grazing has been eliminated along bull trout streams on U.S. Timberlands property (B. Johnson, U.S. Timberlands, in litt. 1997) and adjacent National Forest lands. However, documented cattle trespass on Long and Deming creeks indicates that livestock continue to locally affect bull trout habitats (Light et al. 1996; Buchanan et al. 1997). The meadows in upper Long Creek exhibit bank instability and diminished availability of undercut banks caused by livestock (Buchanan et al. 1997). Channelization and intense grazing by cattle degraded lower Sun Creek and an adjoining stream in the Klamath River basin and may have contributed to the extirpation of migratory bull trout in Sun Creek (Dambacher et al. 1992).

Columbia River Population Segment

Livestock grazing has caused habitat degradation in stream reaches supporting bull trout. On Squaw Creek, a tributary of the Payette River, Idaho, livestock grazing has damaged streambank and riparian vegetation. While fencing and grazing changes are underway to reduce impacts in this area, future damage from grazing will not be eliminated (M. Huffman, Boise National Forest (BNF), in litt. 1997). Livestock grazing continues to affect bull trout habitat for spawning, rearing, and migration in Bear Valley Creek and its tributaries in the BNF, Idaho (T. Burton, BNF, pers. comm. 1997). Livestock grazing was a factor in the decline of bull trout habitat in Pataha Creek, Washington (WDFW 1997). In Montana, severe overgrazing occurs in the Bitterroot River valley bottom streams and along the mainstem Clark Fork River in the Deerlodge valley, Flint Creek valley, and parts of Rock Creek, and limits bull trout restoration in these drainages (MBTSG 1995a,b; Maxell 1996). Overall, livestock grazing in portions of the Wieser, Grande Ronde, Imnaha, and Malheur rivers has degraded streamside habitat (Adams 1994; Buchanan et al. 1997). Of the 141 subpopulations the Service identified in the Columbia River population segment, approximately 50 percent were threatened by ongoing livestock grazing.

Agricultural Practices

Agricultural practices, such as cultivation, irrigation, and chemical application can affect bull trout. Agriculture has been identified a source of nonpoint source pollution in some areas within the range of bull trout (Idaho Department of Health and Welfare (IDHW) 1991; Washington Department of Ecology (WDE) 1992; MDHES 1994). These practices can release sediment, nutrients, pesticides and herbicides into streams, increase temperature, reduce riparian vegetation, and alter the hydrologic regime, typically with low flows in the spring and summer. Irrigation diversions also affect bull trout by altering stream flow and through entrainment. Bull trout may enter unscreened irrigation diversions and become stranded in ditches and agricultural fields. Diversion dams, without proper passage facilities, prevent bull trout from migrating and may isolate subpopulations (Dorratcaque 1986; Light et al. 1996).

Klamath River Population Segment

Historical agricultural use in the Klamath River basin has had a profound effect on bull trout habitat in the larger tributaries and mainstem rivers (Buchanan et al. 1997). Channelization, water diversions, removal of streamside vegetarian, and disturbances have altered the aquatic environment by elevating water temperature, reducing water quantity and quality, and increasing sedimentation (Light et al. 1996). Deming, Long, Threemile, and Sun creeks have diversions immediately downstream of occupied bull trout habitat (Dunsmoor and Bienz, in litt. 1997). Unscreened diversions result in the transport of fish into irrigation canals (e.g., Deming and Sun creeks), often resulting in mortality (Light et al. 1996).

Columbia River Population Segment

In 1988, the Idaho Department of Environmental Quality (IDEQ) conducted an assessment of nonpoint source pollution of the Salmon River basin. Of 4,080 km (2,550 mi) of streams assessed, an estimated 2,059 km (1,287

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mi) were affected by nonpoint sources, of which 1,374 km (859 mi) were affected by agricultural practices (IDHW 1991). Dewatering of stream reaches due to irrigation has restricted bull trout migration and isolated bull trout into subpopulations. Examples include the Powder, Malheur, Grande Ronde, Umatilla, and John Day rivers in Oregon (Buchanan et al. 1997); the Tucannon, Snake, Yakima, Methow, and Walla Walla rivers in Washington (WDW 1992; WDFW 1997); the upper Salmon and Lemhi rivers in Idaho (Dorratcaque 1986; Chapman et al. 1991); and the Clark Fork, Blackfoot, and Bitterroot rivers in Montana (Clancy 1993; MBTSG 1995a,b,c; 1996b,c; Swanberg 1996).

The mainstem Umatilla River is frequently dry during the irrigation season, effectively isolating bull trout (M. Northrop, Umatilla National Forest, pers. comm. 1997). Moreover, two diversion facilities in the Umatilla River inhibit migration during portions of the year (Buchanan et al. 1997). Walla Walla River basin bull trout subpopulations are segregated in the Touchet River, Mill Creek, and South Fork and North Fork of the Walla Walla River by four irrigation diversion dams (Buchanan et al 1997; WDFW 1997). Streams are also channelized in agricultural areas, reducing stream length and area of aquatic habitat, altering stream channel morphology, and diminishing aquatic habitat complexity.

In Idaho, Dorratcaque (1986) documented chronic flow and passage problems on the Lemhi River, where the stream has been dewatered during the irrigation season. An irrigation diversion dewaters the upper Salmon River in Idaho from mid-July to the end of the irrigation season, preventing chinook salmon access to spawning areas. Juvenile chinook salmon, which are used as prey by bull trout, are, thereby, no longer available (Chapman et al. 1991). Streamflows in the Umatilla River basin in Oregon have been fully appropriated during the irrigation season since 1920 (Oregon Water Resources Division (OWRD), in litt. 1988). Over-appropriations have resulted in dewatered stream reaches that limit bull trout distribution within the basin. Similarly, the Oregon State Game Commission (OSGC) first recognized the negative effects of irrigation diversions on fisheries resources in the Deschutes River as early as 1950 (OSGC, in litt. 1950). In Washington, over 80 percent of the annual stream flow in the Yakima River basin is seasonally diverted for irrigation (WDW 1992). Bull trout in the basin are isolated into eight subpopulations in upper watershed tributaries by reduced summer flows and dams (WDW 1992). The lower reaches of the Walla Walla River in Washington are often dewatered during the irrigation season, isolating three bull trout subpopulations in perennial headwater reaches (Martin et al. 1992).

In 1991, MFWP listed Montana streams that support or contribute toimportant fisheries and are substantially dewatered from diversions and appropriated streamflows (MFWP, in litt. 1991). Within the range of bull trout, 101 stream reaches totaling 958.4 km (599 mi) were listed as chronically dewatered due to irrigation withdrawals and an additional 220.8 km (138 mi) were listed as periodically dewatered. Although bull trout do not occur in all streams cited, all are within the range of bull trout and dewatering likely affects fish migration and connectivity among subpopulations.

The extirpation of bull trout in the mainstem Bitterroot River, Montana, and the loss of migratory fish are attributed to chronic dewatering of the mainstem Bitterroot and the lower reaches of most of its tributaries (Clancy 1993, 1996; MBTSG 1995b). Some diversions on the mainstem Bitterroot are fish passage barriers or entrain downstream migrants into irrigation ditches (MBTSG 1995b). Nearly 104 km (65 mi) of 18 tributary streams are chronically dewatered in the Bitterroot River basin (MBTSG 1995b). Dewatering of tributary streams is a limitation to restoration of bull trout in the Bitterroot River basin (MBTSG 1995b) and the cause of habitat fragmentation isolating 27 subpopulations.

In the Clark Fork River basin, Montana, irrigation diversions, canals, and dams in the Jocko and lower Flathead rivers eliminated bull trout access to spawning and rearing areas; however, some of these structures are in the process of being modified (MBTSG 1996c; Hansen and DosSantos 1997; MBTRT 1997). The lower reaches of the Jocko River are severely affected by grazing and irrigated agriculture (Hansen and DosSantos 1997). Because migratory bull trout can no longer ascend Grant Creek from the mainstem Clark Fork River due to irrigation diversions, only resident bull trout exist upstream (MBTSG 1996c; R. Berg, MFWP, pers. comm. 1997). Dewatering, irrigation return flows, and denuded riparian areas have increased water temperatures in the Blackfoot River and Clark Fork River basins, Montana (MBTSG 1995a,c). Water temperatures in the mainstem upper Clark Fork River frequently exceed 20 deg.C (68 deg. F) and temperatures in tributaries, including the Little Blackfoot and Flint Creek, may exceed bull trout tolerance limits (MBTSG 1995a). In the Blackfoot River basin, irrigation returns have contributed to the warming of this historic coldwater river (MBTSG 1995c; Pierce et al. 1997). Irrigation diversions, particularly in the Little Blackfoot River and in Flint Creek of the upper Clark Fork River, are physical and thermal passage barriers to bull trout (MBTSG 1995a). Diversion for irrigation is the primary cause of 622 km (389 mi) of streams in the upper Clark Fork basin being chronically dewatered (MDHES 1994). Irrigation diversions also continue to limit restoration of migratory bull trout in the Blackfoot River basin (MBTSG 1995c). Recently, several diversions have been renovated to provide passage and eliminate ditch entrainment (MBTRT 1997).

Unscreened irrigation diversions in eastern Washington are known to trap or divert bull trout in Ahtanan Creek (Yakima River basin), Ingalls and Peshastin creeks (Wenatchee River basin), Roaring Creek (Entiat River basin), and Buttermilk, Little Bridge, Eagle, and Wolf Creeks (Methow River basin) (J. Easterbrooks, WDFW, pers. comm. 1997). Channelization has altered 56 km (35 mi) of the Methow River (Mullan et al. 1992). Approximately 72 km (45 mi) of the lower Coeur d'Alene, St. Joe, and St. Maries rivers of the Spokane River basin have been channelized. These streams were once considered important rearing areas and migratory corridors for migratory (fluvial) bull trout.

Approximately 47 percent of the bull trout subpopulations in the Columbia River population segment are affected by the past and ongoing effects from agricultural practices, including diversions.

Road Construction and Maintenance

Non-forest roads degrade salmonid habitat by creating flow constraints in ephemeral, intermittent, and perennial channels; increasing erosion and sedimentation; creating passage barriers; channelization; and reducing riparian vegetation (Furniss et al. 1991; Ketcheson and Megahan 1996).

Klamath River Population Segment

Streamside roads may have multiple locations of elevated sediment delivery. Some level of sedimentation is normal, and can be documented along parts of Boulder, Deming, Threemile, Brownsworth, and Leonard creeks. In contrast, Long and Sun creeks have relatively little sediment delivery from roads in reaches occupied by bull trout (Light et al. 1996). Streamside roads inadequately constructed with misplaced water bars and culverts still discharge sediment laden waters directly into streams. Over-road flow can lead to gullying and direct sediment delivery, as found in parts of Deming Creek (Light et al. 1996). Streamside roads can also reduce large woody debris recruitment and vegetation shade by occupying the growing space next to streams. In addition, road construction may require stream straightening or channel reconfiguration next to roads, resulting in channelization as along Boulder and Deming creeks (Light et al. 1996; Dunsmoor and Bienz, in litt. 1997). Habitat degradation from channelization includes decreased pool habitat, decreased sediment transport, increased embeddedness, and reduced interstitial space in substrates (Dunsmoor and Bienz, in litt. 1997).

Columbia River Population Segment

Construction and improvement of Interstate 90 is a contributing factor to the decline and suppression of bull trout in Gold Creek, a tributary of the Yakima River, Washington (Craig and Wissmar 1993). In Montana, Interstate 90 and a railroad system parallel to the Clark Fork and St. Regis rivers has contributed to channelization and increased the risk of hazardous spills (MBTSG 1996b,c). Approximately 18 percent of the bull trout subpopulations in the Columbia River basin are affected by road construction and ongoing maintenance.

Mining

Mining can degrade aquatic habitat by altering water acidity or alkalinity, changing stream morphology and flow, and causing sediment, fuel, and heavy metals to enter streams (Martin and Platts 1981; Spence et al. 1996). The types of mining that occur within the range of bull trout include extraction of hard rock minerals, coal, gas, oil, and nonminerals. Past and present mining activities have adversely affected bull trout and bull trout habitats in Idaho, Oregon, Montana, and Washington (Martin and Platts 1981; Johnson and Schmidt 1988; Moore et al. 1991; WDW 1992; Platts et al. 1993; MBTSG 1995a,c, 1996b,c).

Klamath River Population Segment

Mining effects are not known to be a factor affecting bull trout subpopulations in the Klamath River basin.

Columbia River Population Segment

Mining severely impacts large portions of the Spokane River basin. Effects include roading, stream diversion and alteration, watershed degradation from airborne emissions, and the discharge of massive quantities of waste materials, including the release into the South Fork Coeur d'Alene River of 72 million tons of hazardous mine wastes laden with heavy metals such as lead, zinc, and cadmium (Coeur d'Alene tribe of Idaho et al. 1991). During the early 1930s, the South Fork Coeur d'Alene River and about 20 miles of the lower Coeur d'Alene River were considered devoid of aquatic life due to mining waste discharge (Ellis 1940). Although some aquatic species have returned to the river, bull trout are not among them. In Montana, bull trout have not recolonized the upper mainstem Clark Fork River where mining-related stream degradation extirpated all fish prior to the turn of the century (MBTSG 1995a; Titan Environmental Corp. 1997). The lingering effects of mining done over the past century in the Butte and Anaconda reaches of the upper Clark Fork River has resulted in four Superfund sites being designated. Mining continues to impair water quality in 558 km (349 mi) of stream in these reaches (MDHES 1994). Eleven fish kills documented between 1959 and 1991 were attributed to mining contamination of the river (Titan Environmental Corporation 1997).

Numerous abandoned mines, such as the Blackbird and Cinnabar mines in the Salmon River drainage, Idaho, degrade water quality where toxic heavy metals continue to leach from mine sites into streams or groundwater. Old mine tailings in the floodplains of Newsome Creek, American River, and Crooked River, tributaries to the Clearwater River in Idaho, continue to prevent recovery of riparian areas (N. Gearhardt, Nez Perce National Forest, pers. comm. 1997). In Idaho, mine tailings abandoned decades ago contaminated a tributary of the Middle Fork Boise River with heavy metals, including arsenic, during flood flows in 1997 when migrating bull trout were present (R. Barker, Idaho Statesman, in litt. 1997: S. West, IDEQ, in litt. 1997). In Montana, historic mining in many tributaries of the Middle Clark Fork River has impaired water quality in 245 km (153 mi) of stream (MDHES 1994). The MBTSG (1995c) ranked mining in the Blackfoot River drainage as a limitation to bull trout restoration. Many mines exist in the western and southern portions of the Blackfoot River basin causing direct loss of bull trout habitat and contamination of waters from mine effluents (MBTSG 1995c). Fishes in the upper Blackfoot River are still affected by the washout of the Mike Horse tailings dam in 1975, which spilled contaminated tailings into the Blackfoot River (MBTSG 1995c). Research in the Blackfoot drainage demonstrated that heavy metal contaminants released in the headwaters affect chemical trends, metal concentrations, metal bioavailabilty, and fish for 25 km (15.6 mi) from the contaminant source (Moore et al. 1991).

New open-pit mines using cyanide leach pads are planned for watersheds currently occupied by bull trout in the Middle Fork Boise River basin, Idaho, and in the Stibnite area of the East Fork South Fork Salmon River, Idaho (G. Visconty, Boise National Forest, in litt. 1996; Payette National Forest (PNF), in litt. 1996). In Montana, a large underground copper-silver mine proposed for Rock Creek in the lower Clark Fork River basin is currently in the permitting process. Tailings would be stored at the confluence of Rock Creek and the Clark Fork River (MBTSG 1996b; R. Stewart, USDI, in litt. 1995). Rock Creek is one of only two bull trout ``core" areas in this subpopulation (MBTSG 1996b). A proposal for a large open-pit gold mine using cyanide heap leach processing is proposed for the upper Blackfoot River basin, Montana. Much of the ore body occurs below the water table, requiring pumping of groundwater. Thus, the hydrology of the upper Blackfoot River system could be affected and an increase in contamination risks could result (S. Cody, Environmental Protection Agency (EPA), in litt. 1997; K. McMaster, Service, in litt. 1997).

The North Fork Flathead River headwaters in Canada contain a large coal deposit that could be developed (MBTSG 1995d). Mining this deposit could destroy spawning habitat and degrade water quality in the Montana portion of the Flathead River system (MBTSG 1995d).

Approximately 20 percent of the bull trout subpopulations in the Columbia River population segment are threatened by past, ongoing, or potential future mining activities.

Residential Development

Residential development is rapidly increasing within portions of the range of bull trout. Development increases threaten to alter stream and riparian habitats through streambank modification and destabilization, increased nutrient loads, and increased water temperatures (MBTSG 1995b). Indirectly, urbanization within floodplains alters groundwater recharge by routing water into streams through drains rather than through more gradual subsurface flow (Booth 1991).

Klamath River Population Segment

Residential development is not known to be factor affecting existing bull trout subpopulations in the Klamath River basin.

Columbia River Population Segment

In Montana, rural residential development is rapidly increasing, particularly in drainages of the Bitterroot, Blackfoot, and Flathead rivers (MBTSG 1995b,c,d). The lower Bitterroot River is a major non-point source of nutrient pollution, primarily from sewage effluent and land development (U.S. Environmental Protection Agency (EPA) 1993 in MBTSG 1995b). Efforts to mitigate effects of rural development in the Blackfoot River basin have been encouraged by an active local group, the Blackfoot Challenge, which has been working to acquire conservation easements, among other projects. Residential development in the Flathead Lake system is considered a limitation for restoration of bull trout because of the threat to water quality from domestic sewage and changes to stream morphology (MBTSG 1995d).

Approximately 26 percent of the bull trout subpopulations in the Columbia River population segment are threatened by the effects of residential development.

B. Overutilization for commercial, recreational, scientific, or educational purposes. Declines in bull trout have prompted states to institute restrictive fishing regulations on all waters throughout bull trout range. Recent observations of increased numbers of adult bull trout in some areas have been attributed to more restrictive regulations. However, illegal harvest and incidental harvest still continue to threaten bull trout.

Klamath River Population Segment

Legal harvest of bull trout in the Klamath River basin was eliminated in 1992 when ODFW imposed a fishing closure. Because recreational fishing for other trout species continues in the basin, incidental fishing mortality of bull trout likely occurs (OCAFS 1993). During recent ODFW angler surveys in the Klamath River basin, all anglers contacted were aware of the no harvest regulation for bull trout (D. Bertram, ODFW, in litt. 1995; Light et al. 1996). Incidental bull trout mortality due to angling is unknown, but is not suspected to be suppressing bull trout subpopulations in the Klamath River basin (Light et al. 1996). However, Dunsmoor and Bienz (in litt. 1997) consider angling to be a factor negatively affecting bull trout, especially subpopulations with low numbers and proximity to highway access, such as Threemile Creek.

Columbia River Population Segment

Overharvest of bull trout in the Columbia River basin, historically, likely contributed to their decline. In the past, harvest included legal recreational angling, poaching, and State-sponsored eradication programs (Thomas 1992). Bull trout were often targeted for removal by anglers and government agencies because bull trout preyed on salmon and other desirable species (Simpson and Wallace 1982; Bond 1992). As recently as 1990, State and Federal agencies instituted programs to eradicate bull trout through bounties and poisoning of waterways (Ratliff and Howell 1992; ODFW 1993; Newton and Pribyl 1994;Palmisano and Kaczynski, in litt. 1997). For instance, during the 1940's and 1950's in Oregon, several hundred bull trout migrating from Wallowa Lake to spawn in Wallowa River were trapped in a weir and exterminated (B. Smith, WDFW, in litt. 1997). Bull trout were recently re-introduced to Wallowa Lake in summer 1997 in an effort to re-establish the fish.

In recognition of the decline of bull trout, State management agencies in Idaho, Montana, Washington, and Oregon suspended harvest in the Columbia River basin except in Lake Billy Chinook (Oregon) and Swan Lake (Montana). State regulations still allow catch and release fishing for bull trout, and the harvest of other salmonid species is allowed in most bull trout waters. However, in Montana, (MFWP 1996), the revised regulations are believed to be partially responsible for increasing bull trout numbers in the Swan River basin where the taking or intentional fishing for bull trout is prohibited (MBTSG 1996a). Mortality from incidental catch and release angling of bull trout and harvest as a result of misidentification still continues under existing fishing regulations. For example, about half or fewer of anglers surveyed were able to correctly identify bull trout from other salmonids in west-central Montana (Kelly et al. 1996; M. Long and S.P. Whalen, MFWP, in litt. 1997). In 1997, the day after two radio tagged bull trout were released into Wallowa Lake, Oregon, one of the fish was unintentionally, but illegally harvested by a young angler. The MBTSG (1995d) is concerned with the catch and release mortality of bull trout as a result of intense fishing pressure on lake trout in Flathead Lake and the Flathead River. Legal and illegal harvest can seriously affect declining subpopulations already subjected to other factors such as competition, degraded habitat, and isolation (WDW 1992; Donald and Alger 1993; Pratt and Huston 1993; Swanberg and Burns 1997).

Poaching of bull trout likely continues, and can be especially detrimental to small, isolated subpopulations of migratory fish (WDFW 1992; Craig and Wissmar 1993; Pratt and Huston 1993; Long 1997). A study in the Metolius River suggested that 2 of 22 radio-tagged adult bull trout were illegally harvested (Ratliff et al. 1996). Illegal harvest of bull trout in northwest Montana has been a recurring problem for over 50 years, especially in drainages of the Blackfoot, Kootenai, South Fork Flathead, and Clark Fork rivers (MBTSG 1995e; Swanberg 1996; Long 1997). In response, the MFWP instituted a program in 1994 funded by the Bonneville Power Administration to reduce the illegal harvest of bull trout, disperse information to improve anglers' fish identification skills, and increase understanding of the importance of native species (Long 1994). Additionally, the Montana legislature increased the penalties for bull trout poaching, and the Bonneville Power Administration, until recently, funded increased enforcement (M. Racicot, Governor of Montana, in litt. 1995).

Approximately 21 percent of the bull trout subpopulations in theColumbia River population segment are threatened by the effects of poaching.

C. Disease or predation. Although diseases affecting salmonids are likely present in both the Klamath River and Columbia River basins, they are not thought to be a major factor affecting bull trout. However, interspecific interactions, including predation, are thought to negatively affect bull trout where non-native salmonids have been introduced (Palmisano and Kaczynski, in litt. 1997).

Klamath River Population Segment

Diseases have not been documented affecting bull trout in the Klamath River basin. However, brook trout and brown trout have been introduced in the basin, and either one or both species co-exist with bull trout in all subpopulations except Deming Creek (Buchanan et al. 1997). Brown trout predation on bull trout is evidenced by a direct observation in Boulder Creek (Light et al. 1996). Overall, bull trout co-occur with brown trout and brook trout in about half of the occupied habitat. Buchanan et al. (1997) indicated that bull trout occupy approximately 34.1 km (20.5 mi) of streams. However, allopatric (occurring in different

geographic areas or in isolation) bull trout have been estimated to occupy only 13.4 to 15.7 km (8.3 to 9.8 mi) within the basin (Buchanan et al. 1997; Schroeder and Weeks, in litt. 1997).

Columbia River Population Segment

Health samples from 207 juvenile bull trout collected from 8 streams in the Flathead River basin in 1992 and 1993 were negative in tests for furunculus, enteric redmouth, bacterial kidney disease, and viral hemorrhagic septicemia (VHS) or infectious pancreatic necrosis (IPN) (Fredenberg 1993). Bull trout are susceptible to whirling disease, caused by a protozoan parasite (Myxobolus cerebralis), and recently detected in bull trout waters in Montana (Montana Whirling Disease Task Force 1996). However, bull trout are less susceptible to whirling disease than rainbow trout (McDowell et al. 1997). Whirling disease is currently untreatable in the wild, and the parasite appears to be rapidly spreading into previously uninfected waters. The consequences of whirling disease on bull trout may not be apparent for years.

Bull trout are most vulnerable to predation as juveniles. Several non-native fishes, such as lake trout, brown trout, brook trout and northern pike (Esox lucius) are considered potential predators (and competitors, see Factor E below) of many bull trout subpopulations in the Columbia River basin (Donald and Alger 1992; Pratt and Huston 1993; Rieman and McIntyre 1993; MBTSG 1995d, 1996a; MFWP 1997).

Dramatic declines in the Priest Lake, Idaho, bull trout harvest began about 20 years ago. Between 1956 and 1970, an annual average of 1,200 fish were harvested. In 1978, a record 2,320 were harvested, declining in 1983 to 159 (Mauser et al. 1988). There has been no legal harvest of bull trout since 1984. Bull trout were extirpated from Priest Lake through interactions with introduced lake trout (Pratt and Huston 1993). Mauser et al. (1988) described bull trout in Priest Lake as ``functionally extinct as long as lake trout abundance is high.'' Similarly, lake trout introduced into Flathead Lake feed on juvenile bull trout entering the lake from the Flathead River, and are thought to be a factor in recent declines of the bull trout subpopulation (MBTSG 1995d). Introduced non-native fishes limit bull trout restoration in all the major drainages in Montana (MBTSG 1995a-e, 1996a-f).

For bull trout in the Columbia River population segment, disease is not considered a listing factor; however, approximately 62 percent of the subpopulations are threatened by introduced non-native fishes, including the effects of predation.

D. The inadequacy of existing regulatory mechanisms. Although efforts are underway to conserve bull trout (e.g., Batt, in litt. 1997; Joslin, in litt. 1997; Thomas, in litt. 1997), the implementation and enforcement of existing Federal and State laws designed to conserve fishery resources, maintain water quality, and protect aquatic habitat have not prevented past and ongoing habitat degradation. This inadequacy has led to bull trout declines and isolation and is a factor in the determination to list bull trout population segments. Regulatory mechanisms, including the National Forest Management Act, the Federal Land Policy and Management Act, the Public Rangelands Improvement Act, the Clean Water Act, the National Environmental Policy Act, the Federal Power Act, State Endangered Species Acts and numerous State laws and regulations govern an array of land and water management activities that affect bull trout and their habitat.

National Forest Management Act

The National Forest Management Act (NFMA) and the Federal Land Policy and Management Act (FLPMA) require the USFS and BLM to develop and implement land and resource management plans (LRMPs) and Resource Management Plans (RMPs), respectively) to protect fish and wildlife resources and produce forest and range products. However, reviews by the U.S. Department of Agriculture (USDA) of LRMP monitoring and evaluation reports for 28 national forests indicate that many watersheds do not meet NFMA Forest Plan standards. Compliance with LRMPs and effectiveness of best management practices on current projects is improving, but, a majority of streams that had been affected by past practices were not healing as fast as anticipated (USDA 1995).

Reviews of existing LRMPs implemented outside the range of the northern spotted owl, even as amended by the Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH) (USDA 1995), have inadequately protected salmonid habitat on BLM and national forest lands (Henjum et al. 1994; R. Schmitten, NMFS, in litt. 1995; Espinosa et al. 1997). While the severe resource damage from forest management that occurred in the 1950s through the 1970s has ceased, the current LRMPs have not fully taken into account the habitat needs of salmonids and recovery of degraded habitats has not occurred as predicted. For example, most LRMPs were developed prior to listing the Snake River salmon stocks, and, consequently, the biological requirements of these fish are not fully considered under the parameters of the LRMPs. The NMFS noted that even though PACFISH provided some improvements in many standards and guidelines of the LRMPs, comprehensive, landscape-scale conservation strategies for salmonid survival and recovery are still lacking (Schmitten, NMFS, in litt, 1995). Espinosa et al. (1997) listed several reasons why the Clearwater National Forest Plan adopted in 1987 has failed to adequately protect salmonid habitats in forest watersheds. Reasons included for this failure were-- projected timber harvests and levels of associated road construction too high to achieve fish habitat quality standards; inaccurate riparian habitat inventories; watershed recovery following disturbance was slower than expected; and inaccurate inventories of the timber resources.

Under the NFMA and the FLPMA, livestock grazing occurs on over 70 percent of federally-administered western rangeland, or about 108.5 million ha (268 million acres (ac)) of land in 16 western states (General Accounting Office (GAO) 1988). Ongoing livestock grazing on lands administered by the BLM and USFS continues to occur in watersheds occupied by bull trout (Henjum et al. 1994; McIntosh et al. 1994; USDA and USDI 1997). Technical solutions to improving riparian areas damaged by livestock grazing were available as early as 1988 (GAO 1988). However, the GAO (1988) noted that correcting damage from grazing was not readily solvable due to funding and political pressure to maintain the status quo grazing systems. Within the Interior Columbia River Basin, the BLM and USFS have had difficulty correcting practices that cause grazing damage to streams due to lack of funding, conflicting requirements of different laws, or budget allocations (USDA and USDI 1997). However, in some areas supporting federally listed fish or designated critical habitat, the BLM and the USFS have been able to improve livestock management in riparian areas, including habitat for shortnose sucker (Chasmistes brevirostris) and Lost River sucker (Deltistes luxatus) in the Klamath River basin, and the Lohontan cutthroat trout

(Oncorhynchus clarki henshawii) of the Great Basin.

Interior Columbia Basin Ecosystem Management Project

The USFS, BLM, EPA, NMFS, and Service are cooperating in development of the Interior Columbia Basin Ecosystem Management Project (ICBEMP), a large-scale land management plan for lands administered by these agencies in eastern Oregon and Washington, Idaho and western Montana. The alternatives described in the Draft Environmental Impact Statement (DEIS) do not specifically address bull trout conservation in ``depressed'' areas outside the range of steelhead and chinook salmon; the preferred alternative depends on subbasin review and ecosystem analysis at the watershed scale as the basis for decision-making within the Interior Columbia Basin (USDA and USDI 1997). The ICBEMP is in draft, and possible outcomes from implementing future bull trout conservation actions as part of an unapproved management alternative are not predictable. Funding and staffing to implement those components are also not secured.

Streamlined Consultation Procedures

On March 8, 1995, the USFS, Service, BLM, and NMFS, issued a memorandum directing the agencies to participate in ``streamlined'' consultation procedures. These procedures were initiated to address forest health and salvage projects (T. Dwyer, Service, in litt. 1995). By May 31, 1995, these procedures were extended indefinitely to include all consultation efforts (Dwyer, in litt. 1995). These procedures apply to Federal land management activities in Idaho, Oregon, Washington, Montana and California (California lands managed by BLM are subject to streamlined procedures only when forest ecosystem activities are involved). The purpose of the streamlined procedures is to improve the efficiency of the section 7 consultation process (C. Dunn, Service, in litt. 1997). Conservation and protection of bull trout habitat has been inconsistent due in part to the USFS and BLM discretionary option to review non-listed, candidate species or species of concern (R. Vizgirdas, Service, in litt. 1997; R. Strach, Service, in litt. 1997; P. Zenone, Service, in litt. 1997). In Idaho and eastern Oregon, Federal land management agencies have often not considered the effects of projects on bull trout through the streamlining process.

Endangered Species Act

In the Klamath River basin, the Service listed the shortnose sucker and Lost River sucker under the Act as endangered on August 26, 1987 (52 FR 32145), and proposed critical habitat for the species on December 1, 1994 (50 CFR 61744). Bull trout likely used portions of the proposed critical habitat in the past, including tributaries in the upper Klamath River, Crooked Creek, Sevenmile Creek, and Wood River. Although some of the earliest records of bull trout in the basin are from Fort Creek, a tributary of the Wood River (Dunsmoor and Bienz, in litt. 1997), bull trout do not presently occur within the habitat occupied by the two suckers. Therefore, conservation and recovery actions undertaken for the listed suckers will not directly benefit bull trout.

In the Columbia River basin, three species of salmon in the Snake River are listed--sockeye salmon (endangered), spring/summer chinook salmon (threatened) and fall chinook salmon (threatened). Critical habitat for all three salmon was designated, including the Columbia River migration corridor, and historically accessible streams in the Snake River basin upstream of Hell's Canyon Dam in Idaho, Oregon and Washington (58 FR 68543-68554). Downstream of Hell's Canyon and

Dworshak Dam, the designation extends to reaches historically accessible to salmon, below historically impassible barriers (58 FR 68543-68554). The designation extends protection to bull trout habitat in areas where they co-occur with the salmon. However, in many areas bull trout tend to spawn and rear upstream of listed salmon habitats. For instance, Fall Creek, a tributary of the Salmon River, Idaho, has an impassible waterfall near its mouth, and habitat for the listed salmon ends at the impassible falls (58 FR 68543-68554), but bull trout spawn and rear above the falls. In this example, bull trout spawning and rearing habitat does not overlap with the listed salmon; thus, bull trout would not receive indirect protection under the Act.

On August 18, 1997, five evolutionarily significant units (ESUs) of steelhead were listed as threatened--three in California, one in Washington (Columbia River from the Yakima River to Grand Coulee Dam), and one in the Snake River basin in Oregon, Washington, and Idaho (62 FR 43937). Although protection for bull trout under the Act would be afforded where they co-occur with steelhead, measures to protect steelhead may be insufficient for bull trout due to differences in the life history between the species and lack of complete habitat overlap.

Northwest Forest Plan

The Northwest Forest Plan (NWFP) addresses management of USFS and BLM lands within the range of the northern spotted owl, and implementation began in April 1994 (Tuchmann et al. 1996). The NWFP includes an aquatic conservation strategy, consisting of four inter-related elements. The first element is riparian reserves, which is the system of lands along streams allocated toward the conservation and restoration of aquatic and riparian dependent species. The second is key watersheds, which are watersheds with special values and appropriate management standards. The third element is watershed analysis, which is required to help land managers understand the processes that maintain habitats and to manage to preserve these processes. The fourth element is watershed restoration projects, which are funded to move watersheds toward recovery. For instance, in 1994 through 1996, 1675 watershed restoration projects (or groups of projects) were funded under the NWFP (Tuchmann et al. 1996). The conservation strategy generally addresses the maintenance of the four elements. Although the strategy does not specifically address bull trout needs, it contains objectives for riparian and stream conservation and maintenance that may facilitate conservation of bull trout habitat (W. Cole, Service, in litt, 1997). Additionally, the implementation of the NWFP is dependent on interagency collaboration to achieve resource conservation and a sampling of projects unaffected by the 1995 Salvage Rider (see below) indicates that bull trout are generally protected by the NWFP. However, the NWFP covers only a minor portion of bull trout habitat for the Columbia River population segment.

PACFISH and INfish

The USFS and BLM developed the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho and Portions of California, known as PACFISH. PACFISH is intended to be an ecosystem-based, aquatic habitat and riparian-area management strategy for Pacific salmon, steelhead, and sea-run cutthroat trout habitat on lands administered by the two agencies and outside the area subject to implementation of the NWFP (USDA and USDI 1995). PACFISH amended Regional Guides, forest plans and land use plans by applying management

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measures for all ongoing and proposed or new projects that pose an unacceptable risk to anadromous fish involving the management of timber, roads, grazing, and other land uses. The Service is participating with NMFS, the USFS, and the BLM in reviewing action-agency PACFISH screening efforts for anadromous fish. Within the area of PACFISH where the habitats of salmon and bull trout overlap, the screening effort is to protect both anadromous fish and bull trout from major effects. However, efforts to include bull trout in the PACFISH review are not always successful (Vizgirdas, in litt. 1997; Strach, in litt. 1997; Zenone, in litt. 1997).

The Inland Native Fish Strategy (INfish) was developed by the USFS to provide an interim strategy for inland native fish in eastern Oregon and Washington, Idaho, western Montana and portions of Nevada (USDA and USDI 1995). It has not been determined whether INfish is an effective strategy for removing the threats for bull trout. In Idaho, the USFS does not place a priority on application of INfish and generally has determined that anadromous watersheds have a higher priority than bull trout watersheds (Vizgirdas, in litt. 1997; Strach in litt. 1997; Zenone, in litt. 1997).

Clean Water Act

Under sections 303 and 304 of the Clean Water Act (CWA), States or EPA set water quality standards, which combine designated beneficial uses and criteria established to protect those uses. Water bodies that are identified as failing water quality standards are designated by States under section 303(d) as water quality limited (MDHES 1994; EPA 1994; ODEQ 1996), and subject to development of management plans to restore water quality and protect designated uses. These management plans, or total maximum daily loads (TMDLs), address both point and non-point sources of pollutants within a watershed. Best Management Practices (BMPs) are used with TMDLs to address non-point sources of pollution, such as mining, forestry, and agriculture; however, regulatory authority to enforce the BMPs varies among the states. It is estimated that 10 percent of total length of streams within the ICBEMP assessment area, including the Klamath River and Columbia River basins, are listed as water quality limited. This may underestimate the true extent and distribution of streams with impaired water quality potentially affecting bull trout (USDA and USDI 1997). In the Klamath River basin, stream reaches designated as water quality limited (i.e., cited on the 303(d) list of Oregon for various water quality standards (ODEQ 1996)) are estimated to apply to six of the seven bull trout subpopulations. In the Columbia River basin, water bodies designated as water quality limited by Oregon, Washington, Idaho, and Montana are estimated to apply to at least 64 of the 141 bull trout subpopulations.

Relative to water temperature, Oregon established a water quality criterion of 10 deg. C (50 deg. F) as a weekly average based on daily maximum temperatures in bull trout spawning and rearing waters (OAR 340-41-685 and OAR 340-41-026); however, water bodies where these criteria would apply have not been identified. In Washington, temperature criteria for waters vary among the different classifications that are assigned to each waterbody, and range from 16 to 22 deg. C (60.8 to 71.6 deg. F) (Chapter 173-201 WAC). Washington is reviewing these standards with the intent of creating more appropriate water quality standards; however, whether the criteria specifically are for bull trout is unknown. In Idaho, EPA disapproved the state's temperature criteria applications within the geographic range of bull trout (EPA 1997). The EPA determined that the criteria did not provide adequate protection for bull trout relative to two designated uses--cold water biota and salmonid spawning (maximum daily average of 13 deg. C (55.5 deg. F) and 9 deg. C (48.2 deg. F) for each respective use). In July 1997, EPA promulgated a temperature criterion of 10 deg. C (50 deg. F) during June through September in designated stream areas, as a weekly average based on daily maximum temperatures for spawning and rearing of bull trout (EPA 1997). To date, the State has not adopted EPA's promulgated criterion, but has adopted 12 deg. C as a daily average during June-August for juvenile rearing and 9 deg. C for September and October for spawning. Additionally, Idaho has established a geographical area where these criteria would apply. It is unknown whether EPA will approve the State's criteria and withdraw the promulgated rule. In Montana, the temperature criterion applied to waters with bull trout is 19 deg. C (66 deg. F); temperature can be raised 0.6 deg. C (1 deg. F) by discharges, but water temperature may not exceed 19.5 deg.C (67 deg.F) (Administrative Rules of Montana 1996).

In accordance with Section 319 of the CWA, States also develop programs to address non-point sources of pollution such as agriculture, forestry, and mining. The effectiveness of controlling water pollution from these activities has been mixed. The State of Washington monitored the effectiveness in meeting water quality criteria for temperature in riparian areas on forest lands and concluded that regulations for stream shading were inadequate to meet criteria (Sullivan et al. 1990).

In summary, it is uncertain whether the CWA can provide sufficient protective measures for conservation of bull trout. Temperature regime is one of the most important factors affecting bull trout distribution (Adams and Bjornn 1997, Rieman and McIntyre 1995). Given the known temperature requirements of bull trout (Buchanan and Gregory 1997), criteria developed by the four States may not be conducive to either spawning, incubation, rearing, migration, or combinations of these life-history stages.

State Regulations and Conservation Planning Efforts

All four States within the range of the Klamath River and Columbia River population segments of bull trout have regulations affecting bull trout and their habitat. Idaho, Montana, and local or county organizations have recently developed or are developing conservation plans to maintain and restore bull trout, primarily through stream habitat protection.

In 1995, Idaho Governor Phil Batt initiated a conservation plan to restore bull trout populations in Idaho. The mission of the Governor's Plan, approved in July 1996, is to ``... maintain and/or restore complex interacting groups of bull trout populations throughout their native range in Idaho'' (Batt, in litt. 1997). A recent status report of implementation of the Plan stated that advisory groups, which will develop water quality and bull trout conservation measures, have formed only in some areas. Although the harvest of bull trout is closed throughout Idaho and State-sponsored survey and monitoring has increased (S. Mealey, IDFG, in litt. 1997), few on-the-ground recovery actions for bull trout have been implemented to date.

Other efforts include a 1994 conservation agreement (CA) between the Idaho Department of Transportation (IDOT) and the Service to protect bull trout (USDI and IDOT, in litt. 1994), and recent conservation activities by the IDFG that were funded by Section 6 of the Act. The IDOT finished only one passage restoration project under the CA, and recently declined to renew the CA (R. Howard, Service, pers. comm. 1997). Since 1994, IDFG has used Section 6 funds to begin several habitat restoration actions in northern and southwestern Idaho. Aside from enacting restrictive fishing regulations,

few protective or restoration projects have been completed that substantially reduce threats to bull trout throughout the Columbia River.

Beginning in 1992 and 1993, several interagency bull trout working groups were formed in Oregon (R. Rosen, ODFW, in litt. 1995). These working groups have been instrumental in gathering additional status information and developing preliminary conservation strategies for bull trout in their respective basins. These efforts are encouraging for bull trout conservation in the future, but the outcome has not yet been demonstrated.

In March 1997, Oregon also adopted the Oregon Coastal Salmon Restoration Initiative (OCSRI 1997) (Oregon Plan). The Oregon Plan is designed to ``... restore salmon to a level at which they can once again be part of people's lives ...'' in coastal Oregon. The Oregon Plan's initial focus is on areas within the range of Oregon coastal coho salmon, and does not overlap with presently occupied bull trout habitat. Oregon recently acknowledged support for developing future bull trout conservation measures by including bull trout in the Oregon Plan (J. Kitzhaber, Governor of Oregon, in litt, 1997), although no conservation measures specific to bull trout have been completed to date.

The Upper Klamath Basin Bull Trout Conservation Strategy (Light et al. 1996) was developed by the Klamath Basin Bull Trout Working Group in response to the limited and shrinking distribution and number of bull trout. The Working Group, formed in 1993, is composed of representatives from the Service, ODFW, Fremont and Winema National Forests, Crater Lake National Park, PacifiCorp, USBR, Sprague River Water Users Association, Klamath Basin Water Users Protective Association, U.S. Timberlands, and Klamath Tribes. The defined goals of this group as identified in the Conservation Strategy are--(1) secure existing bull trout populations and (2) restore populations to some of their former distribution (Light et al. 1996). Phase 1 has concentrated on addressing threats to bull trout from non-native salmonids, including eradication of brook trout and brown trout above barriers where isolated subpopulations of bull trout are found. Stream temperatures and sedimentation problems are being addressed concurrent with eradication of exotic species. Phase 2 will involve expanding the number of subpopulations by reestablishing bull trout in high quality headwater habitats, effectively increasing the size of the Klamath River metapopulation and making it more resilient to natural disturbance, variation in breeding success, disease outbreaks, and other environmental factors (Light et al. 1996). Future objectives likely will include establishing natural movement corridors between adjacent headwater streams.

All habitats currently occupied by bull trout in the Klamath River basin are managed by Working Group members. From 1993 through 1996, conservation actions (phase 1) were implemented by the Working Group, including--watershed assessments; fish distribution, abundance, and spawning surveys; collection of stream temperature and sediment data to help identify limiting factors; brook trout eradication efforts in Long, Sun, and Threemile creeks; reduction or elimination of grazing along bull trout habitat owned by U.S. Timberlands; road system improvements, closures, and rehabilitation; and barrier management to prevent access of non-native fishes (Johnson in litt. 1997; Buchanan et al. 1997). Habitat improvement projects have also been implemented in areas historically occupied by bull trout, such as the 9,700 ha (24,000 ac) Nature Conservancy preserve at Sycan Marsh (P. Rexroat, The Nature Conservancy, in litt. 1997) and the Sun Pass State Forest on lower Sun Creek. These ongoing conservation efforts have been complicated by recent private land ownership changes and lack of an approved recovery plan that identifies specific conservation tasks and actions.

In addition to the Klamath Basin Bull Trout Working Group, a federally-authorized, interagency and entity group, the Upper Klamath Basin Working Group, was established in 1994. This group, composed of Federal, State, county, city, tribal, environmental, local business, agricultural-ranching, and local community members, works on a consensus-based approach to Klamath basin ecosystem issues. The group focuses on ecosystem restoration projects and has funded bull trout conservation efforts, a high group priority, such as riparian fencing and road maintenance and obliteration projects.

Other State regulations and policies affect bull trout and their habitat in Oregon. For instance, Oregon has a policy ``to prevent the serious depletion of any indigenous species'' (ORS 496.012). As such, the Oregon Department of Fish and Wildlife's Wildlife Diversity Plan (OAR 635-100) provides for a Sensitive Species List. The Sensitive Species List (OAR-635-100-040) is maintained by ODFW, and is updated biennially. The Sensitive Species List is intended as a ``watch list'' of species potentially eligible for listing as endangered or threatened, and constitutes an early warning system for land managers and the public (ODFW 1996). There are no regulatory protections for species listed as sensitive, nor is the habitat on which they depend protected under OAR 635-100.

The Sensitive Species List has four categories--``critical'' (species for which listing is appropriate or pending); ``vulnerable'' (species for which listing is not imminent and can be avoided via adequate protective measures); ``peripheral or naturally rare'' (occurring in Oregon at the edge of their range, in naturally low numbers due to limited in-state distribution); and ``undetermined'' status (species for which status is unclear). Bull trout is listed in the ``critical'' category (ODFW 1993).

The Washington Department of Fish and Wildlife released the final Environmental Impact Statement for the proposed Wild Salmonid Policy in September 1997 (WDFW 1997). Although the environmental impact statement (IS) focused on salmon and steelhead, referring to bull trout and other wild salmonids in an ancillary manner, it described problems and challenges facing the recovery of anadromous and resident salmonids throughout Washington. The IS presented five alternatives ranging from continuation of current management (i.e., policy generally based on maximum sustainable yield) to alternatives providing more protection for wild salmonids. Each alternative addressed harvest, hatcheries, and habitat relative to wild salmonids, and presented obstacles to recovery and possible actions to facilitate recovery. Regardless of the alternative ultimately selected by the Washington State Fish and Wildlife Commission as the Wild Salmonid Policy, implementation of the policy will suggest guidelines for actions taken by the WDFW and willnot be binding on other State, tribal, and private entities. Because of uncertainties concerning implementation of the policy, the effect of the policy on bull trout conservation in Washington is unknown.

In Montana, Governor Marc Racicot appointed the Bull Trout Restoration Team in 1994 to produce a plan that maintains, protects, and increases bull trout populations. The team appointed a scientific group that has subsequently prepared eleven basin-specific status reports and two technical, peer-reviewed papers. A third technical

paper is presently undergoing peer review. A Montana Bull Trout Recovery Plan, including a recovery goal, is also nearing completion. Watershed groups are being established in some areas to lead local bull trout restoration efforts. As of October 1997, some localized habitat restoration projects, such as removal of fish passage barriers, screening irrigation diversions, riparian fencing, stream restoration projects, and habitat monitoring, had been completed or were underway (Graham and Clinch, in litt. 1997). Because of uncertainties concerning implementation of the restoration plan, the effect of the plan on future bull trout conservation in Montana is unknown.

Oregon, Washington, Idaho, and Montana each have adopted a Forest Practice Act (FPA) or other legislation consisting of rules and regulations addressing forest management on State, Federal, and private lands. In general, the legislation establishes best management practices (BMPs) to be implemented on forests, such as streamside management zones (Montana Department of State Lands 1994), activities allowed in riparian areas, restrictions on harvest adjacent to streams, and location of road construction. The application of BMPs is voluntary in some States. Although audits show that compliance with BMPs is high in Idaho (H. Malany, Idaho Forest Practice Act Advisory Committee Member, in litt. 1997) and Montana (Mathieus 1996), the Service is not aware of evaluations of various States' BMPs relative to the protection of bull trout habitat and processes affecting water quality, such as sediment delivery, water temperature, recruitment of woody debris, and bank stability. In Idaho, half of timber sales audited resulted in contributions of sediment to streams, largely from inadequately maintained roads (Zaroban et al. 1996). Even with high implementation rates, Idaho's forestry BMPs have been ineffective at maintaining beneficial uses, including cold water biota (McIntyre 1993). In Montana, McGreer (1994) noted that the Montana legislation may adequately provide for woody debris and bank stability, but it may be inadequate for temperature control and sedimentation. The MDNRC has discontinued timber harvest and grazing in areas directly adjacent to streams containing bull trout (P. Flowers, MDNRC, in litt. 1996). Based on current information, the Service is unable to conclude that State FPAs and related legislation are adequate to protect bull trout habitat.

E. Other natural or manmade factors affecting their continued existence. Natural and manmade factors affecting the continued existence of bull trout include--previous introductions of non-native species that compete or hybridize with bull trout; fragmentation and isolation of bull trout subpopulations from habitat changes caused by human activities, and subpopulation extirpations due to naturally occurring events such as droughts and floods.

Introduced Non-native Species

Introductions of non-native species by the Federal government, State fish and game departments, and private parties, across the range of bull trout has resulted in declines in abundance, local extirpations, and hybridization of bull trout (Bond 1992; Howell and Buchanan 1992; Leary et al. 1993; Donald and Alger 1993; Pratt and Huston 1993; MBTSG 1995b,d, 1996g; Platts et al 1995; Palmisano and Kaczynski, in litt. 1997). Non-native species may exacerbate stresses on bull trout from habitat degradation, fragmentation, and isolation (Rieman and McIntyre 1993). Introduced species, such as rainbow trout, may benefit large adult bull trout by providing supplemental forage (Faler and Bair 1991; Pratt 1992; ODFW, in litt. 1993). However, introductions of non-native game fish can be detrimental due to increased angling and subsequent incidental catch and illegal harvest of bull trout (Rode 1990; Bond 1992; WDW 1992; MBTSG 1995d).

Non-native fish also threaten bull trout in relatively secure and physically unaltered habitats, including roadless areas, wilderness, and national parks. For instance, brook trout occur in tributaries of the Middle Fork Salmon River within the Frank Church-River of No Return Wilderness, including Elk, Camas, Loon, and Big creeks (Thurow 1985; S. Achord, National Marine Fisheries Service (NMFS), in litt. 1994) and Sun Creek in Crater Lake National Park (Light et al. 1996). Glacier National Park has self-sustaining populations of introduced non-native species, including lake trout, brook trout, rainbow trout, Yellowstone cutthroat trout, lake whitefish (Coregonus clupeaformis), and northern pike (MBTSG 1995d). Although stocking in Glacier National Park was terminated in 1971, only a few headwaters lakes contain exclusively native species, including bull trout. The introduction and expansion of lake trout into the relatively pristine habitats of Kintla Lake and Lake McDonald in Glacier National Park nearly extirpated the bull trout subpopulation from predation and competition (L. Marnell, NPS, in litt. 1995; MBTSG 1995d).

Introduced brook trout threaten bull trout through hybridization, competition, and possibly predation (Leary et al. 1993; Thomas 1992; WDW 1992; Clancy 1993; Rieman and McIntyre 1993; MBTSG 1996). Hybridization between brook trout and bull trout has been reported in Montana (MBTSG 1995a,b, 1996a,c,e; Hansen and DosSantos 1997), Oregon (Markle 1992; Ratliff and Howell 1992), Washington (WDFW 1997), and Idaho (Adams 1996; T. Burton, BNF, pers. comm. 1997). Hybridization results in offspring that are frequently sterile (Leary et al. 1993), but some hybrids show gonadal development (Dunsmoor and Bienz, in litt. 1997), raising concern of potential introgression. Hybrids may be significant competitors; Dunsmoor and Bienz (in litt. 1997) noted that hybrids are aggressive and larger than resident bull trout, suggesting that hybrids may have a competitive advantage. Brook trout mature faster and have a higher reproductive rate than bull trout. This difference may favor brook trout over bull trout when they occur together, often leading to replacement of bull trout with brook trout (Leary et al. 1993; Clancy 1993; MBTSG 1995b). The threat of hybridization and replacement is likely exacerbated where larger, more fecund migratory forms of bull trout have been eliminated (Rieman and McIntyre 1993). The magnitude of threats from non-native fishes is highest for subpopulations supporting only resident fish because resident bull trout typically are small in number and isolated where the effects of interspecific interactions are likely more intense.

Brook trout apparently adapt better to degraded habitats than bull trout (Clancy 1993; Rich 1996). Brook trout likely have higher survival-to-emergence than bull trout in areas with elevated sediment (MBTSG 1996h), and brook trout also tend to occur in streams with higher water temperatures (Adams 1994; MBTSG 1996h). Because elevated water temperatures and sediments are often indicative of degraded habitat, bull trout may be subject to stresses from both interactions with brook trout and degraded habitat (MBTSG 1996h). Watson and Hillman (1997) found an inverse relationship between bull trout occurrence and the presence of brook trout. Dunsmoor and Bienz (in litt. 1997) noted that brook trout have a high probability of displacing bull trout in the Klamath River basin due to degraded bull trout habitat.

Introduced brown trout are established in several areas within the range of bull trout and likely compete with bull trout (Ratliff and Howell 1992;

Platts et al. 1993; Pratt and Huston 1993). Brown trout tend to spawn in the same areas as bull trout, though later in the season, and may compete for spawning and rearing areas and superimpose redds on bull trout redds (Pratt & Huston 1993; Light et al. 1996; MBTSG 1996h). Additionally, brown trout are typically more aggressive than native trout, and can displace brook trout and other native trout species (Fausch and White 1981; Wang and White 1994). Bull trout and brown trout rear in similar areas and may compete for food and space. Elevated water temperatures may favor brown trout over bull trout in competitive interactions (MBTSG 1996h). Brown trout are thought to have been a secondary factor in the decline and eventual extirpation of bull trout in the McCloud River, California, after dam construction altered bull trout habitat (Rode 1990).

Non-native lake trout also negatively affect bull trout (Donald and Alger 1993; MBTSG 1996h). A study of 34 lakes in Montana, Alberta, and British Columbia found lake trout likely limit foraging opportunities and reduce the distribution and abundance of migratory bull trout in mountain lakes (Donald and Alger 1993). Illegal introductions of lake trout and other species have occurred in more than 50 northwest Montana waters in recent years (J. Vashro, MFWP, in litt. 1995). The potential for illegal introduction of lake trout into the Swan River basin and Hungry Horse Reservoir on the South Fork Flathead River, both in Montana, is considered a threat to bull trout (MBTSG 1995e, 1996a), potentially affecting up to six subpopulations. In Idaho, lake trout and habitat degradation were factors in the decline of bull trout from Priest Lake (Mauser et al. 1988; Pratt and Huston 1993). Juvenile lake trout are also using river habitats in Montana, possibly competing with bull trout (MBTSG 1996h). State plans to manage lake trout to reduce interactions with bull trout are unknown.

Non-native northern pike (Esox lucius), bass (Micropterus spp.), and opossum shrimp (Mysis relicta) are also thought to negatively affect bull trout. Northern pike were illegally introduced into Swan Lake in the 1970s (MFWP 1997), and predation on juvenile bull trout has been documented (S. Rumsey, MFWP, pers comm. in MBTSG 1996a). Management of Swan Lake emphasizes protection of native salmonids, particularly bull trout, and control of northern pike to minimize effects on native species (MFWP 1997). Northern pike were also illegally introduced into Salmon, Inez, Seeley, and Alva lakes in the Clearwater River basin, a tributary to the Blackfoot River, Montana (MFWP 1997). Northern pike numbers have increased in Salmon Lake and Lake Inez, having a negative effect on bull trout (Berg, pers. comm. 1997). Northern pike in Seeley Lake and Lake Alva are also expected to increase in numbers (Berg, pers. comm. 1997).

Introduced bass may negatively affect bull trout where the species co-occur (MFWP 1997). In the Clark Fork River, Montana, Noxon Rapids Reservoir supports fisheries for both smallmouth bass (Micropterus dolomieui) and largemouth bass. Both are high priority species in current management of Noxon Rapids Reservoir unless more suitable bull trout habitat is created as a result of dam relicensing. The fishery management objective for Cabinet Gorge Reservoir, downstream of Noxon Rapids Reservoir, is to enhance bull trout while managing the existing bass fishery (MFWP 1997).

Opossum shrimp, a crustacean native to the Canadian Shield area, was widely introduced in the 1970s as supplemental forage for kokanee and other salmonids in several lakes and reservoirs across the northwest (Nesler and Bergerson 1991). The introduction of opossum shrimp in Flathead Lake changed the lake's trophic dynamics, and is widely believed to have been partially responsible for the expanding the lake trout population, resulting in increased competition and predation on bull trout (T. Weaver, MFWP, in litt. 1993) Thus, opossum shrimp have had an indirect, negative effect on bull trout. Conversely, in Swan Lake, Montana, opossum shrimp and kokanee have become established and increased the availability of forage for bull trout, contributing to the significant increase in bull trout numbers in the Swan River basin (MBTSG 1996a). Thus, the effects of introduced species on bull trout involve complex interactions that are dependent on several factors.

Klamath River Population Segment

Bull trout have been displaced by brook trout in portions of the Klamath River basin (Light et al. 1996), and hybrids of the two species have been verified in several of the streams (Ratliff and Howell 1992). Either brook trout, brown trout, or both species occur with bull trout in six of seven subpopulations. Where brook trout or brown trout co-occur with bull trout, the distribution of bull trout has contracted and that of introduced salmonids expanded (e.g., Brownsworth, Leonard, and Long creeks) (Buchanan et al. 1997). Only four subpopulations exist in the absence of brook trout, and these are the most abundant (Ratliff and Howell 1992; Ziller 1992). In 1992, chemical eradication of brook trout was initiated in Sun Creek (Buktenica 1997). The chemical treatment apparently killed a number of bull trout due to the difficulty of removing fish prior to treatment (Buktenica 1997). Other eradication programs relying on chemical treatments would likely have similar effects on bull trout. Ongoing management actions in Threemile and Long creeks focus on brook trout eradication via selective electrofishing, snorkel-spearing, trapping, and chemical treatments with the objective of expanding bull trout range. Brook trout have declined in Threemile Creek, but there has been no measurable change in brook trout numbers in Long Creek (Dunsmoor and Bienz, in litt. 1997).

Columbia River Population Segment

Within the upper Columbia River basin in Montana, brook trout are found in approximately 65 percent of the stream reaches where bull trout occur (J. Hutten, MFWP, in litt. 1993). Brook trout are found in all major basins in Montana that support bull trout except the South Fork of the Flathead River. Brook trout and bull trout hybridization was first documented in the early 1980s in South Fork Lolo Creek in the Bitterroot River basin, Montana (Clancy 1993; MBTSG 1996h). Bull trout have largely been replaced by brook trout.

Introduced brook, brown, and rainbow trout are present in the Bitterroot drainage in Montana (Clancy 1996). The presence of non-native fish may have been a factor causing the fragmentation of bull trout range in the Bitterroot drainage by restricting migratory movements by bull trout (Rich 1996). Brook trout appeared to be replacing bull trout in some streams in the Bitterroot. Bull trout-brook trout hybrids have been documented in at least nine tributaries (MBTSG 1995b). Rich (1996) found a strong negative correlation betweenthe presence of bull trout and brook trout in tributaries of the Bitterroot River.

The MBTSG concluded that introduced species, particularly in the lower Clark Fork River pose a high threat to bull trout (MBTSG 1996b). Non-native fishes have been introduced throughout the Clark Fork River system and brook trout are found throughout. Bull trout-brook trout hybrids exist in the Middle and upper Clark Fork systems (MBTSG 1995a; Hansen and DosSantos 1997).

In Idaho, bull trout densities in Mica Creek, Spokane River basin, during 1972

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ranged from 0.03 to 0.23 fish/100 m\2\ (0.003 to 0.023 fish/100 ft\2\) (Mauser et al. 1972 in Platts et al. 1993). Extensive electrofishing surveys in Mica Creek during 1993 did not find bull trout, but brook trout were numerous at one transect (Martin 1994). Brook trout are present or accessible to most of the Clearwater River basin in Idaho, with hybridization and competition the primary threat to bull trout (A. Espinosa, Clearwater National Forest, pers. comm. 1993; D. Johnson, Nez Perce Tribe, pers. comm. 1995). For example, Meadow Creek, a tributary to the North Fork Clearwater River, contained numerous bull trout in 1987 and 1988, but, currently, high numbers of brook trout occur and bull trout numbers have been sharply reduced (Johnson, pers. comm., 1995).

Negative effects of interactions with introduced non-native species may be the most pervasive threat to bull trout throughout the Columbia River basin. Of the 141 subpopulations of bull trout in the Columbia River population segment, approximately 62 percent were threatened by competition, predation, or displacement by non-native species. Often one or more non-native species have been introduced into bull trout habitats; interactions with bull trout are likely exacerbated by factors such as habitat conditions, water temperature, and isolation. The MBTSG concluded that non-native species pose a limitation to bull trout restoration (MBTSG 1995a-e, 1996a-f). The MBTSG is reviewing recommendations for removing or suppressing non-native fishes to benefit bull trout, but success of such an effort on a large scale is questionable (MBTSG 1996h).

Isolation and Habitat Fragmentation

Bull trout are widely distributed over a large geographic area, and exhibit a patchy distribution due, in part, to specific habitat requirements (Rieman and McIntyre 1993). However, the effects of human activities over the past 100 years have resulted in reductions in the overall distribution of bull trout. In general, habitat fragmentation results in reduction in available habitat and increased isolation from conspecifics (Saunders et al. 1991). In studies of extinction in fragmented landscapes, Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in each local population (i.e., subpopulations) and their probability of extirpation is directly related to the degree of isolation and fragmentation. Without sufficient immigration, overall growth for subpopulations may be low and the overall probability of extirpation for subpopulations is high (Burkey 1989, 1995). Moreover, habitat fragmentation that isolates subpopulations may increase a species' susceptibility to both demographic and naturally occurring events (Rieman and McIntyre 1993).

Metapopulation concepts of conservation biology theory are applicable to the bull trout (Reiman and McIntyre 1993). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). Subpopulations may be extirpated, but can be reestablished by individuals from other subpopulations. Metapopulations are thought to provide a mechanism for spreading risk because the simultaneous loss of all subpopulations is unlikely. Migratory corridors can also allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from perturbations (Saunders et al. 1990). Relative to bull trout, maintenance of migratory corridors is essential to provide connectivity among subpopulations thought to be sources and sinks, and enables the reestablishment of extirpated subpopulations. Where migratory bull trout are not present, disjunct subpopulations cannot be replenished when a disturbance makes local habitats unsuitable (Rieman and McIntyre 1993; USDA and USDI 1997). Moreover, limited downstream movement was observed for resident bull trout in the Bitterroot River basin (Nelson 1996) suggesting low probability that extirpated bull trout would be reestablished by resident fish residing nearby. Of the 141 subpopulations in the Columbia River population segment, approximately 79 percent are unlikely to be reestablished if extirpated; and 50 percent are at risk of extirpation from naturally occurring events.

Passage barriers, degraded habitat, absence of migratory fish, and intensified stream perturbations, such as forest fires, floods, and droughts, reduce the ability of isolated bull trout subpopulations to persist following disturbances to streams (Rieman and McIntyre 1993; USDA and USDI 1997). Bull trout evolved with habitat perturbations to streams that were likely factors in shaping bull trout life history (Rieman and McIntyre 1993). Historically, areas suitable for bull trout spawning were likely distributed in a disjunct pattern (Fraley and Shepard 1989; Rieman and McIntyre 1995; USDA and USDI 1997) maintained by natural perturbations. Although the amount and distribution of spawning areas vary through time, sufficient spawning areas were accessible to bull trout to maintain the species (Rieman and McIntyre 1995; USDA and USDI 1997). Migratory bull trout tend to show fidelity to spawning streams, but they have been documented to spawn in different tributaries from one year to the next, including tributaries not previously known to have recent spawning (Ratliff et al. 1996). Thus, migratory bull trout have the ability to reestablish an area where extirpated previously as long as suitable migratory corridors exist (Rieman and McIntyre 1993).

Today, bull trout exhibiting migratory life histories have declined or are absent in many river systems (Bond, 1992; Schill 1992; Ziller 1992; Pratt and Huston 1993; Rieman and McIntyre 1993; Newton and Pribyl 1994; MBTSG 1995a,b; 1996b,c,e; USDA and USDI 1997). Passage barriers (e.g., dams and diversions) and other habitat alterations prevent bull trout migration from following historical patterns. Additionally, suitable spawning areas are more fragmented across the landscape than historically (USDA and USDI 1997). With fewer and more compressed spawning and rearing areas available, bull trout increasingly persist as small, isolated resident populations instead of few, large connected subpopulations (Bond, 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993, 1995; Rich 1996 Newton and Pribyl 1994; MBTSG 1995a,b; 1996b,c,d,e; USDA and USDI 1997).

As discussed in Factor A, evidence suggests that landscape disturbances, such as floods and fires, have increased in frequency and magnitude of effects within the range of bull trout (Henjum et al. 1994; USDA and USDI 1997). Where recolonization is prevented by passage barriers and suitable habitat, bull trout subpopulations may be extirpated by perturbations (USDA and USDI 1997). Also, isolated subpopulations are typically small, and more likely to be extirpated by local events than larger populations (Rieman and McIntyre 1995). Small populations may be at risk of impaired genetic fitness, as in Gold Creek, Washington (Craig and Wissmar 1993).

An example of the effects of naturally occurring events, such as fire, on bull trout habitat is the Entiat River basin of central Washington. ``Historical and current influences have been significant and include: localized compaction from sheep grazing and trailing; fire exclusion; timber salvage/road building from the early 1970's to present; and recreation. A portion of this (transitional or bull trout) zone has recently been impacted by a large, moderate high

intensity fire'' (Wenatchee National Forest, in litt. 1996). This transitional or bull trout zone in the mainstem Entiat River has had a 30 to 60 percent loss of pools since initially surveyed by the U.S. Bureau of Fisheries during 1935 through 1937 (Wenatchee National Forest, in litt. 1996). Both bull trout densities and recruitment are depressed in the mainstem Entiat in response to habitat degradation.

Conversely, most bull trout recruitment in the Entiat River basin is now occurring in the transitional zone in the Mad River. Pool frequencies have increased dramatically, 85 percent in one reach surveyed, 1,000 percent in the other, since the 1935 through 1937 surveys (Wenatchee National Forest, in litt. 1996). A large fire occurred in the Mad River basin in 1888, and the basin had splash dams and log drives early in this century. It has taken 60 years for the habitat to recover.

Floods or high flows have also been altered by land management (USDA and USDI 1997). Roads and clear cutting forested areas tend to magnify the effects of floods, leading to higher flows, erosion and bedload that scour channels (Furniss et al. 1991; McIntosh et al. 1994; USDA and USDI 1997), and degrade bull trout habitat (Henjum et al. 1994). Erosion from road landslides increases bedload to high stream flows over bedload levels without roads (Furniss et al. 1991). Increased bedload increases the scouring effect of the high water, increasing channel instability, leading to a loss of habitat diversity, especially pools (Henjum et al. 1994; McIntosh et al. 1994). Bull trout eggs and fry in the gravels during the scouring likely survive at lower rates (Henjum et al. 1994). For instance, hundreds of landslides associated with roads on the Clearwater National Forest and Panhandle National Forests (R. Patten and J. Pengkover, Panhandle National Forests, in litt. 1996) resulted from high water in 1995, and the effects of flooding on isolated bull trout populations is unknown. Habitat degradation has reduced the number and size of bull trout spawning areas (USDA and USDI 1997).

The Service has carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to bull trout in the Klamath River and Columbia River distinct population segments of bull trout in developing this final rule. Based on this evaluation the preferred action is to list the Klamath River and the Columbia River population segments of bull trout as threatened.

Klamath River Population Segment

Bull trout are currently limited to seven geographically isolated subpopulations that occupy only a fraction of the historical habitat. The species distribution and numbers have declined due to habitat degradation, isolation, loss of migratory corridors, poor water quality, and the introduction of non-native species. Six of seven bull trout subpopulations are small in number, and unlikely to persist over the next 100 years unless conservation and other corrective actions are taken. Remaining Klamath River bull trout subpopulations are threatened by the effects of past, present and future land and water management practices. Most subpopulations also face more than one threat.

Despite the bull trout's current status, the Service is encouraged that recent conservation and recovery actions are being initiated at Federal, State and local levels to begin to reverse the long-term declining trend for bull trout in the Klamath River basin. Progress has already been made toward improving habitat conditions for bull trout. Although the Service proposed the Klamath River population segment as endangered based on the 1994 administrative record, new information indicates that interagency conservation programs are being implemented and have begun to reduce threats to bull trout. Included are efforts of the Klamath Basin Working Group to eradicate brook trout in Long, Sun and Threemile Creeks, reduce livestock grazing along bull trout streams, and monitor watershed conditions and bull trout status. Moreover, bull trout conservation in the Klamath Basin has benefitted from habitat restoration activities of the Upper Klamath Basin Working Group which began in 1994. Habitat improvements derived from these two programs have just begun to be realized. Thus the final determination is to list the Klamath River population of bull trout as threatened because it is no longer in danger of extinction in the foreseeable future and threats have been reduced.

Columbia River Population Segment

Bull trout in the Columbia River basin, despite their relatively widespread distribution, have declined in both their overall range and numbers. Numerous extirpations of local subpopulations have been reported, with bull trout eliminated from areas ranging in size from relatively small tributaries of currently occupied, though fragmented habitat, to large river systems comprising a substantial portion of the species' previous range. Bull trout in the Columbia River population segment are currently limited to 141 isolated subpopulations, which indicates habitat fragmentation and geographic isolation. Many remaining bull trout occur as isolated subpopulations in headwater lakes or tributaries with migratory life histories lost or restricted. Few bull trout subpopulations are considered ``strong'' in terms of relative abundance and subpopulation stability. These remaining important strongholds tend to be found in large areas of contiguous habitats in the Snake River basin of central Idaho Mountains, upper Clark Fork and Flathead rivers in Montana, and the Blue Mountains in Washington and Oregon. The decline of bull trout is due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices and the introduction of non-native species. Most bull trout subpopulations are affected by one or more threats.

Recent activities to address threats and reverse the long-term decline of bull trout are being initiated at Federal, State and local levels (e.g., restrictive angling regulations, adoption of various land management rules, and development of conservation strategies and plans). While these efforts are important to the long term conservation and recovery of bull trout, threats continue and subpopulation improvement throughout the Columbia River has yet to be demonstrated. Because bull trout in the Columbia River basin are still a wide-ranging species, with some ``strongholds" in relatively protected areas, the Columbia River population segment is not in immediate danger of extinction. Therefore the Service's final determination is to list the Columbia River population segment of bull trout as threatened.

Critical Habitat

Critical habitat is defined in section 3 of the Act as--(i) the specific area within the geographical area occupied by a species, atthe time it is listed in accordance with the Act, on which are found those biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection and; (ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. ``Conservation" means the use of all methods and procedures needed to bring the species to the point at

which listing under the Act is no longer necessary.

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12) require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be endangered or threatened. Service regulations (50 CFR 424.12(a)) state that critical habitat is not determinable if information sufficient to perform required analysis of impacts of the designation is lacking or if the biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat. Section 4(b)(2) of the Act requires the Service to consider economic and other relevant impacts of designating a particular area as critical habitat on the basis of the best scientific data available. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the conservation benefits, unless to do such would result in the extinction of the species.

The Service finds that the designation of critical habitat is not determinable for these distinct population segments based on the best available information. When a ``not determinable" finding is made, the Service must, within 2 years of the publication date of the original proposed rule, designate critical habitat, unless the designation is found to be not prudent. The Service reached a ``not determinable" critical habitat finding for the proposed rule based on the 1994 administrative record. In the proposed rule the Service specifically requested comments on this issue. While the Service received a number of comments advocating critical habitat designation, none of these comments provided information that added to the Service's ability to determine critical habitat. Additionally, no new information regarding specific physical and biological features essential for bull trout in the Klamath River and Columbia River bull trout population segments was obtained during the open comment period including the five public hearings. The biological needs of bull trout in the two population segments are not sufficiently well known to permit identification of areas as critical habitat. Insufficient information is available on the number of individuals or spawning reaches required to support viable subpopulations throughout the distinct population segment. In addition, the extent of habitat required and specific management measures needed for recovery of these fish have not been identified. This informationis considered essential for determining critical habitat for these population segments. Therefore, the Service finds that designation ofcritical habitat for the Klamath River and the Columbia River population segments is not determinable at this time. Protection of bull trout habitat will be addressed through the recovery process and through section 7 consultations to determine whether Federal actions are likely to jeopardize the continued existence of the species.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Endangered Species Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain activities. Recognition through listing encourages and results in conservation actions by Federal, State, and private agencies, groups, and individuals. The Act provides for possible land acquisition and cooperation with the states and requires that recovery actions be carried out for all listed species. The protection required of Federal agencies and the prohibitions against taking and harm are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR Part 402. Section 7(a)(2) requires Federal agencies to insure that activities they authorize, fund, or carry out 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 formal consultation with the Service.

The Klamath River and Columbia River bull trout population segments occur on lands administered by the USFS and BLM; various State-owned properties in Oregon, Washington, Idaho and Montana; and private lands. Federal agency actions that may require consultation as described in the preceding paragraph include Army Corps of Engineers (Corps) involvement in projects such as the construction of roads and bridges, and the permitting of wetland filling and dredging projects subject to section 404 of the Clean Water Act (33 U.S.C. 1344); Federal Energy Regulatory Commission licensed hydropower projects authorized under the Federal Power Act; USFS and BLM timber and grazing management activities; EPA authorized discharges under the National Pollutant

Discharge System of the Clean Water Act; and U.S. Housing and Urban Development projects.

On January 27, 1998, an interagency memorandum between the USFS, BLM and the Service outlined a process for bull trout section 7 conferencing/consultation in recognition of the possibility of an impending listing. The process considers both programmatic actions (e.g., land management plans) and site-specific actions (e.g., timber sales and livestock grazing allotments) and incorporates conferencing/ consultation at the watershed level. The process uses a matrix to determine the environmental baseline and the effects of projects on the environmental baseline of bull trout. The goal of this strategy is to complete conferences for all ongoing actions and proposed actions by the effective date of listing through a system of batching and aggregating of projects to the watershed level. A programmatic LRMP/RMP biological assessment would be used to assess ongoing projects for up to 9 months post-listing that result from implementation of Forest Plans/Resource Management Plans as amended in INFISH, PACFISH and the Northwest Forest Plan. The Service would determine in a programmatic biological opinion whether these issues would jeopardize the continued existence of bull trout, and would authorize incidental take. Part of the project description and evaluation process would stipulate that an ongoing project would be completed by May 10, 1999. For projects that are proposed after the initial 9 month post-listing period, the watershed approach, using the bull trout matrix incorporating local watershed biological data, would be project-specific applied in the section 7 process.

The Act and its implementing regulations found at 50 CFR 17.21 and 17.31 set forth a series of general trade prohibitions and exceptions that apply to all threatened wildlife. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, or collect; or attempt any of these), import or export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been

taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

Permits, authorized under section 10(a)(1) of the Act, may be issued to carry out otherwise prohibited activities involving endangered and threatened wildlife under certain circumstances. Regulations governing permits are at 50 CFR 17.22, 17.23 and 17.32. Such permits are available for scientific purposes, to enhance the propagation or survival of the species, and/or for incidental take in connection with otherwise lawful activities. For threatened species, permits are also available for zoological exhibition, educational purposes, or special purposes consistent with the purpose of the Act. Private landowners seeking permits under section 10 of the Act for incidental take are a means of protecting bull trout habitat through the voluntary development of habitat conservation plans. Information collections associated with these permits are approved under the

Paperwork Reduction Act, 44 U.S.C. 3501 et seq., and assigned Office of Management and Budget clearance number 1018-0094. For additional information concerning these permits and associated requirements, see 50 CFR 17.32.

It is the policy of the Service published in the Federal Register on July 1, 1994, (59 FR 34272) to 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 Act. 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. The Service believes the following actions would not be likely to result in a violation of section 9, provided the activities are carried out in accordance with any existing regulations and permit requirements--

(1) Actions that may affect bull trout in the Klamath and Columbia River basins and are authorized, funded or carried out by a Federal agency when the action is conducted in accordance with an incidental take statement issued by the Service pursuant to section 7 of the Act;

(2) Possession of Columbia River basin bull trout caught legally in accordance with authorized State fishing regulations (see Special Rule section);

(3) State, local and other activities that have been approved by the Service through development of Conservation Plans and special rules under section 4(d) and section 6(c)(1) of the Act.

With respect to both the Klamath River and Columbia River bull trout population segments, the following actions likely would be considered a violation of section 9--

(1) Take of bull trout without a permit, which includes harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting, or attempting any of these actions, except in accordance with applicable State fish and wildlife conservation laws and regulations within the Columbia River bull trout population segment;

(2) To possess, sell, deliver, carry, transport, or ship illegally taken bull trout;

(3) Unauthorized interstate and foreign commerce (commerce across State and international boundaries) and import/export of bull trout (as discussed in the prohibition discussion earlier in this section);

(4) Introduction of non-native fish species that compete or hybridize with, or prey on bull trout;

(5) Destruction or alteration of bull trout habitat by dredging, channelization, diversion, in-stream vehicle operation or rock removal, or other activities that result in the destruction or significant degradation of cover, channel stability, substrate composition, temperature, and migratory corridors used by the species for foraging, cover, migration, and spawning;

(6) Discharges or dumping of toxic chemicals, silt, or other pollutants into waters supporting bull trout that result in death or injury of the species; and

(7) Destruction or alteration of riparian or lakeshore habitat and adjoining uplands of waters supporting bull trout by timber harvest, grazing, mining, hydropower development, or other developmental activities that result in destruction or significant degradation of cover, channel stability, substrate composition, temperature, and

migratory corridors used by the species for foraging, cover, migration, and spawning.

Other activities not identified above will be reviewed on a case-by-case basis to determine if a violation of section 9 of the Act may be likely to result from such activity. The Service does not consider these lists to be exhaustive and provides them as information to the public.

Questions regarding whether specific activities may constitute a violation of section 9 should be directed to the Supervisor of the Service's Snake River Basin Office (see ADDRESSES section). Requests for copies of the regulations concerning listed species and inquiries regarding prohibitions and permits may be addressed to the U.S. Fish and Wildlife Service, Endangered Species Permits, 911 NE 11th Avenue, Portland, Oregon 97232-4181 (telephone 503 231-6241; facsimile 503 231-6243).

Special Rule

Section 4(d) of the Act provides authority for the Service to promulgate special rules for threatened species that would relax the prohibition against taking. The Service finds that statewide angling regulations have become more restrictive in an attempt to protect bull trout throughout Idaho, Montana, Nevada, Oregon, and Washington and are adequate to protect the species from excessive taking. The Service intends to continue to work with the States and Tribes in developing management plans and agreements with the objective of recovery and eventual delisting of the Klamath River and Columbia River distinct population segments. This special rule allows for take of bull trout within the Klamath River and Columbia River distinct population segments when it is in accordance with applicable State and Native American Tribal fish and wildlife conservation laws and regulations, as constituted in all respects relevant to protection of bull trout. The Service believes that this special rule will allow for more efficient management of the species, thereby facilitating its conservation.

National Environmental Policy Act

The Service has determined that an Environmental Assessment, as defined under the authority of the National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act, as amended. A notice outlining the Service's reasons for this determination was published in the Federal Register on October 25, 1983 (48 FR 49244).

Required Determinations

This rule does not contain any new collections of information other than those already approved under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq., and assigned Office of Management and Budget clearance number 1018-0094. For additional information concerning permit and associated requirements for threatened species, see 50 CFR 17.32.

References Cited

A complete list of all references cited herein is available upon request from the Snake River Basin Office (see Addresses section).

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List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

PART 17--[AMENDED]

Accordingly, the Service amends part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below--

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361-1407; 16 U.S.C. 1531-1544; 16 U.S.C. 4201-4245; Pub. L. 99-625, 100 Stat. 3500, unless otherwise noted.

2. Amend Sec. 17.11(h) by adding the following, in alphabetical order under FISHES, to the List of Endangered and Threatened Wildlife to read as follows:

Sec. 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species   Vertebrate
----
population where   When   Critical
                                   Historic
range   endangered or   Status   listed   habitat
Special rules
      Common name   Scientific
name   threatened

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* *
* * *
* *

FISHES
* *
* * *
* *

Trout, bull................. Salvelinus U.S.A. (Pacific NW), Klamath R. (U.S.A.- T 637 NA 17.44 (v)
confluentus. Canada
(NW OR)
Territories).
Do....................... do............. do.............
Columbia R. T 637 NA Do.

(U.S.A.--ID, MT,

OR, WA) mainstem
and its

tributaries,

excluding Jarbidge

R., NV, and east

of Continental

Divide, MT.)
* *
* * *
* *

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3. Amend Sec. 17.44 by adding paragraph (v) to read as follows:

Sec. 17.44 Special rules--fishes.

* * * * *

(v) Bull trout (Salvelinus confluentus), Columbia River and Klamath River population segments.

(1) Prohibitions. Except as noted in paragraph (v)(2) of this section, all prohibitions of 50 CFR 17.31 and exemptions of 50 CFR 17.32 shall apply to the bull trout Columbia River and Klamath River population segments within the contiguous United States.

(2) Exceptions. No person shall take this species, except in accordance with applicable State and Native American Tribal fish and wildlife conservation laws and regulations, as constituted in all respects relevant to protection of bull trout in effect on June 10, 1998.

(3) Any violation of applicable State and Native American Tribal fish and wildlife conservation laws or regulations with respect to the

taking of this species is also a violation of the Endangered Species Act.

(4) No person shall possess, sell, deliver, carry, transport, ship, import, or export, any means whatsoever, any such species taken in violation of this section or in violation of applicable State and Native American Tribal fish and game laws and regulations.

(5) It is unlawful for any person to attempt to commit, solicit another to commit, or cause to be committed, any offense defined in paragraphs (v) (2) through (4) of this section.

Dated: June 1, 1998.

Jamie Rappaport Clark,
Director, Fish and Wildlife Service.
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