National Marine Fisheries Service
Endangered Species Act Section 7 Consultation
Biological Opinion

Agency: United States Forest Service

Activities Considered: Proposal to promulgate a new National Forest System Land Management Planning Rule (36 CFR 219; Planning Rule)

Consultation Conducted by: Interagency Cooperation Division of the Office of Protected Resources, National Marine Fisheries Service

Approved by: ______________________

Date: FEB 15 2012

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1539(a)(2)) requires federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a federal agency's action "may affect" a protected species, that agency is required to consult formally with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service, depending on the particular endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR 402.14(a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS or the U.S. Fish and Wildlife Service concur with that conclusion (50 CFR 402.14(b)).

The U.S. Forest Service initiated formal consultation with NMFS and the U.S. Fish and Wildlife Service on its proposal to promulgate a new National Forest System Land Management Planning Rule. This document represents NMFS' programmatic biological opinion (Opinion) on the Forest Service's proposal to issue those permits at the national level. As an assessment of a national program of categories of activities, this Opinion does not assess the effects of individual land management plans or of site-specific projects or activities. Instead, this Opinion results from the national-level consultation on an action or series of actions affecting many species over all or a major portion of the United States and its territories as described in the Interagency Endangered Species Consultation Handbook (U.S. Fish and Wildlife Service and NMFS 1998). The specific effects of specific land management plans or of site-specific projects or activities would be addressed in separate consultations by NMFS regions.

Consultation History

On 27 July 2011, NMFS initiated formal consultation on the U.S. Forest Service's Planning Rule, which was published on 14 February 2011 (76 Federal Register 8480-8528; "Planning Rule"), and the Forest Service's 27 July 2011 working draft biological assessment. This request came after several months of meetings and discussions between the U.S. Forest Service, NMFS, and U.S. Fish and Wildlife Service that were designed to identify and resolve questions about how endangered and threatened species, designated critical habitat, and proposed and candidate species would addressed in future land management plans under the proposed rule.

On 4 October 2011, the Forest Service provided NMFS with its final biological assessment on the Planning Rule, which allowed NMFS to begin a formal analysis of the effects of the Forest Service's proposal.

On 11 November 2011, the Forest Service provided NMFS with a copy of its draft final Planning Rule ("draft final Planning Rule"), which reflected the Forest Service's responses to comments it had received on the Planning Rule and recommendations that NMFS and the U.S. Fish and Wildlife Service had provided during the formal consultation on the National Forest System Land Management Planning Rule (this Opinion uses the term "Planning Rule" to encompass both the proposed and draft final Planning Rule, but distinguishes between the Planning Rule that had been proposed in the Federal Register and the draft final Planning Rule when that clarity is warranted).

Description of the Proposed Action

The U.S. Forest Service proposes to promulgate a new National Forest System Land Management Planning Rule (36 CFR 219; Planning Rule) which sets requirements for land management planning on all units of the National Forest System. The National Forest System Land Management Planning Rule controls the development of land management plans and sets standards and criteria that apply to those plans. The Forest Service is taking the proposed action pursuant to the National Forest Management Act of 1976 (88 Stat. 476; 16 U.S.C. 1601-1610; NFMA) which requires the Agency to have a Planning Rule developed "under the principles of the Multiple-Use, Sustained-Yield Act of 1960, that set[s] out the process for the development and revision of land management plans, and the guidelines and standards" (16 U.S.C. 1604(g)).

The Forest Service approaches land management through three layers of planning:

1. the Planning Rule entails regulations that (a) prescribe what land management plans must contain, (b) prescribe guidelines that must be followed when agency personnel prepare land management plans, and (c) govern the development, revision, and amendment of land management plans.

2. land management plans establish desired conditions, objectives, suitability determinations for portions of a plan area and standards and guidelines that provide for land uses, including resources outputs that are anticipated and must comply with the requirements of the Planning Rule. Land management plans do not make site-specific decisions or specify resource outputs; instead, they apply general management practices that are designed to achieve multiple-use goals and objectives in the most efficient manner. Land management plans guide land management activities on units of the National Forest System at least every 15 years. After plans are adopted, they may be changed by amendment (16 U.S.C. 1604(f)(4)) or by revision (16 U.S.C. 1604(f)(5)).

   In addition to complying with the requirements of the Planning Rule, land management plans must comply with the mandatory directives contained in Forest Service Directive System is interrelated to the Planning Rule. The Forest Service Directive System consists of the Forest Service Manual and Forest Service Handbooks, which codify the Forest Service's policies, practices, and procedures and serves as the primary basis for internal management and control of all Forest Service programs and the primary source of administrative direction to Forest Service employees. We discuss these directives in more detail in the Interrelated and Interdependent Actions section of this Opinion (which immediately follows this

Description of the Proposed Action) and consider the probable effects of the relevant directives in our assessment of the effects of the Planning Rule on endangered and threatened species under NMFS' jurisdiction and critical habitat that has been designated for those species.

3. site-specific analyses are prepared before decisions to undertake activities or projects on units of the National Forest System, including resource plans, permits, contracts, and other documents prepared prior to the use of a forest. The site-specific projects and activities must be consistent with and implemented according to the applicable land management plan and the Planning Rule.

The 2005 and the revised 2008 Planning Rules were held invalid by a Federal District Court on procedural grounds[1], and because it was the last promulgated rule to take effect and not to have been set aside by a court, the Planning Rule issued in 2000, specifically its transition provisions, is currently in use to develop, amend, or revise plans until a new planning rule is issued.

Elements of Land Management Plans

The Planning Rule requires land management plans to include the following elements:

1. Plan Components

   a. *Desired conditions*. A desired condition is a description of specific social, economic, and/or ecological characteristics of the plan area, or a portion of the plan area, toward which management of the land and resources should be directed. Desired conditions must be described in terms that are specific enough to allow progress toward their achievement to be determined, but do not include completion dates.

   b. *Objectives.* An objective is a concise, measurable, and time-specific statement of a desired rate of progress toward a desired condition or conditions. Objectives should be based on reasonably foreseeable budgets.

   c. *Standards*. A standard is a mandatory constraint on project and activity decision making established to help achieve or maintain the desired condition or conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements.

   d. *Guidelines*. A guideline is a constraint on project and activity decision making that allows for departure from its terms, so long as the intent of the guideline is met. Guidelines are established to help achieve a desired condition or conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements.

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[1] *Citizens for Better Forestry v. USDA*, 481 F. Supp. 2d 1059 (N.D. Cal. 2007) (2005 rule); *Citizens for Better Forestry v. USDA,* 632 F. Supp. 2d 968 (N.D. Cal. 2009) (2008 rule)

e. *Suitability of lands*. Specific lands within a plan area will be identified as suitable for various multiple uses or activities based on the desired conditions applicable to those lands. The plan will also identify lands within the plan area as not suitable for uses that are not compatible with desired conditions for those lands. The suitability of lands need not be identified for every use or activity. Suitability identifications may be made after consideration of historic uses and of issues that have arisen in the planning process. Every plan must identify those lands that are not suitable for timber production.

The set of plan components must meet the requirements set forth in this part for sustainability; plant and animal diversity, multiple uses, and timber.

2. Identify watershed(s) that are a priority for maintenance or restoration. Other plan content includes describing the plan area's distinctive roles and contributions within the broader landscape; the monitoring program; and information reflecting proposed and possible actions that may occur on the plan area during the life of the plan, including; the planned timber sale program; timber harvesting levels; and the proportion of probable methods of forest vegetation management practices expected to be used.

3. *Ecological Integrity*. The Planning Rule requires land management plans to include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity, taking into account:

   a. Interdependence of terrestrial and aquatic ecosystems in the plan area;

   b. Contributions of the plan area to ecological conditions within the broader landscape influenced by the plan area;

   c. Conditions in the broader landscape that may influence the sustainability of resources and ecosystems within the plan area;

   d. System drivers, including dominant ecological processes, disturbance, regimes, and stressors, such as natural succession, wildland fire, invasive species, and climate change; and the ability of those terrestrial and aquatic ecosystems on the plan area to adapt to change;

   e. Wildland fire and opportunities to restore fire adapted ecosystems; and

   f. Opportunities for landscape scale restoration.

4. *Air, soil, and water*. The Planning Rule requires land management plans to include standards or guidelines, to maintain, protect, or restore, air quality; soils and soil productivity, including guidance to reduce soil erosion and sedimentation; water quality, water resources in the plan area, including lakes, streams and wetlands; ground water; public water supplies; sole source aquifers; source water protection areas; and

other sources of drinking water; (including guidance to prevent or mitigate detrimental changes in quantity, quality, and availability);

5. *Riparian areas*. The Planning Rule requires land management plans to include plan components, including standards or guidelines, to maintain, protect, or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain, protect, or restore structure, function, composition, and connectivity, taking into account: water temperature or chemical composition; blockages (uncharacteristic and characteristic) of water courses; deposits of sediment; aquatic and terrestrial habitats; ecological connectivity, restoration needs. and floodplain values and risk of flood loss.

   The Planning Rule requires land management plans to establish width(s) for riparian management zones around all lakes, perennial and intermittent streams, and open water wetlands, within which the land management plan will apply, giving special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams and lakes. Riparian management zone width(s) may vary based on ecologic or geomorphic factors or type of water body; and will apply unless replaced by a site-specific delineation of the riparian area.

   The Planning Rule requires land management plans to ensure that no management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment that seriously and adversely affect water conditions or fish habitat shall be permitted within the riparian management zones or the site-specific delineated riparian areas.

   The Planning Rule requires the Chief of the Forest Service to establish requirements for national best management practices for water quality in the Forest Service Directive System. Plan components must ensure that these practices are implemented.

5. Diversity of plant and animal communities. The Planning Rule requires land management plans to include components that provide the ecological conditions to maintain the diversity of plant and animal communities and the persistence of native species in the land management planning area (those communities and species that are within the Forest Service's authority and those ecological conditions that are consistent with the inherent capability of the land management plan area).

   a. *Ecosystem integrity*. The Planning Rule requires land management plans to include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore their structure, function, composition, and connectivity.

   b. *Ecosystem diversity*. The Planning Rule requires land management plans to include standards or guidelines, to maintain or restore the diversity of ecosystems and habitat types throughout the plan area. In doing so, the plan must include plan components to maintain or restore: key characteristics associated with terrestrial and aquatic ecosystem types; rare aquatic and terrestrial plant and animal communities; and the diversity of native tree species similar to that existing in the plan area.

If the responsible official determines that a land management plan is insufficient to provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area, the Planning Rule requires land management plans to develop additional, species-specific plan components, including standards or guidelines, to provide such ecological conditions in the plan area.

If the responsible official determines that it is beyond the authority of the Forest Service or not within the inherent capability of the plan area to maintain or restore the ecological conditions to maintain a viable population of a species of conservation concern in the plan area, the Planning Rule requires responsible officials to (a) document the basis for that determination and (b) include plan components, including standards or guidelines, to maintain or restore ecological conditions within the plan area to contribute to maintaining a viable population of the species within its range. In providing such plan components the responsible official shall coordinate to the extent practicable with other Federal, State, Tribal, and private land managers having management authority over lands where the population exists.

6. *Species of conservation concern*. The Forest Service defines "species of conservation concern" as "a species, other than federally listed threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area."

7. *Multiple uses*. The Planning Rule requires land management plans, while meeting the requirements for sustainability and diversity, to provide for multiple use management while meeting the requirements for sustainability and diversity, including outdoor recreation, range, timber, watershed, wildlife, and fish purposes and provide for ecosystem services within Forest Service authority and the inherent capability of the plan area. These uses include

    a. *Integrated resource management for multiple use*. The plan must have plan components, including standards or guidelines, for integrated resource management to provide for ecosystem services and multiple uses in the plan area. When developing plan components for integrated resource management, the responsible official shall consider:

        i. Aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, geologic features, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources;

        ii. Appropriate placement and sustainable management of infrastructure, such as recreational facilities and transportation and utility corridors;

        iii. Opportunities to coordinate with neighboring landowners to link open spaces and take into account joint management objectives where feasible and appropriate;

iv. Habitat conditions for wildlife, fish, and plants commonly enjoyed and used by the public;

v. Reasonably foreseeable risks to ecological, social, and economic sustainability;

vi. System drivers, including dominant ecological processes, disturbance regimes, and stressors, such as natural succession, wildland fire, invasive species, and climate change; and the ability of terrestrial and aquatic ecosystems on the plan area to adapt to change;

vii. Threatened, endangered, proposed and candidate species, and potential species of conservation concern present in the plan area;

viii. Land status and ownership, use, and access patterns; and

ix. Existing designated areas located in the plan area including wilderness and wild and scenic rivers and potential need and opportunity for additional designated areas.

8. When a Forest Service unit develops a new plan or revises an existing plan, the Planning Rule requires those land management plans to provide for:

a. Protection of congressionally designated wilderness areas as well as management of areas recommended for wilderness designation to protect and maintain the ecological and social characteristics that justify their suitability for wilderness designation.

b. Protection of designated wild and scenic rivers as well as management of rivers found eligible or determined suitable for the National Wild and Scenic River system to protect the values that provide the basis for their suitability for including in the system

c. Appropriate management of other designated areas or recommended designated areas in the plan area, including research natural areas.

9. The Planning Rule requires land management plans to include components that identify

a. Lands not suited for timber production if any one of the following factors applies:

i. Timber production would not be compatible with the achievement of desired conditions and objectives established by the plan for those lands;

ii. The technology is not currently available for conducting timber harvest without causing irreversible damage to soil, slope, or other watershed conditions;

b. Timber harvest for purposes other than timber production. The Planning Rule allows land management plans to allow for timber harvest for purposes other than timber production throughout the plan area, or portions of the plan area, as a tool to assist in achieving or maintaining one or more applicable desired conditions or objectives of the plan to protect other multiple-use values, and for salvage, sanitation, or public health or safety.

Examples include improving wildlife or fish habitat, thinning to reduce extreme fire risk, or restoring meadow or savanna ecosystems where trees have invaded.

c. Limitations on Timber harvest. Whether for the purposes of timber production or other purposes, the Planning Rule requires land management plans to ensure the following:

i. timber harvests for the purposes of timber production do not occur on lands not suited for timber production.

ii. timber harvest would occur only where soil, slope, or other watershed conditions would not be irreversibly damaged;

iii. timber harvests are carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and aesthetic resources.

iv. timber are harvested from National Forest System lands only where such harvest would comply with the resource protections.

10. The Planning Rule requires responsible officials to develop a monitoring plan for land management plan areas and include those monitoring plans in land management plans. The Planning Rule specifies that monitoring information should enable responsible officials to determine if a change in plan components and other plan content that guide management of resources on the plan area may be needed.

The Planning Rule requires land management plans to develop monitoring programs after coordinating with regional foresters and agency staff from State and Private Forestry, and Research and Development. The Planning Rule allows responsible officials of two or more administrative units to jointly develop monitoring programs.

a. Monitoring programs in land management plans set out the monitoring questions and associated indicators. Monitoring questions and associated indicators must be designed to inform the management of resources on the plan area, including by testing relevant assumptions, tracking relevant changes, and measuring management effectiveness and progress toward achieving or maintaining desired conditions or objectives. Questions and indicators should be based on one or more desired conditions, objectives, or other plan component in the plan, but not every plan component needs to have a corresponding monitoring question.

b. Monitoring programs in land management plans should be coordinated and integrated with relevant broader-scale monitoring strategies, to ensure that monitoring is complementary and efficient, and that information is gathered at scales appropriate to the monitoring questions.

c. The responsible official has the discretion to set the scope and scale of the plan monitoring program, after considering:

  i. Information needs identified through the planning process as most critical for informed management of resources on the plan area;

  ii. Financial and technical capabilities of the Agency.

d. The Planning Rule requires land management plans to contain one or more monitoring questions and associated indicators that address each of the following:

  i. the status of select watershed conditions;

  ii. the status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems;

  iii. the status of focal species to assess the ecological conditions required under § 219.9;

  iv. the status of ecological conditions required under § 219.9 to contribute to the recovery of federally listed threatened and endangered species; conserve proposed and candidate species; and maintain a viable population of each species of conservation concern within the plan area;

  vi. measurable changes on the plan area related to climate change and other stressors on the plan area; and

  vii. the progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities; and

e. The Planning Rule requires regional foresters to develop broader-scale monitoring strategies for plan monitoring questions that can best be answered at a geographic scale broader than one plan area. When they develop these monitoring strategies, the Planning Rule requires regional foresters to coordinate with the relevant responsible officials, agency staff from State and Private Forestry and Research and Development, partners, and the public. Two or more regional foresters may jointly develop broader-scale monitoring strategies.

f. The Planning Rule requires responsible officials to conduct biennial evaluations of new information gathered through the plan monitoring program and relevant information from the broader-scale strategy, and shall issue a written report of the evaluation and make it available to the public.

i. The evaluation must indicate whether a change to the plan, management activities, or monitoring program may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management on the plan area.

ii. The monitoring evaluation report may be incorporated into other planning documents if the responsible official has initiated a plan revision or relevant amendment.

iii. The monitoring evaluation report is not a decision document representing final agency action, and is not subject to the objection provisions of subpart B.

11. The Planning Rule requires responsible officials to describe in an approval document how projects and activities are consistent with the applicable plan components developed or revised by meeting the following criteria:

a. Goals, desired conditions, and objectives. The project or activity contributes to the maintenance or attainment of one or more goals, desired conditions, or objectives or does not foreclose the opportunity to maintain or achieve any goals, desired conditions, or objectives, over the long term.

b. Standards. The project or activity complies with applicable standards.

c. Guidelines. The project or activity:

i. Is designed to comply with applicable guidelines as set out in the plan; or

ii. Is designed in a way that is as effective in carrying out the intent of the applicable guidelines.

Any resource plan developed by the Forest Service that apply to the resources or land areas within the planning area must be consistent with plan components. Resource plans developed prior to plan decision must be evaluated for consistency with the plan and amended if necessary.

1. When a proposed project or activity is not consistent with the applicable plan components, the responsible official shall either:

2. Modify the proposed project or activity to make it consistent with the applicable plan components;

3. Reject the proposal to terminate the project or activity.

4. Amend the plan so that the project or activity will be consistent with the plan as amended; or

5. Amend the plan contemporaneously with the approval of the project or activity so that the project or activity will be consistent with the plan as amended. This amendment may be limited to apply only to the project or activity.

Interrelated and Interdependent Actions

Interdependent actions are actions that have no independent utility apart from the proposed action [50 CFR §402-02]. Interrelated actions are actions that are part of a larger action and depend on the larger action for their justification [50 CFR §402-02]. NMFS did not identify any specific activities that are interrelated to or interdependent with the Planning Rule. However, the Forest Service Directive System is interrelated to the Planning Rule because it establishes additional requirements that land management plans must comply with and places constraints on the set of decisions that would be appropriate for responsible officials in the Forest Service to make.

Specifically, the Forest Service Directive System places additional constraints on the Forest Service's land management plans. This Directive System consists of the Forest Service Manual (FSM) and Forest Service Handbooks (FSH), which codify the Forest Service's policies, practices, and procedures and serves as the primary basis for internal management and control of all Forest Service programs and the primary source of administrative direction to Forest Service employees.

The Forest Service Manual contains legal authorities, objectives, policies, responsibilities, instructions, and guidance that are needed by Forest Service line officers and primary staff in more than one unit to plan and execute assigned programs and activities. Forest Service line officers may depart from mandatory direction when it is necessary to deal effectively with extreme or highly unusual situations and it is legal to do so (FSM 1103.6). In such a case, the line officer must promptly document and inform higher-level officials of the reasons for taking such exception to established policy and procedure. The Forest Service Manual allows line officers to issue immediate direction to employees in the event of an emergency or for reasons of safety (FSM 1103.7), but these directives should be incorporated into the directive system within 15 days for an interim directive or 30 days for an amendment or supplement. Forest Service managers are directed to use the Directive System when conducting reviews of unit performance to determine whether units are complying with direction and/or to identify any changes needed in direction (FSM 1103.11).

The Forest Service directives contain mandatory direction, suggested direction, and procedural direction. Mandatory direction, or requirements applicable to Forest Service employees as the fulfill their duties, is denoted using the words "must" or "shall." Suggested direction, or preferred or advisable courses of action that employees must fully consider, but may depart from based on a written finding are generally denoted using the words "should," "may," or "consider." Procedural direction provide instructions to Forest Service employees on how to carry out their duties.

The chapters of the Forest Service Manual that are relevant for this assessment are:

1. FSM Chapter 2550: Soil Management. This directive establishes the management framework for sustaining soil quality and hydrologic function while providing goods and services outlined in forest and grassland land management plans. It establishes the objective of maintaining and restoring soil quality on National Forest System lands and managing resource uses and soil resources on National Forest System lands to sustain ecological processes and function so that desired ecosystem services are provided in perpetuity.

   This directive establishes Forest Service policy to (FSM 2550.3):

   1. Manage ecosystems to maintain or improve soil quality.

2. Collect and manage information about the properties, distribution, capabilities, condition, suitabilities, and limitations of soils associated with National Forest System lands in accordance with Agency inventory, monitoring, assessment and information management policies.

3. Use chemical, physical, and biological soil properties to assess existing soil condition for watershed condition and ecological assessments.

4. Use soil properties to assess the condition and potential affects on soils, when planning and implementing project activities.

5. Participate as an active partner in the National Cooperative Soil Survey (NCSS) program.

6. Implement established agency standards for soil and terrestrial ecological unit inventories.

2. FSM Chapter 2620: Habitat Planning And Evaluation. This directive identifies the broad objective of habitat planning and evaluation as "to provide habitats to meet goals and objectives for wildlife and fish, including endangered, threatened, and sensitive animal and plant species set forth in land and resource management plans" (FSM 2620.2). Specific objectives are to:

   1. Integrate habitat planning into land management and project plans to meet National, Regional, and local objectives for wildlife and fish, including threatened, and endangered and sensitive animal and plant species.

   2. Provide a sound base of information to support management decision-making affecting wildlife and fish, including endangered, threatened, and sensitive animal and plant species, and their habitats.

   3. Identify opportunities and management strategies to maintain and improve habitats throughout the National Forest System.

   4. Coordinate forest planning for wildlife and fish with State comprehensive planning conducted pursuant to the Fish and Wildlife Conservation Act, as amended by the Sikes Act (FSM 2601, item 6). Include in Forest plans and projects objectives required by the Act.

   5. Achieve Service-wide consistency in how habitats of wildlife, fish, sensitive, and threatened and endangered species are evaluated and considered in land and resource management planning.

   This directive establishes Forest Service policy to (FSM 2620.3):

   1. Use management indicators to address issues, concerns and opportunities for plants, wildlife, fish, and sensitive species habitats through all planning levels.

2. Provide habitat management direction to support recovery of Federally-listed species. Provide habitat management direction to ensure maintenance of viable populations generally well-distributed throughout their current range.

3. Evaluate the cumulative effects of proposed management activities on habitat capability for management indicators.

4. Specify in forest plans and project plans the standards, guidelines, and prescriptions needed to meet identified habitat goals and objectives for wildlife and fish, including endangered, threatened, and sensitive animal and plant species.

5. Monitor management indicators to evaluate compliance of management activities with plan direction, effectiveness of prescribed management, and validity of information used in habitat evaluation and planning.

3. FSM Chapter 2630: Management Of Wildlife And Fish Habitat. This directive identifies the broad objective of maintaining and improving wildlife and fish habitat as identified in a Forest Plan.

This directive establishes Forest Service policy to (FSM 2630.3):

1. Carry out direct habitat improvement projects to achieve wildlife and fisheries objectives.

2. Coordinate with other uses and activities to accomplish habitat management objectives and to reduce detrimental effects on wildlife and fisheries.

3. Mitigate the negative effects of other resource projects upon wildlife and fish habitat.

4. Cooperate with States, other Federal agencies, and private groups to plan and accomplish habitat management.

4. FSM Chapter 2640: Stocking And Harvesting. This directive identifies the objective of providing diverse opportunities for esthetic, scientific, and consumptive uses of wildlife and fish resources on a sustained-yield basis under applicable Federal and State laws and regulations (FSM 2640.2).

This directive establishes Forest Service policy to (FSM 2640.3):

1. Provide habitat for stocked species and assist in stocking and introduction operations to restore locally extinct indigenous species, to recover threatened and endangered species, and to introduce new species in coordination with State and Federal agencies.

2. Provide a variety of fishing, hunting, trapping, viewing, studying, and photographing opportunities and experiences in cooperation with the State fish and wildlife agencies.

3. Emphasize the protection, enhancement, and maintenance of habitats for production of wildlife and fish. Introductions or stocking of species may be made to restore resources following

environmental changes, to provide recreation opportunities where reproduction is insufficient to meet demand, or to introduce new species desired by the public.

4. Favor native or desirable non-native species over new exotic species in stocking and introductions.

5. FSM Chapter 2670: Threatened, Endangered, And Sensitive Plants And Animals. This directive establishes the objectives of managing National Forest System habitats and activities for threatened and endangered species to achieve recovery objectives so that special protection measures provided under the Endangered Species Act are no longer necessary and promoting recovery efforts through Research and Development and State and Private Forestry programs (2670.21). This directive establishes objectives, policies, and guidance that also apply to sensitive species.

   This directive establishes Forest Service policy to (FSM 2670.3):

   1. Place top priority on conservation and recovery of endangered, threatened, and proposed species and their habitats through relevant National Forest System, State and Private Forestry, and Research and Development activities and programs.

   2. Establish, through the Forest planning process, objectives for habitat management and/or recovery of populations, in cooperation with states, the Department of the Interior, Fish and Wildlife Service (FWS) or the Department of Commerce, National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries), and other federal agencies.

   3. Review, through the biological evaluation process, actions and programs authorized, funded, or carried out by the Forest Service to determine their potential for effect on threatened and endangered species and species proposed for listing.

   4. Avoid all adverse impacts on threatened and endangered species and their habitats, except when it is possible to compensate adverse effects totally through alternatives identified in a biological opinion rendered by the Department of the Interior, Fish and Wildlife Service (FWS) or Department of Commerce, National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries); when an exemption has been granted under the act; or when the FWS or NOAA Fisheries biological opinion recognizes an incidental taking. Avoid adverse impacts on species proposed for listing during the conference period and while their federal status is being determined.

   5. Initiate consultation or conference with the FWS or NOAA Fisheries when the Forest Service determines that proposed activities may have an effect on threatened or endangered species; are likely to jeopardize the continued existence of a proposed species; or result in the destruction or adverse modification of critical or proposed critical habitat.

6. Identify and prescribe measures to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species. Protect individual organisms or populations from harm or harassment as appropriate.

The Administrative Procedure Act (5 U.S.C. 553), the National Forest Management Act of 1976, and the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (16 U.S.C. 1612(a)) require the Forest Service to involve the public in the formulation of directives. When responsible officials determine that formal public review is necessary for agency-wide directives that would be contained in the Forest Service Manual (pursuant to procedures prescribed by 36 CFR 216.4), the Forest Service is required to publish those directives for public review and comment. In those cases, Forest Service regulations require the agency to publish notice in the Federal Register and provide the public with a minimum of 60 calendar days for review and comment (36 CFR 216.6(a)(3)).

In addition to the directives in the Forest Service Manual, the following Forest Service Handbooks contain policies and guidance that are relevant to this consultation:

1. FSH 2609.21 Wildlife Habitat Evaluation Handbook.

2. FSH 2609.23 Fisheries Habitat Evaluation Handbook.

3. FSH 2609.24 Wildlife and Fisheries Habitat Management Handbook.

4. FSH 2609.25 Threatened and Endangered Plants Program Handbook.

2 Approach to the Assessment

2.1 Overview of NMFS' Assessment Framework

Section 7(a)(2) of the Endangered Species Act of 1973, as amended, requires federal agencies, in consultation with and with the assistance of the Services, to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of endangered species, threatened species, or critical habitat that has been designated for these species (16 U.S.C. 1539). During consultations on specific actions, NMFS fulfills its obligations using an assessment framework that begins by identifying the physical, chemical, or biotic components of proposed actions that are likely to have individual, interactive, or cumulative direct and indirect effect on the environment (we use the term "potential stressors" for these components of an action); we then determine whether listed species or designated critical habitat are likely to be exposed to those potential stressors; we estimate how listed species or designated critical habitat are likely to respond to any exposure; then we conclude by estimating the risks those responses pose to the individuals, populations, and species or designated critical habitat that are likely to be exposed.

Federal agency programs apply to activities over large geographic areas over long periods of time, with substantial uncertainty about the number, location, timing, frequency, and intensity of specific activities those programs would authorize, fund, or carry out. Our traditional approaches to section 7(a)(2)consultations, which focus on the specific effects of a specific proposal, are not designed to deal with the spatial and temporal scales and level of uncertainty that is typical of consultations on agency programs.

Instead of trying to adapt traditional consultation approaches to programmatic consultations, we have developed an assessment framework that specifically allows us to help Federal agencies insure that their programs comply with the requirements of section 7(a)(2) of the ESA. Specifically, our programmatic consultations examine the decision-making processes that are integrated into Federal agency programs to determine whether those decision-making processes are likely to insure that specific actions the agency authorizes, funds, or carries out through the program comply with the requirements of section 7(a)(2). That is, during programmatic consultations we ask whether or to what degree the Federal action agency (in this case, the U.S. Forest Service) has structured its proposed program so that the agency (1) collects the information necessary to allow it to know or reliably estimate the probable individual and cumulative consequences of its program on the environment, generally, and listed resources specifically; (2) evaluates the information it collects to assess how its actions have affected the environment, generally, and endangered species, threatened species, and designated critical habitat specifically; and (3) when this information suggests that the activities authorized, funded, or carried out by its program no longer comply with the mandate and purposes of its program or of section 7(a)(2) of the ESA, does the Action Agency use its authorities to bring those activities into compliance with program mandates and the requirements of section 7(a)(2) of the ESA. Here, "program structure" refers to the decision-making processes, applications of standards and criteria (including standards of information and treatment of uncertainty), feedback loops and internal audits, and controls (including permit conditions) that agencies employ to ensure that agency decisions to authorize fund, or carry out specific actions or a class of actions are likely to fulfill the mandates of the program before the agency authorizes, funds, or carries out those actions.

Figure 1.0 displays a normative model of a decision-making process that includes these program elements and feedback loops. The process trigger on the left-hand side of the figure (Box D1) might represent an application from a prospective permittee or licensee, a request for prospective funding, or a proposed action that would be undertaken by a federal agency. These process triggers are typically subjected to two screening processes (Box D2):

1. an initial screening process that are designed to insure that proposals minimally comply with statutory, regulatory, or policy requirements that are applicable to requests for permits, licenses, or funding and

2. secondary screening processes that are designed to insure that an agency satisfies the statutory, regulatory, or policy requirements or criteria that must be met before an agency can issue a permit, license, or funding.

As applied to this consultation, the new Land Management Planning Rule the Forest Service proposes to promulgate, in effect, establishes the criteria that would be used to screen land management plans or approval documents associated with specific projects or activities. As described in the Planning Rule, screening criteria for land management plans would include a determination of whether a land management plan included a statement of desired condition for the plan area, included components that address ecological integrity, diversity of plant and animal communities, species of special concern, integrated resource management, and timber requirements. Additional screens would include compliance with the statutory requirements of the National Forest Management Act of 1976, the Multiple-Use, Sustained-Yield Act of 1960, National Environmental Policy Act, Endangered Species Act of 1973, Clean Water Act, Clean Air Act, Wilderness Act, etc. Process triggers would consist of the approval of land management plans or approval of specific projects of activities undertaken in accordance with a land management plan.

Agency screening processes typically produce recommendations to agency decision-makers, who have the authority to make final decisions on Agency Actions (Figure 2.1, Box D3). Following those decisions, the Action Agency, permittee, licensee, or funding recipient undertakes the action, including any terms or conditions the Action Agency has attached (Figure 2.1, Box O1). The action produces a set of direct, indirect, and cumulative effects on the environment and any living organisms that occur in or rely on the environment that is affected by the action (Figure 2.1, Box O2) and the condition of the environment changes in response to those effects (Figure 2.1, Box O3). The significance of any changes in the condition of the environment should be determined by comparing the state of the environment with the action in place to some reference criterion, which is typically the desired condition of the environment (often established in statute).

Figure 1.0 A normative model of a decision-making process that includes these program elements and feedback loops. See text for further explanation

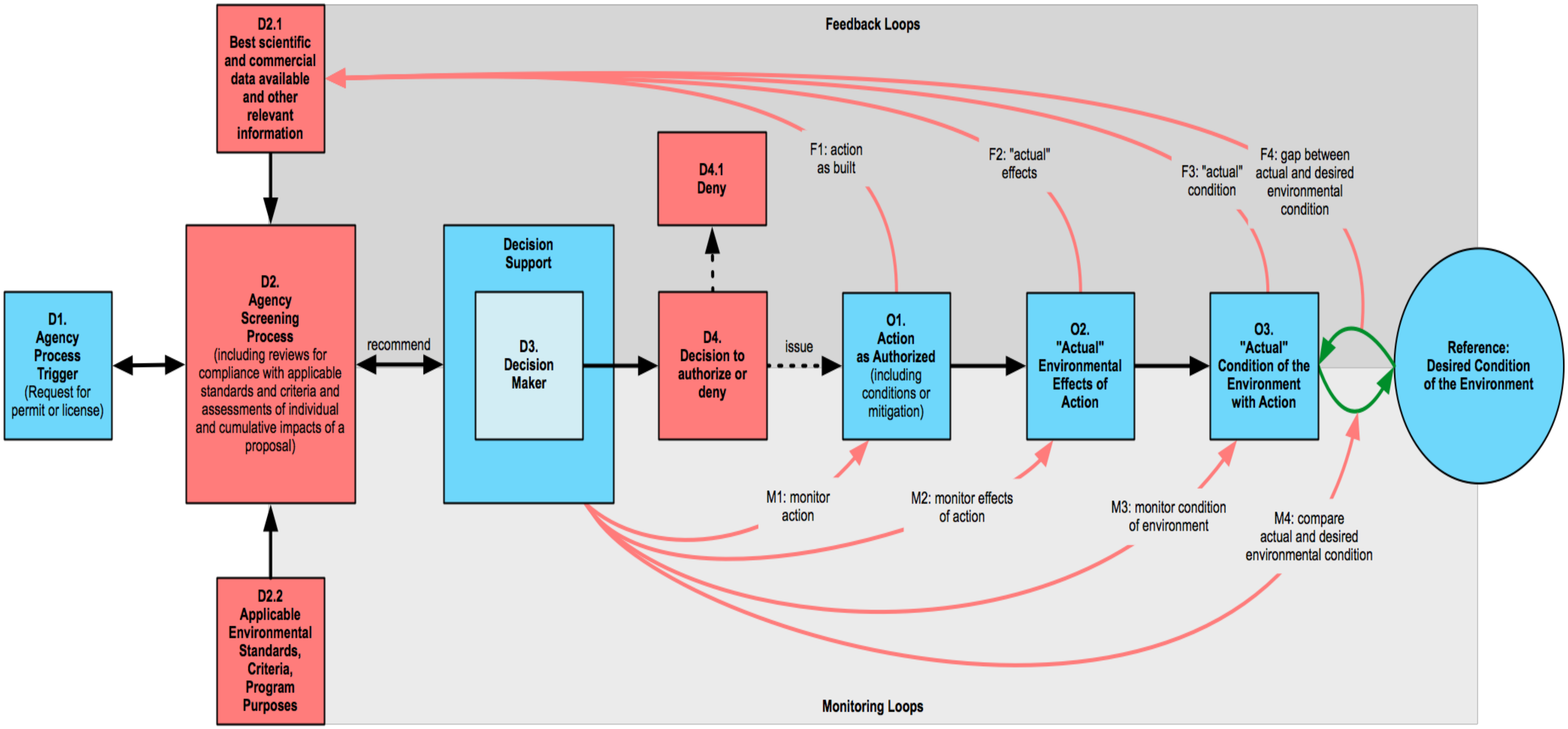

Figure 2.1 also displays a program that contains an audit function represented by a monitoring component (Figure 2.1, Lines M1 to M4), a feedback component (Figure 2.1, Lines F1 to F4), and an information gathering and evaluation component that informs a screening process (Figure 2.1, Box D2.1). The monitoring component would collect empirical information on individual actions or a sample of individual actions to (a) identify what action actually occurred for comparison with the action that had been proposed and approved (implementation monitoring; Figure 2.1, Line M1); (b) identify which terms and conditions, if any, were satisfied, including any mitigation measures that were required (implementation monitoring; Figure 2.1, Line M1), (c) gather empirical information on the action's direct and indirect effects on the environment, including the effectiveness of any mitigation measures that had been required (validation and compliance monitoring; Figure 2.1, Line M2), (d) gather the empirical evidence to determine whether or to what degree the environment changed in response to those effects (Figure 2.1, Line M3); and (e) gather the empirical evidence sufficient to determine whether a proposal contributed to environmental conditions that fail to meet program purposes and standards (compliance monitoring; Figure 2.1, Line M4). The feedback component evaluates empirical data collected by monitoring and incorporates those data into agency decisions about prior or subsequent actions (Figure 2.1, Lines F1 through F4).

Regardless of whether an agency's decision-making processes corresponds to the model presented in Figure 2.1, five components of an agency's decision-making process are critical to our assessment of whether or to what degree an agency's program would be expected to insure that individual actions authorized, funded, or carried out by the program comply with the requirements of section 7(a)(2) of the ESA. The first critical component is the screening process an agency applies to specific actions authorized, funded, or carried out by a program. When we examine this component of an Agency's decision-making process, questions we ask include: What standards apply to the screening process? How rigorous are those standards? How rigorously does the Action Agency apply those standards? Are proposals assumed to comply with an Agency's statute barring evidence of non-compliance or vice versa? Which party (prospective permittees or the Action Agency) bears the responsibility for presenting the evidence that supports their position? Does an Agency's record of performance allow us to conclude that the screening process works as designed by filtering out proposals that do not satisfy applicable environmental mandates, standards, criteria, and program purposes?

The second critical component is the information that forms the foundation for the agency's screening process (Figure 2.1, Boxes D1.1, D2.1, and D2.2). When we examine this component of an agency's decision-making process, questions we ask include: Does the agency assess the individual and cumulative impacts of specific proposals? Does the agency's methodology consider all of the variables that would have to be considered to determine whether a specific proposal is likely to have adverse consequence for endangered or threatened species and designated critical habitat? Do assessments employ data acquisition procedures that are likely to identify, gather, and analyze all of the information that would be relevant to identify the presence or absence of consequence for endangered or threatened species and designated critical habitat? Does the assessment process incorporate quality assurance and quality control procedures? Are those procedures designed to prevent Type I decision error (falsely concluding that a proposal had an adverse impact), Type II decision error (falsely concluding that a proposal had no adverse impact), or both?

The third critical component is an Action Agency's decision-making process, which includes the information and variables that inform the Agency's decision on whether or not to authorize, fund, or implement an action, the decisions the Agency makes, and any conditions or terms the Agency attaches to its decision. When we examine this component of an agency's decision-making process, questions we examine patterns in prior decisions the Agency has made to determine whether or to what degree those decisions have insured that the subsequent action complies with the requirements of section 7(a)(2) of the ESA.

The fourth critical component is an audit function. Does the Action Agency regularly or continuously audit the results of its actions? Are the monitoring and feedback loops (Figure 2.1, lines M1 to M4 and F1 to F4) designed to allow the Agency to (a) collect empirical information that allows them to insure that specific actions they authorize, fund, or carry out are undertaken as designed (including any terms, conditions, or mitigation measures associated with the proposal), (b) assess the actual effects of those actions, and (c) determine whether the program is fulfilling its mandate, purposes, and goals. Finally, we examine an Agency's record of performance over time to determine whether or to what degree its actual decisions show evidence of incorporating new information to improve subsequent decisions.

The final critical component is the agency's authority to modify its prior and subsequent decisions — and its willingness to use that authority — when new information (particularly information provided by the audit function) reveals that particular authorizations have not satisfied applicable environmental mandates, standards, criteria, and program purposes (the applicable environmental mandates includes compliance with section 7(a)(2) of the ESA).

We organize our programmatic consultations using a sequence of questions that focus on the agency's decision-making process, in general, and the five critical components we just described. Those questions focus on whether and to what degree an Agency has structured a program so that the Agency is in a position to know or reliably estimate whether endangered or threatened species or designated critical habitat are likely to be (a) exposed to stressors associated with specific actions a program would authorize, fund, or carry out; (b) respond to that exposure; and (c) experience individual-level, population-level, or species-level risks as a result of those responses. Further, we ask whether or to what degree an agency actively gathers that information, whether or to what degree an agency incorporates that information into its decision-making processes about specific actions, and whether or to what degree an agency changes the decisions it makes about specific actions based on that information.

It might be possible for NMFS to conclude that a Federal Action Agency had failed to insure that their actions comply with the requirements of section 7(a)(2) of the ESA without endangered or threatened species or designated critical habitat being adversely affected by that failure. To address this possibility, we preface our assessments of an agency's decision-making process with an assessment of the probable consequences of exposing endangered and threatened species and designated critical habitat to the physical, chemical, and biotic stressors that are known to be associated with actions the program would authorize, fund, or carry out. This component of our analyses establish the risks program pose to endangered and threatened species and designated critical habitat. Any risks we identify in this component of our analyses provide the context for our assessment of whether or to what degree an agency's program is likely to eliminate or avoid the risks the program poses.

RISK ANALYSES FOR ENDANGERED AND THREATENED SPECIES AND DESIGNATED CRITICAL HABITAT. As we described in the introduction to this Chapter, NMFS helps Action Agencies determine whether or to what degree they have complied with the requirements of section 7(a)(2) of the ESA by assessing whether and to what degree an Agency has structured a program so that the Agency is in a position to know or reliably estimate (a) whether endangered or threatened species are likely to be placed at increased risk of extinction, or (b) if those species avoid extinction, whether they are likely to experience increased risk of failing to recover from having been endangered or threatened because of the actions the program authorizes, funds, or carries out.

However, as we described in the preceding subsection of this Chapter, we preface our assessments of an agency's decision-making process with an assessment of the probable consequences of exposing endangered and threatened species and designated critical habitat to the physical, chemical, and biotic stressors that are known to be associated with actions the program would authorize, fund, or carry out. This component of our analyses establish the risks program pose to endangered and threatened species and designated critical habitat[2]. Any risks we identify in this component of our analyses provide the context for our assessment of whether or to what degree an agency's program is likely to manage those risks by eliminating or avoiding them.

Our consideration of how well an agency's program manages risks to endangered and threatened species reflects ecological relationships between listed species, the populations that comprise them, and the individuals that comprise those populations: the continued existence of species is determined by the fate of the populations that comprise them and the continued existence of a population is determined by the fate of the individuals that comprise them. Populations grow or decline as the individuals that comprise the population live, die, grow, mature, migrate, and reproduce, or fail to do so. When we assess whether or to what degree an agency's program is likely to eliminate or avoid risks to endangered or threatened species, we are mindful of the distinction between species, the populations that comprise the species, and the individuals that comprise those populations.

When we assess whether or to what degree an agency's program is likely to eliminate or avoid risks to individual members of endangered or threatened species, we think in terms of the individuals' fitness — its current or expected future reproductive success — which integrates an individuals' longevity with its current and future reproductive success. In particular, we examine the scientific and commercial data available to determine if an individual's probable response to stressors produced by an Action would reasonably be expected to reduce the individual's current or expected future reproductive success by increasing an individual's likelihood of dying prematurely, increasing the age at which it becomes reproductively mature, reducing the age at which it stops reproducing, reducing the number of live births it produces during any reproductive bout, reducing the number of reproductive bouts it engages in over its reproductive lifespan (in animals that reproduce multiple times), or causing the individual's progeny to experience any of these phenomena (Brommer 2000, Brommer *et al*. 1998, 2002; Clutton-Brock 1998, Coulson *et al*. 2006, Kotiaho *et al*. 2005, McGraw and Caswell 1996, Newton and Rothery 1997, Oli and Dobson 2003, Roff 2002, Stearns 1992, Turchin 2003).

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[2] We are aware that several courts have ruled that the definition of destruction or adverse modification that appears in the section 7 regulations at 50 CFR 402.02 is invalid and do not rely on that definition for the determinations we make in this Opinion. Instead, as we explain in the text, we use the "conservation value" of critical habitat for our determinations which focuses on the designated area's ability to contribute to the conservation of the species for which the area was designated.

When individual members of an endangered or threatened species can be expected to experience reductions in their current or expected future reproductive success or experience reductions in the rates at which they grow, mature, or become reproductively active, we would expect those reductions to also reduce the abundance, reproduction rates, and growth rates (or increase variance in one or more of these rates) of the populations those individuals represent (see Stearns 1992). Actions that are likely to reduce one or more of these variables (or one of the variables we derive from them) have fulfilled a *necessary* condition for reductions in viability of the population(s) those individuals represent, which would also satisfy a *necessary* condition for reductions in the viability of the species those populations comprise. Our programmatic assessments focus on whether or to what degree an agency's program is likely to insure that the direct or indirect effects of actions the program would authorize are not likely to reduce the fitness of listed individuals or are not likely to reduce that fitness to a degree that would be sufficient to reduce the viability of the population(s) those individuals represent.

Our consideration of how well an agency's program manages risks to designated critical habitat focuses on the value of the physical, chemical, or biotic phenomena of the critical habitat for the conservation of the endangered and threatened species for which the critical habitat was designated. In this step of our assessment, we consider information about the contribution of constituent elements of critical habitat (or of the physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species, particularly for older critical habitat designations that have no constituent elements) to the conservation value of those areas of critical habitat that occur in the action area. Then we consider the contribution of the conservation value of those areas to the conservation value of the entire critical habitat designation. Our programmatic assessments focus on whether or to what degree an agency's program is likely to insure that the direct or indirect effects of actions the program would authorize are not likely to reduce the conservation value of critical habitat that has been designated for endangered or threatened species or are not likely to reduce that conservation value to a degree that would be sufficient to reduce the species' likelihood of recovering from having been endangered or threatened.

2.2 Application of this Approach in this Consultation

As we have already discussed in section 2.1 of this chapter, we treat the proposed Land Management Planning Rule as establishing a "program" of requirements that would apply land management plans, which control the subsequent development of site-specific projects or actions. Specifically, the Planning Rule requires land management plans to contain specific components — desired conditions, objectives, standards, guidelines, etc. — and requires projects or activities to be consistent with those plan components.

The Planning Rule establishes a framework that is similar to the normative decision-model that we described in Figure 1, and that would apply to new, amended, and revised land management plans. The Planning Rule establishes requirements that would be used to screen land management plans or approval documents associated with specific projects or activities, including statements of desired conditions for plan areas, components that address ecological integrity, diversity of plant and animal communities, species of special concern, integrated resource management, and timber management. For these reasons, we assess the probable effects of the Planning Rule using the five critical elements of a decision-making process that we discussed in the preceding section:

1. What standards apply to the process of approving or rejecting land management plans and project approval documents?

   1.1 How rigorous are the standards that are established by the Planning Rule? That is, are those standards sufficient to insure that land management plans that are likely to increase the extinction risks of endangered or threatened species are not approved? Are those standards sufficient to insure that projects or activities that are consistent with a land management plan and that would be likely to increase the extinction risks of endangered or threatened species are not approved?

   1.2 How rigorously does the U.S. Forest Service enforce adherence to the requirements established by the Planning Rule?

   1.3 Are projects or activities undertaken in accordance with approved land management plans assumed to comply with the requirements of the Planning Rule barring evidence of non-compliance or vice versa?

   1.4 Does the Planning Rule require responsible officials within the U.S. Forest Service to present evidence that establishes that a land management plan or a project or activity undertaken in accordance with a land management plan complies with the requirements of the Planning Rule or are those projects or activities assumed to be compliant barring evidence to the contrary?

2. What information forms the foundation for the Forest Service's approval of land management plans or project or activities undertaken in accordance with those plans (Figure 2.1, Boxes D1.1, D2.1, and D2.2)?

   2.1 Does the Planning Rule or other agency regulation, policy, or guidance require agency personnel to assess the individual and cumulative impacts of specific projects or activities contained in individual land management plans or between land management plans?

   2.2 Does the Planning Rule or other agency regulation, policy, or guidance require Forest Service personnel to adopt assessment methods that consider the variables that would have to be considered to determine whether an individual projects or activities are likely to have adverse consequence for endangered or threatened species and designated critical habitat when undertaken individually or cumulatively?

   2.3 Does the Planning Rule or other agency regulation, policy, or guidance require agency personnel to actively identify, gather, and analyze data and other information that would be relevant to identifying the presence or absence of adverse consequences for endangered or threatened species and critical habitat that has been designated for such species?

   2.4 Does the Planning Rule or other agency regulation, policy, or guidance establish quality assurance and quality control procedures that would apply to land management plans or project or activity approval documents?

2.5 Does the Planning Rule or other agency regulation, policy, or guidance establish procedures that are designed to prevent Type I decision error (falsely concluding that a project or activity undertaken in accordance with an approved plan had an adverse impact), Type II decision error (falsely concluding that a project or activity undertaken in accordance with an approved plan had no adverse impact), or both?

3. What constraints, if any, does the Planning Rule place on the decisions of officials who are responsible for approving land management plans or projects or activities undertaken in accordance with those plans? When we examine this component of an agency's decision-making process, we examine patterns in prior decisions the Agency has made to determine whether or to what degree those decisions have insured that the subsequent action complies with the requirements of section 7(a)(2) of the ESA.

4. Does the Planning Rule or other agency regulation, policy, or guidance establish a mechanism by which the U.S. Forest Service will regularly or continuously audit land management plans or projects or activities undertaken in accordance with those plans to insure that they bring the plan areas closer to the desired conditions of those areas?

   Are the monitoring and feedback loops (Figure 2.1, lines M1 to M4 and F1 to F4) designed to allow Forest Service units to:

   4.1 collect empirical information that allows them to insure that specific project or activities undertaken in accordance with land management plans are undertaken as designed (including any terms, conditions, or mitigation measures associated with the proposal),

   4.2 assess the actual effects of those actions, and

   4.3 determine whether the land management plan is fulfilling its mandate, purposes, and goals. As part of this process, we examine an Agency's record of performance over time to determine whether or to what degree its actual decisions show evidence of incorporating new information to improve subsequent decisions.

5. Does the Planning Rule or other agency regulation, policy, or guidance require responsible officials to modify their prior and subsequent decisions when new information (particularly information provided by the audit function) reveals that particular projects or activities (considered individually or cumulatively) have not satisfied applicable environmental mandates, standards, criteria, and program purposes, including compliance with section 7(a)(2) of the ESA?

   As we also discussed in the introduction to this chapter, it might be possible for NMFS to conclude that a Federal agency had failed to insure that their actions comply with the requirements of section 7(a)(2) of the ESA without endangered or threatened species or designated critical habitat being adversely affected by that failure. To address this possibility, we preface our assessment of the decision-making process that would be established by the Planning Rule with an assessment of the decision-making processes the U.S.

Forest Service currently employs and the consequences of those processes for endangered and threatened species and designated critical habitat.

Evidence Available for the Consultation

The evidence available for this consultation includes the numerous reviews of land management plans and the management planning process that have been conducted since the late 1970s. For example, in 1990, the U.S. Forest Service conducted a comprehensive review of the management planning process that appeared as an 11 volume series of reports "Critique of Land Management Planning;" that review evaluated a wide variety of subjects, including the usefulness of forest plans, the effectiveness of Forest Service decision-making processes, and analytical tools available to support the planning process. Between 1997 and 1999, a committee of scientists developed recommendations on how the Forest Service could better manage the National Forest System (Committee of Scientists 1999). The evidence also consisted of reviews of U.S. Forest Service and U.S. Bureau of Land Management planning processes that have been conducted by the Congressional Research Service (for example, Grote 1998 and Grote *et al*. 2008), U.S. General Accountability Office (1991, 1994, 1997, 2000a, 2000b, 2009, 2011), analyses developed by personnel in Forest Service research stations (for example, Deal 2008, Everest *et al*. 1997, Jensen *et al*. 1994), the 2011 science review of the Forest Service's draft Environmental Impact Statement for the Planning Rule (Resolve 2011), and reviews available in the public scientific literature.

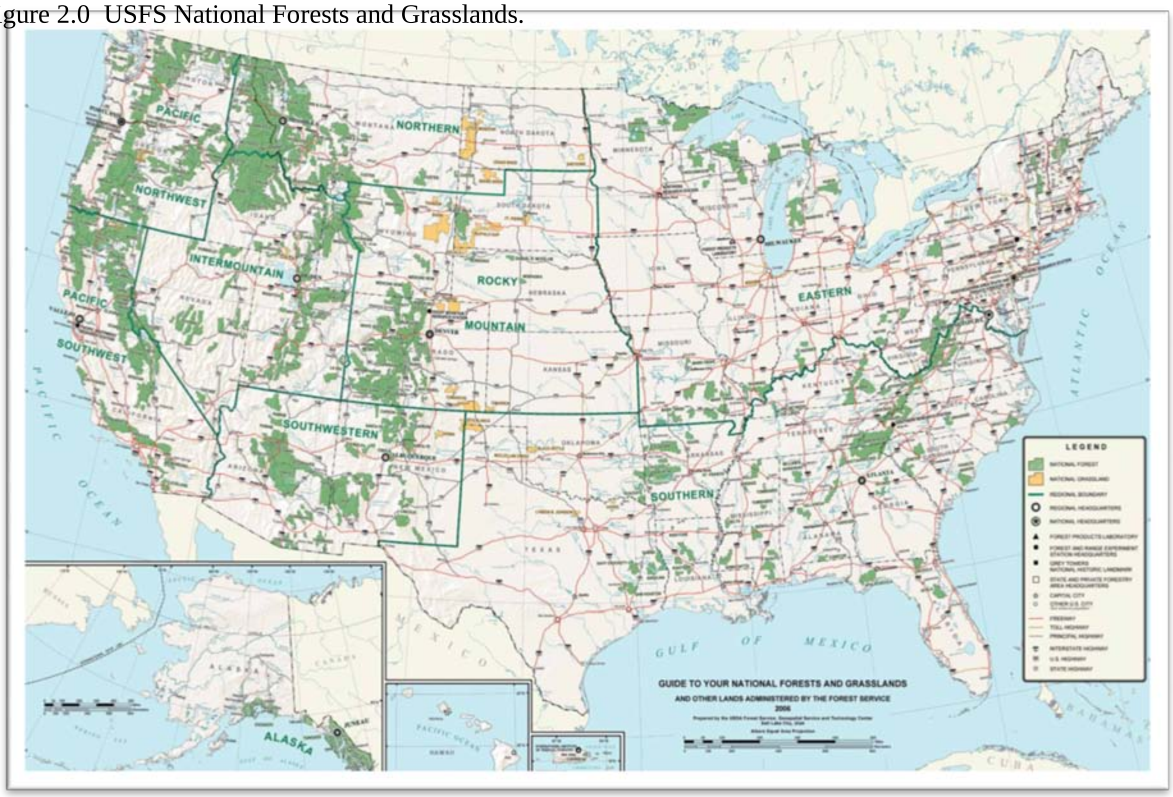
We supplemented this information by conducting electronic searches of literature published in English or with English abstracts using the Library of Congress' First Search and Dissertation Abstracts databases; SCOPUS, Web of Science; Cambridge Abstract's Aquatic Sciences and Fisheries Abstracts (ASFA); Google and Google Scholar; Yahoo! and Yahoo! Advanced Web Search; Microsoft Bing; Mendeley; ScienceDirect, and Scribd database services. The First Search databases provide access to literature in the biological, ecological, and agricultural sciences, master's theses, and doctoral dissertations published in professional journals between 1980 and today (although references for many scientific journals contained in the database only date to 1990 or 1992). In the First Search suite of databases, we specifically used the ArticleFirst, BasicBiosis, Proceedings and ECO databases, which index the major journals dealing with issues of ecological risk and water quality issues (for example, the journals Environmental Toxicology and Chemistry, Human and Ecological Risk Assessment), wetland ecology, conservation, and management (Environmental Management, Estuaries, Journal of Wildlife Management, Restoration Ecology, Wetlands, Wildlife Society Bulletin) and the ecology of threatened and endangered species (Ambio, Biological Conservation, Bioscience, Canadian Journal of Fisheries and Aquatic Sciences, Conservation Biology, Ecology, Ecological Applications Journal of Animal Ecology, Journal of Applied Ecology). In addition, we conducted electronic searches of journals published by Springer-Verlag and Elsevier using their respective web-sites and search engines.

For our electronic searches, we used paired combinations of the keywords: land management plan, land and resources management plan, Bureau of Land Management, Forest Service, U.S. Forest Service, National Forest, National Forest System, forest sustainability, and public land management. We acquired all references that, based on a reading of their titles or abstracts, appeared to comply with these keywords. If a reference's title did not allow us to eliminate it as irrelevant to this inquiry, we acquired the reference. We supplemented our electronic searches by searching the literature cited sections of journal articles and other documents we acquired electronically. Because the geographic scope of the Planning Rule is limited to the United States, its territories, and possessions, we limited the scope of our searches to that geographic area as well. We organized the results of these searches using bibliographic software.

Action Area

The Planning Rule applies to land and resource management planning for all the lands and resources of the National Forest System, which includes approximately 193 million acres in 44 states, Puerto Rico, and the Virgin Islands (Figure 2). The National Forest System is composed of 155 national forests, 20 national grasslands, one national prairie, and other miscellaneous lands under the jurisdiction of the Secretary of Agriculture. The U.S. Forest Service administers the National Forest System in accordance with the Multiple-Use Sustained-Yield Act, the NFMA, and other laws.

Figure 2.0 USFS National Forests and Grasslands.



Because NMFS only has jurisdiction over anadromous and estuarine fish species, marine mammals, sea turtles and marine invertebrates and their critical habitat, this consultation addresses the potential effects of the Planning Rule in a portion of this Action Area. Specifically we focus on the effects of the Planning Rule within the boundaries of the following states out to the Pacific Ocean: Alaska, Idaho, Washington, Oregon, California and Hawaii; Atlantic Ocean: North Carolina, South Carolina, and Florida; including Puerto Rico and the Virgin Islands. These states encompass the geographic areas where U.S. Forest Service's authority overlaps with the distribution of endangered or threatened species and their designated critical habitat under NMFS' jurisdiction occur.

3. Status of Listed Resources

In this section of this Opinion we state the threatened and endangered species[3] and their designated critical habitat that occur in the action area and may be exposed to the direct or indirect effects of actions that would be carried out under NFS Land management plans authorized by the proposed NMFA Planning Rule. Over 90 ESA-listed or proposed listed species are under NMFS jurisdiction, but not all of these species will be affected by the Planning Rule. For this consultation, any listed or proposed species or their critical habitat living on or downstream of U.S. Forest Service lands could be affected by the implementation of the Planning Rule will be analyzed in the biological opinion. The species proposed for listing will be analyzed in this document as a conference opinion, which could then be adopted as a biological opinion following the final listing decision.

Since the Planning Rule may be effective for many decades, the specific species affected could and almost certainly will change over time. However, it will always address endangered and threatened listed species, as well as proposed and candidate species on National Forest System lands, regardless of when they become listed, since each management plan must undergo a Section 7(a)(2) consultation when a new species becomes listed.

NMFS has determined that the following species and critical habitat designations may be affected by the proposed NFMA Planning Rule:

Table 1. Species and critical habitat designations considered in this consultation

Common Name	*Scientific Name*	Listed As
Beluga whale, Cook Inlet (with critical habitat)	*Delphinapterus leucas*	Endangered
Killer whale, Southern Resident (with critical habitat)	*Orcinus orca*	Endangered
Sea lion, Steller (eastern population)	Eumetopias jubatus	Threatened
Eulachon, Pacific (Southern population)	Thaleichthys pacificus	Threatened
Salmon, Chinook (California coastal) with critical habitat	Oncorhynchus tshawytscha	Threatened
Salmon, Chinook (Central Valley spring-run) with critical habitat		Threatened
Salmon, Chinook (Lower Columbia River) with critical habitat		Threatened

[3] In this section of the Opinion, we use the word "species" as it has been defined in section 3 of the ESA, which include "species, subspecies, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature (16 U.S.C. 1533)". Pacific salmon that have been listed as endangered or threatened were listed as "evolutionarily significant units (ESU)" which NMFS uses to identify distinct population segments (DPS) of Pacific salmon. Any ESU or DPS is a "species" for the purposes of the ESA.

Table 1. Species and critical habitat designations considered in this consultation

Common Name	*Scientific Name*	Listed As
Salmon, Chinook (Puget Sound) with critical habitat		Threatened
Salmon, Chinook (Snake River fall-run) with critical habitat		Threatened
Salmon, Chinook (Snake River spring/summer-run) with critical habitat		Threatened
Salmon, Chinook (Upper Columbia River spring-run) with critical habitat		Endangered
Salmon, Chinook (Upper Willamette River) with critical habitat		Threatened
Salmon, Chum (Columbia River) with critical habitat	Oncorhynchus keta	Threatened
Salmon, Chum (Hood Canal summer run) with critical habitat		Threatened
Salmon, Coho (Lower Columbia River)		Threatened
Salmon, Coho (Oregon Coast)		Threatened
Salmon, Coho (Southern Oregon Northern Coastal California) with critical habitat		Threatened
Salmon, Sockeye (Snake River) with critical habitat		Endangered
Steelhead (California Central Valley) with critical habitat	Oncorhynchus mykiss	Threatened
Steelhead (Lower Columbia River) with critical habitat		Threatened
Steelhead (Middle Columbia River) with critical habitat		Threatened
Steelhead (Northern California) with critical habitat		Threatened
Steelhead (Snake River Basin) with critical habitat		Threatened
Steelhead (South Central California coast) with critical habitat		Threatened
Steelhead (Southern California) with critical habitat		Endangered
Steelhead (Upper Columbia River) with critical habitat		Threatened
Steelhead (Upper Willamette River) with critical habitat		Threatened
Sturgeon, Green (southern population) with critical habitat	Acipenser medirostris	Threatened
Sturgeon, Shortnose	Acipenser brevirostrum	Endangered

3.1 Introduction to the Status Assessment

We begin the narratives that follow with an overview of the projected effects of climate change on endangered and threatened species under NMFS' jurisdiction and critical habitat that has been designated for those species. That narrative appears in this section of our Opinion because climate change will affect the global status of the species we consider in this Opinion. The rest of this chapter consists of narratives for each of the threatened and endangered species and designated critical habitat that are likely to occur in the action area and that may be adversely affected by the Planning Rule.

Climate Change

There is general consensus within the scientific community that atmospheric temperatures on earth are increasing (warming) and that these increases will continue for at least the next several decades (IPCC 2001, Oreskes 2004). The Intergovernmental Panel on Climate Change (IPCC) estimated that average global land and sea surface temperature has increased by 0.6°C (± 0.2) since the mid-1800s, with most of the change occurring since 1976. This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley 2000). The IPCC reviewed computer simulations of the effect of greenhouse gas emissions on observed climate variations that have been recorded in the past and evaluated the influence of natural phenomena such as solar and volcanic activity. Based on their review, the IPCC concluded that natural phenomena are insufficient to explain the increasing trend in land and sea surface temperature, and that atmospheric warming observed over the last 50 years is probably attributable to human activities (IPCC 2001). Climatic models estimate that global temperatures would increase between 1.4 to 5.8°C from 1990 to 2100 if humans do nothing to reduce greenhouse gas emissions from current levels (IPCC 2001).

In the Northeast, annual average temperatures have increased by 2°F since 1970, with winter temperatures increasing by up to 4°F (Karl *et al*. 2009). Over the same time interval, the Northeast has experienced more days with temperatures greater than 90°F, a longer growing season, increased heavy precipitation, more winter precipitation falling as rain than as snow, reduced snowpack, earlier breakup of winter ice on lakes and rivers, earlier spring snowmelt resulting in earlier peak river flows, rising sea surface temperatures and sea level.

Over the next several decades, the Northeast is expected to experience temperatures increases of another 2.5 to 4°F during the winter season and 1.5 to 3.5°F during the summer season as a result of carbon emissions that have already occurred (Burakowski *et al*. 2008, Hayhoe *et al*. 2007, Karl *et al*. 2009). Forecasts beyond the middle of this century are sensitive to the level of carbon emissions produced today. If carbon emissions are not reduced, the length of the winter snow season would be cut in half across northern New York, Vermont, New Hampshire, and Maine, and reduced to a week or two in southern parts of the region; the Northeast would have fewer cold days during the winter and experience more precipitation (Hayhoe *et al*. 2007, Hayhoe *et al*. 2008, Huntington *et al*. 2004, Karl *et al*. 2009).

Cities in the Northeast that currently experience temperatures greater than 100°F for a few days each summer would experience an average of 20 days of such temperatures each summer; some cities in the Northeast -- Hartford, Connecticut, and Philadelphia, Pennsylvania, for example -- would experience an average of 30 days of such temperatures each summer (Karl *et al*. 2009). Hot summer conditions would arrive three weeks earlier and last three weeks longer into the fall. Droughts lasting from one- to three-months are projected to occur as frequently as once each summer in the Catskill and Adirondack Mountains, and across the New England states. Finally, sea levels in this region are projected to rise more than the global average, which would increase coastal flooding and coastal erosion (Karl *et al*. 2009, Kirshen *et al*. 2008).

In the Pacific Northwest, annual average temperatures have increased by about 1.5°F over the past century with some areas experiencing increases of up to 4°F (Elsner and Hamlet 2010, Karl *et al*. 2009, Littell *et al*. 2009). Higher temperatures during the cool season (October through March) have caused more precipitation to fall as rain rather than snow and contribute to earlier snowmelt. The amount of snowpack remaining on April 1, which is a key indicator of natural water storage available for the warm season, has declined substantially throughout the Northwest region. In the Cascade Mountains, for example, the snowpack remaining on April 1 declined by an average of 25 percent over the past 40 to 70 years; most of this decline is attributed to the 2.5°F increase in temperatures during the winter season over the time interval (Christensen *et al*. 2007. Payne *et al*. 2004).

Over the next century, average temperatures in the Northwest Region are projected to increase by another 3 to 10°F, with higher emissions scenarios resulting in warming in the upper end of this range (Christensen *et al*. 2007, Karl *et al*. 2009). Increases in winter precipitation and decreases in summer precipitation are projected by many climate models, though these projections are less certain than those for temperature.

There is consensus within the scientific community that warming trends will continue to alter current weather pattern and patterns of natural phenomena that are influenced by climate, including the timing and intensity of extreme events such as heat-waves, floods, storms, and wet-dry cycles. Oceanographic models project a weakening of the thermohaline circulation resulting in a reduction of heat transport into high latitudes of Europe, an increase in the mass of the Antarctic ice sheet, and a decrease in the Greenland ice sheet, although the magnitude of these changes remain unknown (Levermann *et al*. 2007, Schmittner *et al*. 2005). As ice melts in the Earth's polar regions in response to increases in temperature, increases in the distribution and abundance of cold water are projected to influence oceanic currents, which would further alter weather patterns. In addition to influencing atmospheric temperatures and weather patterns, increases in greenhouse gases in the Earth's atmosphere have begun to increase rates of carbon capture and storage in the oceans: as carbon dioxide levels in the oceans increase, the waters will become more acidic, which would affect the physiology of large marine animals and cause structures made of calcium carbonate (for example, corals) to dissolve (IPCC 2001, Royal Society 2005).

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Houghton *et al*. 2001, McCarthy *et al*. 2001, Parry *et al*. 2007; see Table 2). Climate-mediated changes in the global distribution and abundance are expected to reduce the productivity of the oceans by affecting keystone prey species in marine ecosystems such as phytoplankton, krill, cephalopods.

Increasing atmospheric temperatures have already contributed to changes in the quality of the freshwater, coastal, and marine ecosystems that are essential to the survival and recovery of salmon populations and have contributed to the decline of populations of endangered and threatened species (Karl *et al*. 2009, Littell *et al*. 2009). Since the late 1970s, sea surface temperatures have increased and coastal upwelling -- which is recognized as an important mechanism governing the production of both phytoplankton and zooplankton -- has decreased resulting in reduced prey availability and poorer marine survival of Pacific salmon. Changes in the number of Chinook salmon escaping into the Klamath River between 1978 and 2005 corresponded with changes in coastal upwelling and marine productivity and the survival of Snake River spring/summer Chinook salmon and Oregon Coho salmon has been predicted using indices of coastal ocean upwelling (Elsner and Hamlet 2010, Karl *et al*. 2009, Littell *et al*. 2009). The majority (90%) of year-to-year variability in marine survival of hatchery reared Coho salmon between 1985 and 1996 can be explained by coastal oceanographic conditions.

Changes in temperature and precipitation projected over the next few decades are projected to decrease snow pack, affect stream flow, and water quality throughout the Pacific Northwest region (Knowles *et al*. 2006, Mote *et al*. 2008, Mote and Salathé 2010, Rauscher *et al*. 2008). Warmer temperatures are expected to reduce snow accumulation and increase stream flows during the winter, cause spring snowmelt to occur earlier in the year causing spring stream flows to peak earlier in the year, and reduced summer stream flows in rivers that depend on

Table 2. Phenomena associated with projections of global climate change including levels of confidence associated with projections (adapted from IPCC 2001 and Campbell-Lendrum Woodruff 2007)

Phenomenon	Confidence in Observed Changes (observed in the latter 20th Century)	Confidence in Projected Changes (during the 21st Century)
Higher maximum temperatures and a greater number of hot days over almost all land areas	Likely	Very likely
Higher minimum temperatures with fewer cold days and frost days over almost all land areas	Very likely	Very likely
Reduced diurnal temperature range over most land areas	Very likely	Very likely
Increased heat index over most land areas	Likely over many areas	Very likely over most areas
More intense precipitation events	Likely over many mid- to high-latitude areas in Northern Hemisphere	Very likely over many areas
Increased summer continental drying and associated probability of drought	Likely in a few areas	Likely over most mid-latitude continental interiors (projections are inconsistent for other areas)
Increase in peak wind intensities in tropical cyclones	Not observed	Likely over some areas
Increase in mean and peak precipitation intensities in tropical cyclones	Insufficient data	Likely over some areas

snow melt (most rivers in the Pacific Northwest depend on snow melt). As a result, seasonal stream flow timing will probably shift significantly in sensitive watersheds (Littell *et al*. 2009).

The States of Idaho, Oregon, and Washington, are likely to experience increased forest growth over the next few decades followed by decreased forest growth as temperature increases overwhelm the ability of trees to make use of higher winter precipitation and higher carbon dioxide. In coastal areas, climate change is forecast to increase coastal erosion and beach loss (caused by rising sea levels), increase the number of landslides caused by higher winter rainfall, inundate areas in southern Puget Sound around the city of Olympia, Washington (Littell *et al*. 2009).

Rising stream temperatures will likely reduce the quality and extent of freshwater salmon habitat. The duration of periods that cause thermal stress and migration barriers to salmon is projected to at least double by the 2080s for most analyzed streams and lakes (Littell *et al*. 2009). The greatest increases in thermal stress (including diseases and parasites which thrive in warmer waters) would occur in the Interior Columbia River Basin and the Lake Washington Ship Canal. The combined effects of warming stream temperatures and altered stream flows will very likely reduce the reproductive success of many salmon populations in Washington watersheds, but impacts will vary according to different life-history types and watershed-types. As more winter precipitation falls as rain rather than snow, higher winter stream flows scour streambeds, damaging spawning nests and washing away incubating eggs for Pacific Northwest salmon. Earlier peak stream flows flush young salmon from rivers to estuaries before they are physically mature enough for transition, increasing a variety of stressors including the risk of being eaten by predators.

As a result of these changes, about one third of the current habitat for either the endangered or threatened Northwest salmon species will no longer be suitable for them by the end of this century as key temperature thresholds are exceeded (Littell *et al*. 2009). As summer temperatures increase, juvenile salmon are expected to experience reduced growth rates, impaired smoltification, and greater vulnerability to predators.

Ocean acidification caused by increasing amounts of carbon dioxide (CO_2) in the Earth's atmosphere poses a more wide-spread threat because virtually every major biological function has been shown to respond to acidification changes in seawater, including photosynthesis, respiration rate, growth rates, calcification rates, reproduction, and recruitment (The Royal Society 2005).

At the same time as these changes in regional weather patterns and ocean productivity are expected to occur, the oceans are expected to being increasingly acidic. Over the past 200 years, the oceans have absorbed about half of the CO_2 produced by fossil fuel burning and other human activities. This increase n carbon dioxide has led to a reduction of the pH of surface seawater of 0.1 units, equivalent to a 30 percent increase in the concentration of hydrogen ions in the ocean. If global emissions of carbon dioxide from human activities continue to increase, the average pH of the oceans is projected to fall by 0.5 units by the year 2100 (The Royal Society 2005).

Although the scale of these changes are likely to vary regionally, pHs would be lower than the oceans have experienced about 420,000 years and the rate of change is probably one hundred times greater than the oceans have experienced at any time over that time interval. More importantly, it would take tens of thousands of years for ocean chemistry to return to a condition similar to that occurring at pre-industrial times (The Royal Society 2005).

Marine species such as fish, larger invertebrates, and some zooplankton take up oxygen and lose respired carbon dioxide through their gills. Increased carbon dioxide levels and decreased pH would have a major effect on this respiratory gas exchange system because oxygen is much harder to obtain from surface seawater than it is from air (primarily because concentrations of oxygen are lower in water). The processes involved in supplying oxygen to the gills means that more carbon dioxide is removed from these aquatic animals than is removed from air breathing animals of a similar size. This more ready removal of carbon dioxide from body fluids means that the level and range of CO_2 concentration in the bodies of water-breathing animals are much lower than is the case for air-breathing animals. As a result, large water breathing marine animals are more sensitive to changes in the carbon dioxide concentration in the surrounding seawater than are large air-breathing animals.

This has important implications because higher ambient levels of carbon dioxide would acidify the body tissues and fluids of these species and affect the ability of their blood to carry oxygen. Experimental studies have demonstrated that acidosis of tissues decrease cellular energy use, lower respiratory activity, and lower rates of protein synthesis (Pörtner *et al* 2000, 2004). These changes would reduce the performance of almost every physiological process of larger animals including their growth and reproduction (Langenbuch and Pörtner 2002, 2003). By itself, this effect of climate change poses severe risks for endangered and threatened anadromous and marine species. In combination with changes in seasonal temperatures, formation of snow pack in terrestrial ecosystems, upwelling phenomena, and ocean productivity, ocean acidification would lead us to expect the status of endangered and threatened anadromous, coastal, and marine species to trend toward increasing decline over the next three or four decades.

Status of the Species and Critical Habitat

In this section of this Opinion we state the threatened and endangered species and their designated critical habitat that occur in the action area and may be exposed to the direct or indirect effects of actions carried out under NFS Land management plans authorized by the proposed NMFA Planning Rule. Since this proposed rule may be effective for many decades, the specific species affected could and most likely will change over time. All listed species within NMFS' jurisdiction are "aquatic" or "aquatic dependent" and may occur within portions of the action area (Table 1).

The narratives that follow summarize the global status of the endangered and threatened species under NMFS' jurisdiction and designated critical habitat that occur on or are likely to be affected by management activities on National Forest System units. We present information on the distribution, population structure, and threat regime to support our assessment of the global status of the different species. This information also allows us to determine where the distribution of these species overlaps with the areas affected by the Planning Rule and to identify specific populations that might be exposed to land management plans or projects and other activities undertaken in accordance with those plans. More complete reviews of the literature on the different species and critical habitat designations are available in five-year status reviews, listing documents, and recovery plans for the species we discuss or in the public literature.

Beluga whale, Cook Inlet

Distribution

Cook Inlet beluga are one of five populations (or "stocks") of beluga whales that are currently recognized in Alaska (Angliss and Outlaw, 2007). The range of this species is generally limited to Cook Inlet in south central Alaska, although they have been sighted in the Gulf of Alaska outside of Cook Inlet.

Status

On October 22, 2008, NMFS listed the Cook Inlet beluga whale as endangered (73 FR 62919). Historic numbers of beluga whales in Cook Inlet are unknown. Dedicated surveys began in earnest in the 1990s when NMFS began conducting aerial surveys for beluga whales in Cook Inlet. Prior to then, survey efforts were inconsistent, part of larger sea bird and marine mammal surveys, made by vessel, or estimated following interviews with fishermen (Klinkhart 1966). In many cases the survey methodology or confidence intervals were not described. For instance, (Klinkhart 1966) conducted aerial surveys in 1964 and 1965, where he describes having estimated the populations at 300-400 whales, but the methodology was not described nor did he report the variance around these estimates. Other estimates were incomplete due to the small area the survey focused upon (e.g. river mouth estimates; e.g., Hazard 1988). The most comprehensive survey effort prior to the 1990s occurred in 1979 and included transects from Anchorage to Homer, and covered the upper, middle and lower portions of Cook Inlet. From this effort, and using a correction factor of 2.7 to account for submerged whales Calkins (1989) estimated the 1979 abundance at about 1,293 whales.

Between 1979 and 1994, according to above noted population estimates, Cook Inlet beluga whales declined by 50%, with another 50% decline observed between 1994 and 1998. Using a growth fitted model Hobbs *et al*., (2008) observed an average annual rate of decline of -2.91% (SE = 0.010) from 1994 to 2008, and a -15.1% (SE = 0.047) between 1994 and 1998. A comparison with the 1999-2008 data suggests the rate of decline at 1.45% (SE=0.014) per year (Hobbs *et al*. 2008). Given that harvest was curtailed significantly between 1999 and 2008, NMFS had expected the population would begin to recover at a rate of 2-6% per year. However, abundance estimates demonstrate that this is not the case (Hobbs and Shelden 2008).

In conducting its status review, NMFS conducted a suite of population viability analyses to estimate the time to extinction for Cook Inlet beluga whales. The models were sensitive to a variety of parameters such as killer whale predation, Allee effects and unusual mortality events. The best approximation of the current population incorporated killer whale predation at only one beluga whale per year and allowed for an unusual mortality event occurring on average every 20 years. Based on this scenario, there is an 80% probability that the Cook Inlet beluga whale is declining, a 26% probability that this species will be extinct in 100 years (by 2108) and a 70% probability that this species will be extinct within 300 years (by 2308).

Critical Habitat

On April 11, 2011 NMFS designated critical habitat for the Cook Inlet beluga whale 76 FR 20180. Two specific areas are designated comprising 7,800 square kilometers of marine habitat. Area one encompasses all marine waters of Cook Inlet north of a line from the mouth of Threemile Creek (61°08.5′ N., 151°04.4′ W.) connecting to Point Possession (61°02.1′ N., 150°24.3′ W.), including waters of the Susitna River south of 61°20.0′ N., the Little Susitna River south of 61°18.0′ N. and the Chickaloon River north of 60°53.0′ N. (2) Area two encompasses all marine waters of Cook Inlet south of a line from the mouth of Threemile Creek (61°08.5′ N., 151°04.4′ W.) to Point Possession (61°02.1′ N., 150°24.3′ W.) and north of 60°15.0′N., including waters within two nautical miles seaward of the mean high water boundary along the western shoreline of Cook Inlet between 60°15.0′ N. and the mouth of the Douglas River (59°04.0′ N., 153°46.0′ W.); all waters of Kachemak Bay east of 151°40.0′ W.; and waters of the Kenai River below the Warren Ames bridge at Kenai, Alaska.

Area 1 has the highest concentration of beluga whales in the spring through fall as well as the greatest potential for adverse impact from anthropogenic threats. It contains many rivers with large eulachon and salmon runs, including two rivers in Turnagain Arm (Twenty-mile River and Placer River) which are visited by beluga whales in the early spring. Use declines in the summer and increases again in August through the fall, coinciding with Coho salmon returns. Also included in Area 1 are Knik Arm and the Susitna delta. Area 2 is located south of Area 1 and is used by Cook Inlet beluga whales for fall and winter feeding and as transit waters.

The primary constituent elements essential to the conservation of Cook Inlet beluga whales are: (1) intertidal and subtidal waters of Cook Inlet with depths <30 ft. (mean lower low water) and within 5 miles of high and medium flow accumulation anadromous fish streams; (2) primary prey species consisting of four species of Pacific salmon (Chinook, Coho, sockeye and chum salmon), Pacific eulachon, Pacific cod, walleye pollock, saffron cod and yellowfin sole; (3) waters free of toxins or other harmful agents; (4) Unrestricted passage within or between the critical habitat areas, and; (5) an absence of in-water noise levels that result in the abandonment of habitat by Cook Inlet beluga whales.

Killer whale, Southern Resident

Distribution

Southern Resident killer whales occur in the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait during the spring, summer, and fall although they will seasonally migration to coastal waters as far north as Queen Charlotte Islands and Vancouver Island in Canada and Washington, Oregon, and California.

Status

Southern resident killer whales were listed as endangered on November 18, 2005, because of the demographic consequences of whales that had been captured for aquarium display, killed to reduce their level of predation on fish species and because overfishing has depleted their prey base, the water quality of Puget Sound has been degraded degradation, and individuals are killed in collisions with ships (70 Federal Register 69903). These whales also appear to be threatened by noise from industrial sources and military activities, entanglement in fishing gear, and disturbance associated with whale-watching vessels.

Critical habitat was designated for this species on November 29, 2006 (71 Federal Register 69054) and encompasses three specific areas in Puget Sound: (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca. the designated area encompasses about 2,560 square miles (6,630 sq km) of marine habitat.

Critical Habitat

Critical habitat that has been designated for southern resident killer whales includes the summer core area in Haro Strait and waters around the San Juan Islands, the Puget Sound area, and the Strait of Juan de Fuca, which together comprise about 2,560 square miles of marine and coastal habitat (71 FR 69054). The critical habitat designation includes three marine areas of Puget Sound in Clallam, Jefferson, King, Kitsap, Island, Mason, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom Counties in the State of Washington. The critical habitat designation includes all waters relative to a contiguous shoreline delimited by the line at a depth of 20 feet (6.1 m) relative to extreme high water in (see 50 CFR 226.206 for complete latutide and longitude references to all points contained in the following narratives):

1. the summer core areas, which includes all U.S. marine waters in Whatcom and San Juan counties; and all marine waters in Skagit County west and north of the Deception Pass Bridge (Highway 20);

2. Puget Sound, which includes (a) all marine waters in Island County east and south of the Deception Pass Bridge (Highway 20) and east of a line connecting the Point Wilson Lighthouse and a point on Whidbey Island located at 48°12'30" N. latitude and 122 ° 44'26"W. longitude; (b) all marine waters in Skagit County east of the Deception Pass Bridge (Highway 20); (c) all marine waters of Jefferson County east of a line connecting the Point Wilson Lighthouse and a point on Whidbey Island located at latitude 48 ° 12'3″N. latitude and 122 ° 44'26"W. longitude, and north of the Hood Canal Bridge (Highway 104); (d) all marine waters in eastern Kitsap County east of the Hood Canal Bridge (Highway 104); (e) all marine waters (excluding Hood Canal) in Mason County; and (f) all marine waters in King, Pierce, Snohomish, and Thurston counties

3. Strait of Juan de Fuca Area: All U.S. marine waters in Clallam County east of a line connecting Cape Flattery, Washington, Tatoosh Island, Washington, and Bonilla Point, British Columbia; all marine waters in Jefferson and Island counties west of the Deception Pass Bridge (Highway 20), and west of a line connecting the Point Wilson Lighthouse and a point on Whidbey Island located at 48° 12'30"N. latitude and 122° 44'26"W. longitude.

Critical habitat that has been designated for southern resident killer whales does not include waters offshore of the Washington coast, Hood Canal or Dabob Bay, the Keyport Range Complex, Sinclair Inlet (near Bremerton), Ostrich Bay and Oyster Bay, portions of Whidbey Island and Navy Operating Area 3 (north and west of Whidbey Island).

Sea Lion, Steller – eastern population

Distribution

Steller sea lions are distributed around the rim of the North Pacific Ocean from the Channel Islands off Southern California to northern Hokkaido, Japan. In the Bering Sea, the northernmost major rookery is on Walrus Island in the Pribilof Island group. The northernmost major haulout is on Hall Island off the northwestern tip of St. Matthew Island. Their distribution also extends northward from the western end of the Aleutian chain to sites along the eastern shore of the Kamchatka Peninsula. Their distribution is probably centered in the Gulf of Alaska and the Aleutian Islands (NMFS 1992).

Eastern Steller sea lions are distributed from California to Alaska and the population includes all rookeries east of Cape Suckling, Alaska south to Año Nuevo Island, which is the southernmost extant rookery. After the breeding season, adult male Steller sea lions disperse widely. Outside of the period from May through August, males that breed in California move north after the breeding season and are rarely seen in California or Oregon (Mate 1973).

Status

Steller sea lions were listed as threatened under the Endangered Species Act on November 26, 1990 (55 FR 49204). These sea lions were listed after the U.S. population declined by about 64 percent over three decades. In 1997, the species was split into two separate populations based on demographic and genetic differences (Bickham *et al.* 1996, Loughlin 1997), the western population was reclassified as endangered while the eastern population remained threatened (62 FR 30772). Critical habitat for both of these species was designated on August 27, 1993 (58 FR 45269).

Numbers of Steller sea lions declined dramatically throughout much of the species' range, beginning in the mid- to late 1970s (Braham *et al*. 1980, Merrick *et al*. 1987, NMFS 1992, NMFS 1995). For two decades prior to the decline, the estimated total population was 250,000 to 300,000 animals (Kenyon and Rice 1961, Loughlin *et al*. 1984). The population estimate declined by 50-60 percent to about 116,000 animals by 1989 (NMFS 1992), and by an additional 15 percent by 1994.

The decline has generally been restricted to the western population of Steller sea lions which had declined by about 5 percent per year during the 1990s. Counts for this population have fallen from 109,880 animals in the late 1970s to 22,167 animals in 1996, a decline of 80% (NMFS 1995). Over the same time interval, the eastern population has remained stable or increased by several percent per year, in Southeast Alaska (Sease and Loughlin 1999), in British

Columbia, Canada (P. Olesiuk, Department of Fisheries and Oceans, unpublished data), and in Oregon (R. Brown, Oregon Department of Fish and Wildlife, unpublished data). Counts in Russian territories have also declined and are currently estimated to be about one-third of historic levels (NMFS 1992).

Critical Habitat For The Eastern Population Of Steller Sea Lions

Critical habitat that has been designated for the eastern population of Steller sea lions includes an air zone that extends 3,000 feet (0.9 km) above areas historically occupied by sea lions at each major rookery in California and Oregon, measured vertically from sea level. Critical habitat includes an aquatic zone that extends 3,000 feet (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery in California and Oregon.

In Oregon, the Steller sea lion rookeries included in the critical habitat designation are Pyramid Rock on Rogue Reef (42 26.4N latitude, 124 28.1W. longitude) and Long Brown Rock (42 47.3N. latitude, 124 36.2W. longitude) and Seal Rock (42 47.1N latitude 124 35.4W. longitude) on Orford Reef. In California, the Steller sea lion rookeries included in the critical habitat designation are Ano Nuevo Island (37 06.3N latitude, 122 20.3W. longitude), southeast Farallon Island (37 41.3N latitude, 123 00.1W. longitude), and Sugarloaf Island.- Cape Mendocino (40 26.0N latitude, 124 24.0W. longitude). Critical habitat for the eastern population of Steller sea lions has not been designated in the State of Washington.

Eulachon, Pacific (Southern population)

Distribution

The southern population of Pacific eulachon consists of populations spawning in rivers south of the Nass River in British Columbia, Canada, to, and including, the Mad River in California (74 FR 10857).

Status

The southern population of eulachon was listed as threatened on 18 March 2010 (74 FR 10857). On 20 October 2011, NMFS published final regulations to designate 16 specific areas as critical habitat within the states of California, Oregon, and Washington as critical habitat for this species. The designated areas are a combination of freshwater creeks and rivers and their associated estuaries, comprising approximately 539 km (335 mi) of habitat. The Tribal lands of four Indian Tribes (Lower Elwha Tribe, Washington; Quinault Tribe, Washington; Yurok Tribe, California; and Resighini Rancheria, California) were excluded from designation after evaluating the impacts of designation and benefits of exclusion associated with Tribal land ownership and management by the Tribes.

Southern eulachon are primarily threatened by increasing temperatures in the marine, coastal, estuarine, and freshwater environments of the Pacific Northwest that are at least causally related to climate change; dams and water diversions, water quality degradation, dredging operations in the Columbia and Fraser Rivers; commercial, recreational, and subsistence fisheries in Oregon and Washington that target eulachon; and bycatch in commercial fisheries.

Eulachon are particularly vulnerable to capture in shrimp fisheries in the United States and Canada as the marine areas occupied by shrimp and eulachon often overlap. In Oregon, the bycatch of various species of smelt (including eulachon) has been as high as 28 percent of the total catch of shrimp by weight (Hannah and Jones, 2007). In

Canada, bycatch of eulachon in shrimp fisheries has been significant enough to cause the Canadian Department of Fisheries and Oceans to close the fishery in some years (DFO 2008).

Chinook Salmon

Chinook salmon are the largest of the Pacific salmon and historically ranged from the Ventura River in California to Point Hope, Alaska in North America, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). In addition, Chinook salmon have been reported in the Canadian Beaufort Sea (McPhail and Lindsey 1970). We discuss the distribution and status of the nine species of endangered and threatened Chinook salmon separately.

Over the past few decades, the size and distribution of Chinook salmon populations have declined because of natural phenomena and human activity, including the operation of hydropower systems, over-harvest, hatcheries, and habitat degradation. Natural variations in freshwater and marine environments have substantial effects on the abundance of salmon populations. Of the various natural phenomena that affect most populations of Pacific salmon, changes in ocean productivity are generally considered most important.

Chinook salmon are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation probably contributes to significant natural mortality, although the levels of predation are largely unknown. In general, Chinook are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the increasing size of tern, seal, and sea lion populations in the Pacific Northwest has dramatically reduced the survival of adult and juvenile salmon.

Salmon, Chinook (California coastal)

Distribution

California Coastal Chinook salmon includes all naturally-spawned coastal Chinook salmon spawning from Redwood Creek south through the Russian River, inclusive.

Listing status

California Coastal Chinook salmon were listed as threatened in 1999, also because of the combined effect of dams that prevent them from reaching spawning habitat, logging, agricultural activities, urbanization, and water withdrawals in the river drainages that support them. The species exists as small populations with highly variable cohort sizes. The Russian River probably contains some natural production, but the origin of those fish is not clear because of a number of introductions of hatchery fish over the last century. The Eel River contains a substantial fraction of the remaining Chinook salmon spawning habitat for this species. Critical habitat was designated for this species on September 2, 2005 (70 Federal Register 52630).

Critical Habitat

NMFS designated critical habitat for California coastal chinook salmon on September 2, 2005 (70 FR 52488). Specific geographic areas designated include the following hydrological units: Redwood Creek, Trinidad, Mad River, Eureka Plain, Eel River, Cape Mendocino, Mendocino Coast, and the Russian River. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding.

The critical habitat designation for California coastal chinook salmon identifies primary constituent elements that include sites necessary to support one or more Chinook salmon life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity. The critical habitat designation (70 FR 52488) contains additional details on the sub-areas that are included as part of this designation, and the areas that were excluded from designation.

In total, California Coastal Chinook salmon occupy 45 watersheds (freshwater and estuarine). The total area of habitat designated as critical includes about 1,500 miles of stream habitat and about 25 square miles of estuarine habitat, mostly within Humboldt Bay. This designation includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bank-full elevation. In estuarine areas the lateral extent is defined by the extreme high water because extreme high tide areas encompass those areas typically inundated by water and regularly occupied by juvenile salmon during the spring and summer, when they are migrating in the nearshore zone and relying on cover and refuge qualities provided by these habitats, and while they are foraging. Of the 45 watershed reviewed in NMFS' assessment of critical habitat for California coastal chinook salmon, eight watersheds received a low rating of conservation value, 10 received a medium rating, and 27 received a high rating of conservation value for the species.

Critical habitat for California coastal chinook salmon consists of limited quantity and quality summer and winter rearing habitat, as well as marginal spawning habitat. Compared to historical conditions, there are fewer pools, limited cover, and reduced habitat complexity. The limited instream cover that does exist is provided mainly by large cobble and overhanging vegetation. Instream large woody debris, needed for foraging sites, cover, and velocity refuges is especially lacking in most of the streams throughout the basin. NMFS has determined that these degraded habitat conditions are, in part, the result of many human-induced factors affecting critical habitat including dam construction, agricultural and mining activities, urbanization, stream channelization, water diversion, and logging, among others.

Salmon, Chinook (Central Valley spring-run)

Distribution

The Central Valley Spring-run Chinook salmon includes all naturally spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries in California. This species 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, sub-yearlings, and yearlings.

Status

Central Valley spring-run Chinook salmon were listed as threatened in 1999, a classification this species retained when the original listing was reviewed on June 28, 2005. This species was listed because dams isolate them from most of their historic spawning habitat and the habitat remaining to them is degraded. Central Valley spring-run Chinook historically occupied the upper reaches of all major tributaries to the Sacramento and San Joaquin rivers.

Of the 21 populations identified by the California Department of Fish and Game in their status review, only 3 self-sustaining populations now exist in the upper Sacramento in Deer, Mill and Butte Creeks. Although these streams have not been affected by large impassable dams, diversions and small dams have degraded the spawning habitat.

Critical Habitat

NMFS designated critical habitat for Central Valley spring-run Chinook salmon on September 2, 2005 (70 FR 52488). Specific geographic areas designated include the following CALWATER hydrological units: Tehama, Whitmore, Redding, Eastern Tehama, Sacramento Delta, Valley-Putah-Cache, Marysville, Yuba, Valley-American, Colusa Basin, Butte Creek and Shasta Bally hydrological units. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more Chinook salmon life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. The critical habitat designation (70 FR 52488) contains additional details on the sub-areas that are included as part of this designation and the areas that were excluded from designation.

In total, Central Valley spring-run Chinook salmon occupy 37 watersheds (freshwater and estuarine). The total area of habitat designated as critical includes about 1,100 miles of stream habitat and about 250 square miles of estuarine habitat in the San Francisco-San Pablo-Suisun Bay complex. This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. In estuarine areas the lateral extent is defined by the extreme high water because extreme high tide areas encompass those areas typically inundated by water and regularly occupied by juvenile salmon during the spring and summer, when they are migrating in the nearshore zone and relying on cover and refuge qualities provided by these habitats and while they are foraging. Of the 37 watersheds reviewed in NMFS' assessment of critical habitat for Central Valley spring-run Chinook salmon, seven watersheds received a low rating of conservation value, three received a medium rating and 27 received a high rating of conservation value for the species.

Factors contributing to the downward trends in this species include: reduced access to spawning/rearing habitat behind impassable dams, climatic variation, water management activities, hybridization with fall-run Chinook salmon, predation and harvest (CDFG 1998). Several actions have been taken to improve and increase the primary constituent elements of critical habitat for spring-run Chinook salmon. These include improved management of Central Valley water, implementing new and improved screen and ladder designs at major water diversions along the mainstem Sacramento River and tributaries, removal of several small dams on important spring-run Chinook salmon spawning streams and changes in ocean and inland fishing regulations to minimize harvest. Although protective measures and critical habitat restoration likely have contributed to recent increases in spring-run Chinook salmon abundance, the species is still below levels observed from the 1960s through 1990. Many threats still exist.

Salmon, Chinook (Lower Columbia River)

Distribution

Lower Columbia River Chinook salmon includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The Cowlitz, Kalama, Lewis, White Salmon, and Klickitat Rivers are the major river systems on the Washington side, and the lower Willamette and Sandy Rivers are foremost on the Oregon side. The eastern boundary for this species occurs at Celilo Falls, which corresponds to the edge of the drier Columbia Basin Ecosystem and historically may have been a barrier to salmon migration at certain times of the year.

Status

Lower Columbia River Chinook salmon were listed as threatened on June 28, 2005. Critical habitat was designated for this species on September 2, 2005 (70 Federal Register 52630).

Critical Habitat

NMFS designated critical habitat for Lower Columbia River Chinook salmon on September 2, 2005 (70 FR 52630). Designated critical habitat includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence with the Hood Rivers as well as specific stream reaches in a number of tributary subbasins. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more Chinook salmon life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity.

Salmon, Chinook (Puget Sound)

Distribution

Puget Sound Chinook salmon include all runs of Chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula. Chinook salmon in this area generally have an "ocean-type" life history. Thirty-six hatchery populations were included as part of the ESU and five were considered essential for recovery and listed including spring Chinook from Kendall Creek, the North Fork Stillaguamish River, White River, and Dungeness River, and fall run fish from the Elwha River.

Status

Puget Sound Chinook salmon were listed as threatened in 1999; that status was re-affirmed on June 28, 2005.

Critical Habitat

NMFS designated critical habitat for Puget Sound Chinook salmon on September 2, 2005 (70 FR 52630). The specific geographic area includes portions of the Nooksack River, Skagit River, Sauk River, Stillaguamish River, Skykomish River, Snoqualmie River, Lake Washington, Green River, Puyallup River, White River, Nisqually River, Hamma Hamma River and other Hood Canal watersheds, the Dungeness/ Elwha Watersheds, and nearshore marine areas of the Strait of Georgia, Puget Sound, Hood Canal and the Strait of Juan de Fuca. This designation includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation.

The designation for this species includes sites necessary to support one or more Chinook salmon life stages. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. Specific primary constituent elements include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat, and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity.

Salmon, Chinook (Snake River fall-run)

Distribution

The present range of spawning and rearing habitat for naturally-spawned Snake River fall Chinook salmon is primarily limited to the Snake River below Hells Canyon Dam and the lower reaches of the Clearwater, Grand Ronde, Salmon, and Tucannon Rivers.

Status

Snake River fall-run Chinook salmon were originally listed as endangered in 1992 but were reclassified as threatened on June 28, 2005. Critical habitat for these salmon was designated on December 28, 1993. This critical habitat encompasses the waters, waterway bottoms, and adjacent riparian zones of specified lakes and river reaches in the Columbia River that are or were accessible to listed Snake River salmon (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams).

Critical Habitat

NMFS designated critical habitat for Snake River fall-run Chinook salmon on December 28, 1993 (58 FR 68543). This critical habitat encompasses the waters, waterway bottoms and adjacent riparian zones of specified lakes and river reaches in the Columbia River that are or were accessible to ESA listed Snake River salmon (except reaches above impassable natural falls and Dworshak and Hells Canyon Dams). These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. Adjacent riparian zones are defined as those areas within a horizontal distance of 300 feet from the normal line of high water of a stream channel or from the shoreline of a standing body of water. Designated critical habitat includes the Columbia River from a straight line connecting the west end of the Clatsop jetty (Oregon side) and the west end of the Peacock jetty (Washington side) and including all river reaches from the estuary upstream to the confluence of the Snake River and all Snake River reaches upstream to Hells Canyon Dam. Critical habitat also includes several river reaches presently or historically accessible to Snake River fall-run Chinook salmon. Limiting factors identified for Snake River fall-run Chinook salmon include: mainstem lower Snake and Columbia hydrosystem mortality, degraded water quality, reduced spawning and rearing habitat due to mainstem lower Snake River hydropower system, harvest impacts, impaired stream flows, barriers to fish passage in tributaries, excessive sediment and altered floodplain and channel morphology (NMFS 2005b).

Salmon, Chinook (Snake River spring/summer-run)

Distribution

Snake River spring/summer-run Chinook salmon are primarily limited to the Salmon, Grande Ronde, Imnaha, and Tucannon Rivers in the Snake River basin.

Status

Snake River spring/summer-run Chinook salmon were originally listed as endangered in 1992, but were reclassified as threatened on June 28, 2005. Critical habitat for these salmon was designated on October 25, 1999. This critical habitat encompasses the waters, waterway bottoms, and adjacent riparian zones of specified lakes and river reaches in the Columbia River that are or were accessible to listed Snake River salmon (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) and is well beyond the area that is likely to be directly or indirectly affected by the proposed action.

Critical Habitat

NMFS designated critical habitat for Snake River spring/summer-run Chinook salmon on October 25, 1999 (64 FR 57399). This critical habitat encompasses the waters, waterway bottoms and adjacent riparian zones of specified lakes and river reaches in the Columbia River that are or were accessible to ESA listed Snake River salmon (except reaches above impassable natural falls and Dworshak and Hells Canyon Dams). Adjacent riparian zones are defined as those areas within a horizontal distance of 300 feet from the normal line of high water of a stream channel or from the shoreline of a standing body of water. Designated critical habitat includes the Columbia River from a straight line connecting the west end of the Clatsop jetty (Oregon side) and the west end of the Peacock jetty (Washington side) and including all river reaches from the estuary upstream to the confluence of the Snake River and all Snake River reaches upstream to Hells Canyon Dam; the Palouse River from its confluence with the Snake River upstream to Palouse Falls, the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; the North Fork Clearwater River from its confluence with the Clearwater river upstream to Dworshak Dam. Critical habitat also includes several river reaches presently or historically accessible to Snake River spring/summer Chinook salmon. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. Limiting factors identified for this species include hydrosystem mortality, reduced stream flow, altered channel morphology and floodplain, excessive fine sediment and degraded water quality (NMFS 2006).

Salmon, Chinook (Upper Columbia River spring-run)

Distribution

Endangered Upper Columbia River spring-run Chinook salmon includes stream-type Chinook salmon that inhabit tributaries upstream from the Yakima River to Chief Joseph Dam. They currently spawn in only three river basins above Rock Island Dam: the Wenatchee, Entiat, and Methow Rivers. Several hatchery populations are also listed including those from the Chiwawa, Methow, Twisp, Chewuch, and White rivers, and Nason Creek.

Status

Upper Columbia River spring-run Chinook salmon were listed as endangered on June 28, 2005, because they had been reduced to small populations in three watersheds. Population viability analyses for this species (using the Dennis Model) suggest that these Chinook salmon face a significant risk of extinction: a 75 to 100 percent probability of extinction within 100 years (given return rates for 1980 to present).

Critical Habitat

NMFS designated critical habitat for Upper Columbia River spring-run Chinook salmon on September 2, 2005 (70 FR 52630). The designation includes all Columbia River estuaries and river reaches upstream to Chief Joseph Dam and several tributary subbasins. This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more Chinook salmon life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. The Upper Columbia River spring-run Chinook salmon species has 31 watersheds within its range. Five watersheds received a medium rating and 26 received a high rating of conservation value to the species. The Columbia River rearing/migration corridor downstream of the spawning range was rated as a high conservation value. Factors contributing to the downward trends in this species include mainstem Columbia River hydropower system mortality, tributary riparian degradation and loss of in-river wood, altered tributary floodplain and channel morphology, reduced tributary stream flow and impaired passage and harvest impacts.

Salmon, Chinook (Upper Willamette River)

Distribution

Upper Willamette River Chinook salmon occupy the Willamette River and tributaries upstream of Willamette Falls. Historically, access above Willamette Falls was restricted to the spring when flows were high. In autumn, low flows prevented fish from ascending past the falls. The Upper Willamette spring-run Chinook are one of the most genetically distinct Chinook groups in the Columbia River Basin. Fall-run Chinook salmon spawn in the Upper Willamette but are not considered part of the species because they are not native. None of the hatchery populations in the Willamette River were listed although five spring-run hatchery stocks were included in the species' listing.

Status

Upper Willamette River Chinook salmon were listed as threatened in 1999.

Critical Habitat

NMFS designated critical habitat for Upper Willamette River Chinook salmon on September 2, 2005 (70 FR 52630). Critical habitat for upper Willamette River Chinook salmon includes defined areas within subbasins of the middle fork Willamette River, upper Willamette River, McKenzie River, Santiam River, Crabtree Creek, Molalla River and Clackamas River. This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more Chinook salmon life stages. Specific sites include freshwater spawning and rearing sites, freshwater migration corridors. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. Of 65 subbasins reviewed in NMFS' assessment of critical habitat for the Upper Willamette River Chinook salmon species, 19 subbasins were rated as having a medium conservation value, 19 were rated as low, and the 27 remaining subbasins were rated as having a high conservation value to Upper Willamette River Chinook salmon. Federal lands were generally rated as having high conservation value to the species' spawning and rearing. Factors contributing to the downward trends in this species include reduced access to spawning/rearing habitat in tributaries, hatchery impacts, altered water quality and temperature in tributaries, altered stream flow in tributaries and lost or degraded floodplain connectivity and lowland stream habitat.

Chum Salmon

Historically, chum salmon were distributed throughout the coastal regions of western Canada and the United States, as far south as Monterey Bay, California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast. Chum salmon are semelparous, spawn primarily in freshwater and, apparently, exhibit obligatory anadromy (there are no recorded landlocked or naturalized freshwater populations) (Randall *et al*. 1987).

Chum salmon spend two to five years in feeding areas in the northeast Pacific Ocean, which is a greater proportion of their life history than other Pacific salmonids. Chum salmon distribute throughout the North Pacific Ocean and Bering Sea, although North American chum salmon (as opposed to chum salmon originating in Asia), rarely occur west of 175^{o}E longitude (Johnson *et al*. 1997).

North American chum salmon migrate north along the coast in a narrow coastal band that broadens in southeastern Alaska, although some data suggest that Puget Sound chum, including Hood Canal summer run chum, may not make extended migrations into northern British Columbian and Alaskan waters, but instead may travel directly offshore into the north Pacific Ocean (Johnson *et al*. 1997).

Chum salmon, like pink salmon, usually spawn in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 100 km from the sea. Juveniles outmigrate to seawater almost immediately after emerging from the gravel that covers their redds (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus Oncorhynchus (e.g., coastal cutthroat trout, steelhead, Coho salmon, and most types of Chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

Chum salmon have been threatened by overharvests in commercial and recreational fisheries, adult and juvenile mortalities associated with hydropower systems, habitat degradation from forestry and urban expansion, and shifts in climatic conditions that changed patterns and intensity of precipitation.

Salmon, Chum (Columbia River)

Distribution

Columbia River chum salmon includes all natural-origin chum salmon in the Columbia River and its tributaries in Washington and Oregon. The species consists of three populations: Grays River, Hardy, and Hamilton Creeks in

Washington State

Status
Columbia River chum salmon were listed as threatened in 1999. Critical habitat was originally designated for this on February 16, 2000 (65 Federal Register 7764) and was re-designated on September 2, 2005 (70 Federal Register 52630).

Critical Habitat
NMFS designated critical habitat for Columbia River chum salmon on September 2, 2005 (70 FR 52630). The designated includes defined areas in the following subbasins: Middle Columbia/Hood, Lower Columbia/Sandy, Lewis, Lower Columbia/Clatskanie, Lower Cowlitz, Lower Columbia subbasin and river corridor. This designation includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation.

The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more chum salmon life stages. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding and are rated as having high conservation value to the species. Columbia River chum salmon have primary constituent elements of freshwater spawning, freshwater rearing, freshwater migration, estuarine areas free of obstruction, nearshore marine areas free of obstructions, and offshore marine areas with good water quality. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity.

Of 21 subbasins reviewed in NMFS' assessment of critical habitat for the Columbia River chum salmon, three subbasins were rated as having a medium conservation value, no subbasins were rated as low, and the majority of subbasins (18), were rated as having a high conservation value to Columbia River chum salmon. The major factors limiting recovery for Columbia River chum salmon are altered channel form and stability in tributaries, excessive sediment in tributary spawning gravels, altered stream flow in tributaries and the mainstem Columbia River, loss of some tributary habitat types, and harassment of spawners in the tributaries and mainstem.

Salmon, Chum (Hood Canal summer run)

Distribution
Hood Canal summer-run chum salmon includes summer-run chum salmon populations in Hood Canal in Puget Sound and in Discovery and Sequim Bays on the Strait of Juan de Fuca. It may also include summer-run fish in the Dungeness River, but the existence of that run is uncertain. Of the sixteen populations of summer chum that are included in this species, seven are considered to be "functionally extinct" (Skokomish, Finch Creek, Anderson Creek, Dewatto, Tahuya, Big Beef Creek, and Chimicum). The remaining nine populations are well distributed throughout the range of the species except for the eastern side of Hood Canal (Johnson *et al*. 1997).

Five hatchery populations are considered part of the species including those from the Quilcene National Fish Hatchery, Long Live the Kings Enhancement Project (Lilliwaup Creek), Hamma Hamma River Supplementation

Project, Big Beef Creek reintroduction Project, and the Salmon Creek supplementation project in Discovery Bay. Although included as part of the species, none of the hatchery populations were listed.

Status

Hood Canal summer-run chum salmon were listed as endangered on March 25, 1999. Critical habitat for this species was designated on September 2, 2005 (70 Federal Register 52630).

Critical Habitat

NMFS designated critical habitat for Hood Canal summer-run chum salmon on September 2, 2005 (70 FR 52630). The specific geographic area includes the Skokomish River, Hood Canal subbasin, which includes the Hamma Hamma and Dosewallips rivers and others, the Puget Sound subbasin, Dungeness/Elwha subbasin, and nearshore marine areas of Hood Canal and the Strait of Juan de Fuca from the line of extreme high tide to a depth of 30 meters. This includes a narrow nearshore zone from the extreme high-tide to mean lower low tide within several Navy security/restricted zones. This also includes about 8 miles of habitat that was unoccupied at the time of the designation in Finch, Anderson and Chimacum creeks (69 FR 74572; 70 FR 52630), but has recently been re-seeded. Chimacum Creek, however, has been naturally recolonized since at least 2007. The designation for Hood Canal summer-run chum, like others made at this time, includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bank-full elevation.

The specific primary constituent elements identified for Hood Canal summer-run chum salmon are areas for spawning, freshwater rearing and migration, estuarine areas free of obstruction, nearshore marine areas free of obstructions, and offshore marine areas with good water quality. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity.

Of 17 subbasins reviewed in NMFS' assessment of critical habitat for the Hood Canal chum salmon, 14 subbasins were rated as having a high conservation value, while only three were rated as having a medium value to the conservation. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. Limiting factors identified for this species include degraded floodplain and mainstem river channel structure, degraded estuarine conditions and loss of estuarine habitat, riparian area degradation and loss of in-river wood in mainstem, excessive sediment in spawning gravels, and reduced stream flow in migration areas.

Coho Salmon

Coho salmon occur naturally in most major river basins around the North Pacific Ocean from central California to northern Japan (Laufle *et al*. 1986). After entering the ocean, immature Coho salmon initially remain in near-shore waters close to the parent stream. Most Coho salmon adults are 3-year-olds, having spent approximately 18 months in freshwater and 18 months in salt water. Wild female Coho return to spawn almost exclusively at age 3. Spawning escapements of Coho salmon are dominated by a single year class. The abundance of year classes can fluctuate dramatically with combinations of natural and human-caused environmental variation.

North American Coho salmon will migrate north along the coast in a narrow coastal band that broadens in southeastern Alaska. During this migration, juvenile Coho salmon tend to occur in both coastal and offshore waters.

During spring and summer, Coho salmon will forage in waters between 46^{o}N, the Gulf of Alaska, and along Alaska's Aleutian Islands.

Salmon, Coho (Lower Columbia River)

Distribution

Lower Columbia River Coho salmon include all naturally spawned populations of Coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers, and includes the Willamette River to Willamette Falls, Oregon, as well as twenty-five artificial propagation programs: the Grays River, Sea Resources Hatchery, Peterson Coho Project, Big Creek Hatchery, Astoria High School Coho Program, Warrenton High School Coho Program, Elochoman Type-S Coho Program, Elochoman Type-N Coho Program, Cathlamet High School FFA Type-N Coho Program, Cowlitz Type-N Coho Program in the Upper and Lower Cowlitz Rivers, Cowlitz Game and Anglers Coho Program, Friends of the Cowlitz Coho Program, North Fork Toutle River Hatchery, Kalama River Type-N Coho Program, Kalama River Type-S Coho Program, Washougal Hatchery Type-N Coho Program, Lewis River Type-N Coho Program, Lewis River Type-S Coho Program, Fish First Wild Coho Program, Fish First Type-N Coho Program, Syverson Project Type-N Coho Program, Eagle Creek National Fish Hatchery, Sandy Hatchery, and the Bonneville/Cascade/Oxbow complex Coho hatchery programs.

Status

Lower Columbia River Coho salmon were listed as endangered on June 28, 2005 (70 Federal Register 37160). Critical habitat has not been designated for this species.

Salmon, Coho (Oregon Coast)

Distribution

The Oregon Coast Coho salmon species includes all naturally spawned populations of Coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco (63 FR 42587; August 1998). One hatchery population, the Cow Creek hatchery Coho salmon, is considered part of the species

Status

The Oregon coast Coho salmon species was listed as a threatened species under the ESA on February 11, 2008 (73 FR 7816). The most recent NMFS status review for the Oregon Coast Coho species was conducted by the biological review team in 2003, which assessed data through 2002. The abundance and productivity of Oregon Coast Coho since the previous status review represented some of the best and worst years on record (Sandercock, 1991). Yearly adult returns for the Oregon Coast Coho species were over 160,000 natural spawners in 2001 and over 260,000 in 2002, far exceeding the abundance observed for the past several decades (Good *et al*., 2005). These increases in spawner abundance in 2000 to 2002 followed three consecutive brood years (the 1994 to 1996 brood years returning in 1997 to 1999, respectively) exhibiting recruitment failure (recruitment failure is when a given year class of natural spawners fails to replace itself when its offspring return to the spawning grounds 3 years later). These 3 years of recruitment failure were the only such instances observed thus far in the entire 55-year abundance time series for Oregon Coast Coho salmon (although comprehensive population-level survey data have only been available since 1980). The 2000 to 2002 increases in natural spawner abundance occurred in many populations in the northern portion of the species, which were the most depressed at the time of the last review (Sandercock, 1991). Although encouraged by the increase in spawner abundance in 2000 to 2002, the biological review team noted that the long-term trends in species productivity were still negative due to the low abundances observed during the 1990s

Critical Habitat
NMFS designated critical habitat for Oregon Coast Coho on February 11, 2008 (73 FR 7816). The designation includes 72 of 80 watersheds occupied by Oregon Coast Coho salmon, and totals about 6,600 stream miles including all or portions of the Nehalem, Nestucca/Trask, Yaguina, Alsea, Umpqua and Coquille basins. These areas are essential for feeding, migration, spawning and rearing. The specific primary constituent elements include: spawning sites with water and substrate quantity to support spawning, incubation and larval development; freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth, foraging, behavioral development (e.g., predator avoidance, competition) and mobility; freshwater migratory corridors free of obstruction with adequate water quantity and quality conditions; and estuarine, nearshore and offshore areas free of obstruction with adequate water quantity, quality and salinity conditions that support physiological transitions between fresh- and saltwater, predator avoidance, foraging and other life history behaviors.

Salmon, Coho (Southern Oregon Northern Coastal California)

Distribution
Southern Oregon/Northern California coast Coho salmon consists of all naturally spawning populations of Coho salmon that reside below long-term, naturally impassible barriers in streams between Punta Gorda, California and Cape Blanco, Oregon. The geographic area of the listed species encompasses five of the seven hatchery stocks reared and released within the species' range of the species although none of the hatchery populations are listed. The three major river systems supporting Southern Oregon – Northern Coastal California coast Coho are the Rogue, Klamath (including the Trinity), and Eel rivers.

Status
Southern Oregon/Northern California coast Coho salmon were listed as threatened in 1997; they retained that classification when their status was reviewed on June 28, 2005 (70 Federal Register 37160).Critical habitat for this species encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive (62 Federal Register 62741, November 25, 1997). That critical habitat was re-designated on May 5, 1999 (64 Federal Register 24049).

Critical Habitat
NMFS designated critical habitat for Southern Oregon/Northern California Coast Coho salmon on May 5, 1999 (64 FR 24049). Critical habitat for this species encompasses all accessible river reaches between Cape Blanco, Oregon, and Punta Gorda, California. Critical habitat consists of the water, substrate, and river reaches (including off-channel habitats) in specified areas. Accessible reaches are those within the historical range of the species that can still be occupied by any life stage of Coho salmon.

Of 155 historical streams for which data are available, 63% likely still support Coho salmon. These river habitats are important for a variety of reasons, such as supporting the feeding and growth of juveniles and serving as spawning habitat for adults. Limiting factors identified for this species include: loss of channel complexity, connectivity and sinuosity, loss of floodplain and estuarine habitats, loss of riparian habitats and large in-river wood, reduced stream flow, poor water quality, temperature and excessive sedimentation, and unscreened diversions and fish passage structures.

Sockeye Salmon

Sockeye salmon occur in the North Pacific and Arctic oceans and associated freshwater systems. This species ranges south as far as the Klamath River in California and northern Hokkaido in Japan, to as far north as far as Bathurst Inlet in the Canadian Arctic and the Anadyr River in Siberia. Sockeye salmon were an important food source for aboriginal people who either ate them fresh or dried them for winter use. Today sockeye salmon remain an important mainstay of many subsistence users and support one of the most important commercial and recreational fisheries on the Pacific coast of North America.

Sockeye salmon can be distinguished from Chinook, Coho, and pink salmon by the lack of large, black spots and from chum salmon by the number and shape of gill rakers on the first gill arch. Sockeye salmon have 28 to 40 long, slender, rough or serrated closely set rakers on the first arch.

Salmon, Sockeye (Snake River)

Distribution

Snake River sockeye salmon includes populations of sockeye salmon from the Snake River Basin, Idaho, although the only remaining populations of this species occur in the Stanley River Basin of Idaho.

Status

Snake River sockeye salmon were originally listed as endangered in 1991 and retained that classification when their status was reviewed on June 28, 2005 (70 Federal Register 37160).

Critical Habitat

Critical habitat for these salmon was designated on December 28, 1993 (58 FR 68543) and encompasses the waters, waterway bottoms and adjacent riparian zones of specified lakes and river reaches in the Columbia River that are or were accessible to ESA listed Snake River salmon (except reaches above impassable natural falls and Dworshak and Hells Canyon Dams). Adjacent riparian zones are defined as those areas within a horizontal distance of 300 feet from the normal line of high water of a stream channel or from the shoreline of a standing body of water. Designated critical habitat includes the Columbia River from a straight line connecting the west end of the Clatsop jetty (Oregon side) and the west end of the Peacock jetty (Washington side) and including all river reaches from the estuary upstream to the confluence of the Snake River and all Snake River reaches upstream to the confluence of the Salmon River; all Salmon River reaches to Alturas Lake Creek; Stanley, Redfish, yellow Belly, Pettit and Alturas Lakes (including their inlet and outlet creeks); Alturas Lake Creek and that portion of Valley Creek between Stanley Lake Creek and the Salmon River. Critical habitat also includes all river lakes and reaches presently or historically accessible to Snake River sockeye salmon. These habitats are critical for the conservation of the species because it provides spawning and juvenile rearing habitat, areas for juvenile growth and development and migration corridors for smolts to the ocean and adults to spawning habitat from the Pacific Ocean. Limiting factors identified for Snake River sockeye include: reduced tributary stream flow, impaired tributary passage and blocks to migration and mainstem Columbia River hydropower system mortality.

Steelhead

Steelhead are distributed from Alaska south to southern California. They can be divided into two basic run-types: the stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in freshwater to mature and spawn and the ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (61 Federal Register 41542).

General life history information

Summer steelhead enter freshwater between May and October in the Pacific Northwest (Busby *et al.* 1996). Winter steelhead enter freshwater between November and April in the Pacific Northwest (Busby *et al*. 1996). Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (61 Federal Register 41542) before hatching. Juveniles rear in fresh water from one to four years, then migrate to the ocean as smolts (61 Federal Register 41542). Winter steelhead populations generally smolt after two years in fresh water (Busby *et al*. 1996).

Steelhead (Lower Columbia River)

Distribution

Lower Columbia River steelhead include naturally-produced steelhead returning to Columbia River tributaries on the Washington side between the Cowlitz and Wind rivers in Washington and on the Oregon side between the Willamette and Hood rivers, inclusive. In the Willamette River, the upstream boundary of this species is at Willamette Falls. This species includes both winter and summer steelhead. Two hatchery populations are included in this species, the Cowlitz Trout Hatchery winter-run stock and the Clackamas River stock but neither was listed as threatened.

Status

Lower Columbia River steelhead were listed as threatened in 1998, after their status was reviewed, they retained their status as threatened on January 5, 2006 (71 Federal Register 834). A more recent status review recommended continuing to recognize this species as threatened (76 FR 50448). Critical habitat was designated for this species on September 2, 2005 (70 Federal Register 52488).

Critical Habitat

NMFS designated critical habitat for Lower Columbia River steelhead on September 2, 2005 (70 FR 52630). Designated critical habitat includes the following subbasins: Middle Columbia/Hood subbasin, Lower Columbia/Sandy subbasin, Lewis subbasin, Lower Columbia/Clatskanie subbasin, Upper Cowlitz subbasin, Cowlitz subbasin, Clackamas subbasin, Lower Willamette subbasin, and the Lower Columbia River corridor. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity. The critical habitat designation (70 FR 52630) contains additional description of the watersheds that are included as part of this designation, and any areas specifically excluded from the designation.

In total, Lower Columbia River steelhead occupy 32 watersheds. The total area of habitat designated as critical includes about 2,340 miles of stream habitat. This designation includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bank full elevation. Of the 32 watersheds reviewed in NMFS' assessment of critical habitat for Lower Columbia River steelhead, two watersheds received a low rating of conservation value, 11 received a medium rating, and 26 received a high rating of conservation value for the species. Limiting factors identified for Lower Columbia River steelhead include: degraded floodplain and steam channel structure and function, reduced access to spawning or rearing habitat, altered stream flow in tributaries, excessive sediment and elevated water temperatures in tributaries, and hatchery impacts.

Steelhead (Middle Columbia River)

Distribution

Middle Columbia steelhead occupy the Columbia River Basin from Mosier Creek, Oregon, upstream to the Yakima River, Washington, inclusive (61 Federal Register 41541). Steelhead from the Snake River Basin (described elsewhere) are excluded. This species includes the only populations of inland winter steelhead in the United States, in the Klickitat River and Fifteenmile Creek (Busby *et al*. 1996). Two hatchery populations are considered part of this species, the Deschutes River stock and the Umatilla River stock; listing for neither of these stocks was considered warranted.

Status

Middle Columbia River steelhead were listed as endangered in 1999, after their status was reviewed, they they retained their status as threatened on January 5, 2006 (71 Federal Register 834. Critical habitat was designated for this species on September 2, 2005 (70 Federal Register 52488). A more recent status review recommended continuing to recognize this species as threatened (76 FR 50448).

Middle Columbia River steelhead occupy the inter-montane region which includes some of the driest areas of the Pacific Northwest, generally receiving less than 40 cm of rainfall annually. Vegetation is of the shrub-steppe province, reflecting the dry climate and harsh temperature extremes. Because of this habitat, occupied by the species, factors contributing to the decline include agricultural practices, especially grazing, and water diversions and withdrawals. In addition, hydropower development has impacted the species by preventing these steelhead from migrating to habitat above dams, and by killing them in large numbers when they try to migrate through the Columbia River hydroelectric system.

Critical Habitat

NMFS designated critical habitat for Middle Columbia River steelhead on September 2, 2005 (70 FR 52630). Designated critical habitat includes the following subbasins: Upper Yakima, Naches, Lower Yakima, Middle Columbia/Lake Wallula, Walla Walla, Umatilla, Middle Columbia/Hood, Klickitat, Upper John Day, North Fork

John Day, Middle Fork John Day, Lower John Day, Lower Deschutes, Trout, and the Upper Columbia/Priest Rapids subbasins and the Columbia River corridor. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. The final rule (70 FR 52630) lists the watersheds that comprise the designated subbasins and any areas that are specifically excluded from the designation.

In total, there are 114 watersheds within the range of Middle Columbia River steelhead. The total area of habitat designated as critical includes about 5,800 miles of stream habitat. This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. Of the 114 watersheds reviewed in NMFS' assessment of critical habitat for Middle Columbia River steelhead, nine watersheds received a low rating of conservation value, 24 received a medium rating and 81 received a high rating of conservation value for the species. Although pristine habitat conditions are still present in some wilderness, roadless and undeveloped areas, habitat complexity has been greatly reduced in many areas of designated critical habitat for Middle Columbia River steelhead. Limiting factors identified for Middle Columbia River steelhead include: hydropower system mortality, reduced stream flow, impaired passage, excessive sediment, degraded water quality and altered channel morphology and floodplain.

Steelhead (Upper Columbia River)

Distribution

Upper Columbia River steelhead occupy the Columbia River Basin upstream from the Yakima River, Washington, to the border between the United States and Canada. This area includes the Wenatchee, Entiat, and Okanogan Rivers. All upper Columbia River steelhead are summer steelhead. Steelhead primarily use streams of this region that drain the northern Cascade Mountains of Washington State. This species includes hatchery populations of summer steelhead from the Wells Hatchery because it probably retains the genetic resources of steelhead populations that once occurred above the Grand Coulee Dam. This species does not include the Skamania Hatchery stock because of its non-native genetic heritage.

Status

Upper Columbia River steelhead were originally listed as endangered in 1997, after their status was reviewed, they were reclassified to threatened on January 5, 2006 (71 Federal Register 834). A more recent status review recommended continuing to recognize this species as threatened (76 FR 50448).

Critical Habitat

NMFS designated critical habitat for Upper Columbia River steelhead on September 2, 2005 (70 FR 52630). Designated critical habitat includes the following subbasins: Chief Joseph, Okanogan, Similkameen, Methow, Upper Columbia/Entiat, Wenatchee, Lower Crab, and the Upper Columbia/Priest Rapids subbasins and the Columbia River corridor. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. The final rule (70 FR 52630) lists the watersheds that comprise the designated subbasins and any areas that are specifically excluded from the designation.

There are 42 watersheds within the range of Upper Columbia River steelhead. The total area of habitat designated as critical includes about 1,250 miles of stream habitat. This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. Of the 42 watersheds reviewed in NMFS' assessment of critical habitat for Upper Columbia River steelhead, three watersheds received a low rating of conservation value, eight received a medium rating and 31 received a high rating of conservation value for the species. In addition, the Columbia River rearing/migration corridor downstream of the spawning range was rated as a high conservation value. Limiting factors identified for the Upper Columbia River steelhead include: mainstem Columbia River hydropower system mortality, reduced tributary stream flow, tributary riparian degradation and loss of in-river wood, altered tributary floodplain and channel morphology and excessive fine sediment and degraded tributary water quality.

Steelhead (Southern California)

Distribution

Southern California steelhead occupy rivers from the Santa Maria River to the southern extent of the species range.

Status

Southern California steelhead were listed as endangered in 1997, when their status was reviewed on January 5, 2006 they retained that classification (71 Federal Register 834).

Critical Habitat

NMFS designated critical habitat for Southern California steelhead on September 2, 2005 (70 FR 52488). Specific geographic areas designated include the following CALWATER hydrological units: Santa Maria River, Santa Ynez, South Coast, Ventura River, Santa Clara Calleguas, Santa Monica Bay, Callequas and San Juan hydrological units. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. The critical habitat designation (70 FR 52488) contains additional details on the sub-areas that are included as part of this designation and the areas that were excluded from designation.

In total, Southern California steelhead occupy 32 watersheds (fresh water and estuarine). The total area of habitat designated as critical includes about 700 miles of stream habitat and about 22 square miles of estuarine habitat, mostly within Humboldt Bay. This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. In estuarine areas the lateral extent is defined by the extreme high water because extreme high tide areas encompass those areas typically inundated by water and regularly occupied by juvenile salmon during the spring and summer, when they are migrating in the nearshore zone and relying on cover and refuge qualities provided by these habitats and while they are foraging. Of the 32 watersheds reviewed in NMFS' assessment of critical habitat for Southern California steelhead, five watersheds received a low rating of conservation value, six received a medium rating and 21 received a high rating of conservation value for the species.

Steelhead (South Central California coast)

Distribution

The South-Central California steelhead ESU includes all naturally spawned populations of steelhead (and their progeny) in streams from the Pajaro River (inclusive) to, but not including the Santa Maria River, California.

Status

South-Central California Coast steelhead were listed as threatened in 1997, when their status was reviewed on January 5, 2006 they retained that classification (71 Federal Register 834). A more recent status review recommended continuing to recognize this species as threatened (76 FR 50448).

Critical Habitat

NMFS designated critical habitat for South-Central California Coast steelhead on September 2, 2005 (70 FR 52488). Specific geographic areas designated include the following CALWATER hydrological units: Pajaro River, Carmel River, Santa Lucia, Salinas River and Estero Bay. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. The critical habitat designation (70 FR 52488) contains additional details on the sub-areas that are included as part of this designation and the areas that were excluded from designation.

In total, South-Central California Coast steelhead occupy 30 watersheds (fresh water and estuarine). The total area of habitat designated as critical includes about 1,250 miles of stream habitat and about 3 square miles of estuarine habitat (e.g., Morro Bay). This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. In estuarine areas the lateral extent is defined by the extreme high water because extreme high tide areas encompass those areas typically inundated by water and regularly occupied by juvenile salmon during the spring and summer, when they are migrating in the nearshore zone and relying on cover and refuge qualities provided by these habitats and while they are foraging. Of the 30 watersheds reviewed in NMFS' assessment of critical habitat for South-Central California Coast steelhead, six watersheds received a low rating of conservation value, 11 received a medium rating and 13 received a high rating of conservation value for the species.

Steelhead (California Central Valley)

Distribution

California central valley steelhead occupy the Sacramento and San Joaquin Rivers and their tributaries.

Status

California Central valley steelhead were listed as threatened in 1998, when their status was reviewed on January 5, 2006 they retained that classification (71 Federal Register 834). A more recent status review recommended continuing to recognize this species as threatened (76 FR 50448).

Critical Habitat

NMFS designated critical habitat for California Central Valley steelhead on September 2, 2005 (70 FR 52488). Specific geographic areas designated include the following CALWATER hydrological units: Tehama, Whitmore, Redding, Eastern Tehama, Sacramento Delta, Valley-Putach-Cache, American River, Marysville, Yuba, Valley American, Colusa Basin, Butte Creek, Ball Mountain, Shata Bally, North Valley Floor, Upper Calaveras, Stanislaus River, San Joaquin Valley, Delta-Mendota Canal, North Diablo Range and the San Joaquin Delta. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. The critical habitat designation (70 FR 52488) contains additional details on the sub-areas that are included as part of this designation and the areas that were excluded from designation.

In total, California Central Valley steelhead occupy 67 watersheds (freshwater and estuarine). The total area of habitat designated as critical includes about 2,300 miles of stream habitat and about 250 square miles of estuarine habitat in the San Francisco-San Pablo-Suisan Bay estuarine complex. This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. In estuarine areas the lateral extent is defined by the extreme high water because extreme high tide areas encompass those areas typically inundated by water and regularly occupied by juvenile salmon during the spring and summer, when they are migrating in the nearshore zone and relying on cover and refuge qualities provided by these habitats and while they are foraging. Of the 67 watersheds reviewed in NMFS' assessment of critical habitat for California Central Valley steelhead, seven watersheds received a low rating of conservation value, three received a medium rating and 27 received a high rating of conservation value for the species.

Steelhead (Northern California)

Distribution

Northern California steelhead includes steelhead in California coastal river basins from Redwood Creek south to the Gualala River, inclusive.

Status

Northern California steelhead were listed as threatened in 2000, when their status was reviewed on January 5, 2006 they retained that classification (71 Federal Register 834). A more recent status review recommended continuing to recognize this species as threatened (76 FR 50448). Critical habitat was designated for this species on September 2, 2005 (70 Federal Register 52488).

Critical Habitat

NMFS designated critical habitat for Northern California steelhead on September 2, 2005 (70 FR 52488). Specific geographic areas designated include the following hydrological units: Redwood Creek, Trinidad, Mad River, Eureka Plain, Eel River, Cape Mendocino, and the Mendocino Coast. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding.

The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity. The critical habitat designation (70 FR 52488) contains additional details on the sub-areas that are included as part of this designation, and the areas that were excluded from designation.

In total, Northern California steelhead occupy 50 watersheds (freshwater and estuarine). The total area of habitat designated as critical includes about 3,000 miles of stream habitat and about 25 square miles of estuarine habitat, mostly within Humboldt Bay. This designation includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. In estuarine areas the lateral extent is defined by the extreme high water because extreme high tide areas encompass those areas typically inundated by water and regularly occupied by juvenile salmon during the spring and summer, when they are migrating in the nearshore zone and relying on cover and refuge qualities provided by these habitats, and while they are foraging. Of the 50 watersheds reviewed in NMFS' assessment of critical habitat for Northern California steelhead, nine watersheds received a low rating of conservation value, 14 received a medium rating, and 27 received a high rating of conservation value for the species. Two estuarine areas used for rearing and migration (Humboldt Bay and the Eel River estuary) also received a rating of high conservation value.

Steelhead (Snake River Basin)

Distribution

Snake River basin steelhead are an inland species that occupy the Snake River basin of southeast Washington, northeast Oregon, and Idaho. The historic spawning range of this species included the Salmon, Pahsimeroi, Lemhi, Selway, Clearwater, Wallowa, Grande Ronde, Imnaha, and Tucannon Rivers.

Status

Snake River steelhead were listed as threatened in 1997, when their status was reviewed on January 5, 2006 they retained that classification (71 Federal Register 834). A more recent status review recommended continuing to recognize this species as threatened (76 FR 50448).

Critical Habitat

NMFS designated critical habitat for Snake River steelhead on September 2, 2005 (70 FR 52630). Designated critical habitat includes the following subbasins: Hells Canyon, Imnaha River, Lower Snake/Asotin, Upper Grand Ronde River, Wallowa River, Lower Grand Ronde, Lower Snake/Tucannon, Upper Salmon, Pahsimeroi, Middle Salmon-Panther, Lemhi, Upper Middle Fork Salmon, Lower Middle Fork Salmon, Middle Salmon, South Fork Salmon, Lower Salmon, Little Salmon, Upper and Lower Selway, Lochsa, Middle and South Fork Clearwater, and the Clearwater subbasins and the Lower Snake/Columbia River corridor. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity. The final rule (70 FR 52630) lists the watersheds that comprise the designated subbasins and any areas that are specifically excluded from the designation.

There are 289 watersheds within the range of Snake River steelhead. The total area of habitat designated as critical includes about 8,000 miles of stream habitat. This designation includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. Of the 289 fifth order streams reviewed in this species, 231 received a high conservation value rating, 44 received a medium rating and 14 received a rating of low conservation value for the species. The lower Snake/Columbia rearing/migration corridor downstream of the spawning range has a high conservation value. Limiting factors identified for Snake River Basin steelhead include: hydrosystem mortality, reduced stream flow, altered channel morphology and floodplain, excessive sediment, degraded water quality, harvest impacts, and hatchery impacts.

Steelhead (Upper Willamette River)

Distribution

Upper Willamette River steelhead occupy the Willamette River and its tributaries upstream of Willamette Falls. This is a late-migrating winter group that enters fresh water in March and April (Howell *et al*. 1985). Only the late run was included is the listing of this species, which is the largest remaining population in the Santiam River system.

Status

Upper Willamette River steelhead were listed as threatened in 1999, when their status was reviewed on January 5, 2006 they retained that classification (71 Federal Register 834). A more recent status review recommended continuing to recognize this species as threatened (76 FR 50448).

A major threat to Willamette River steelhead results from artificial production practices. Fish ¬ways built at Willamette Falls in 1885 have allowed Skamania-stock summer steelhead and early-migrating winter steelhead of Big Creek stock to enter the range of Upper Willamette River steelhead. The population of summer steelhead is almost entirely maintained by hatchery salmon, although natural-origin, Big Creek-stock winter steelhead occur in the basin (Howell *et al*. 1985). In recent years, releases of winter steelhead are primarily of native stock from the Santiam River system.

Critical Habitat

NMFS designated critical habitat for Upper Willamette River steelhead on September 2, 2005 (70 FR 52488). Designated critical habitat includes the following subbasins: Upper Willamette, North Santiam, South Santiam, Middle Willamette, Molalla/Pudding, Yamhill, Tualatin, and the Lower Willamette subbasins and the lower Willamette/Columbia River corridor. These areas are important for the species' overall conservation by protecting quality growth, reproduction and feeding. The critical habitat designation for this species identifies primary constituent elements that include sites necessary to support one or more steelhead life stages. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions and floodplain connectivity. The final rule (70 FR 52630) lists the watersheds that comprise the designated subbasins and any areas that are specifically excluded from the designation.

There are 38 watersheds within the range of Upper Willamette River steelhead. The total area of habitat designated as critical includes about 1,250 miles of stream habitat. This designation includes the stream channels within the designated stream reaches and includes a lateral extent as defined by the ordinary high water line. In areas where the ordinary high-water line is not defined the lateral extent is defined as the bankfull elevation. Of the 38 watersheds reviewed in NMFS' assessment of critical habitat for Upper Willamette River steelhead, 17 watersheds received a low rating of conservation value, six received a medium rating and 15 received a high rating of conservation value for the species. In addition, the lower Willamette/Columbia River rearing/migration corridor downstream of the spawning range was rated as a high conservation value.

Sturgeon, green (southern population)

Distribution

The southern population of green sturgeon occurs in the freshwater and estuarine waters of the Sacramento and Feather Rivers in central California .

Status

The southern population of Green sturgeon was listed as threatened on April 7, 2006, primarily because of population declines caused by dams the prevented them from reaching spawning areas located above the dams (FWS 1995). A substantial amount of habitat in the Feather River above Oroville Dam also was lost, and threats to green sturgeon on the Feather River are similar to those faced in the Sacramento River (NMFS 2004).

Critical Habitat For Green Sturgeon

On October 9, 2009, NMFS designated critical habitat for southern green sturgeon (74 FR 52300). The area identified as critical habitat is the entire range of the biological species, green sturgeon, from the Bering Sea, Alaska, to Ensenada, Mexico. Specific freshwater areas include the Sacramento River, Feather River, Yuba River, and the Sacramento-San Joaquin Delta.

Specific coastal bays and estuaries include estuaries from Elkhorn Slough, California, to Puget Sound, Washington. Coastal marine areas include waters along the entire biological species range within a depth of 60 fathoms. The principle biological or physical constituent elements essential for the conservation of southern green sturgeon in freshwater include: food resources; substrate of sufficient type and size to support viable egg and larval development; water flow, water quality such that the chemical characteristics support normal behavior, growth and viability; migratory corridors; water depth; and sediment quality. Primary constituent elements of estuarine habitat include food resources, water flow, water quality, migratory corridors, water depth, and sediment quality. The specific primary constituent elements of marine habitat include food resources, water quality, and migratory corridors.

Critical habitat of southern green sturgeon is threatened by several anthropogenic factors. Four dams and several other structures currently are impassible for green sturgeon to pass on the Sacramento, Feather, and San Joaquin rivers, preventing movement into spawning habitat. Threats to these riverine habitats also include increasing temperature, insufficient flow that may impair recruitment, the introduction of striped bass that may eat young sturgeon and compete for prey, and the presence of heavy metals and contaminants in the river.

Sturgeon, shortnose

Distribution

Shortnose sturgeon occur along the Atlantic Coast of North America, from the St. John River in Canada to the St. John's River in Florida. Nineteen, geographically-distinct populations of shortnose sturgeon in the wild are distributed from New Brunswick, Canada; Maine; Massachusetts; Connecticut; New York; New Jersey and Delaware; Chesapeake Bay and Potomac River; North Carolina; South Carolina; Georgia; and Florida. Two additional, geographically distinct populations represent shortnose sturgeon that were isolated by dams occur in the Connecticut River (above the Holyoke Dam) and in Lake Marion on the Santee-Cooper River system in South Carolina (above the Wilson and Pinopolis Dams).

Status

Shortnose sturgeon were listed as endangered on March 11, 1967 (32 Federal Register 4001) and remained on the endangered species list with enactment of the Endangered Species Act of 1973, as amended. These sturgeon were listed as endangered because of population declines resulting from the construction of dams in the large river systems of the northeastern United States during the late-1800s and early-1900s, dredging, the effects of water pollution, bridge construction, and incidental capture in commercial fisheries. More recently, alteration of freshwater flows into the estuaries of rivers had reduced the nursery habitat of juvenile shortnose sturgeon and larval and juvenile shortnose sturgeon have been killed after being impinged on the intake screens or entrained in the intake structures of power plants on the Delaware, Hudson, Connecticut, Savannah and Santee rivers.

Critical habitat has not been designated for shortnose sturgeon**.**

Environmental Baseline

By regulation, environmental baselines for biological opinions include the past and present *impacts* of all state, Federal or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02, emphasis added). The "impact" of the activities we normally identify in the *Environmental Baselines* of Opinions allow us to assess the prior experience and state (or condition) of the endangered and threatened individuals and areas of designated critical habitat that occur in an action area. This is important because, as we noted in the *Approach to the Assessment* section of this Opinion, in some phenotypic states, listed individuals will commonly exhibit responses they would not exhibit in other phenotypic states. The same is true for populations of endangered and threatened species: the consequences of changes in the performance of individuals on a population depends on the prior state of the population. Designated critical habitat is not different: under some ecological conditions, the physical and biotic features of critical habitat will exhibit responses that they would not exhibit in other conditions.

Our summary of the environmental baseline complements the information provided in the status of the species section of this biological opinion, provides information on the past and present ecological conditions of the action area that is necessary to understand the species' current risk of extinction, and provides the background necessary to understand information presented in the *Effects of the Action*, and *Cumulative Effects* sections of this biological opinion. When we "add" the probable direct and indirect effects of a new, continuing, or proposed action to the prior condition of endangered and threatened individuals and designated critical habitat, as our regulations require, our assessments are more likely to represent a proposed action's probable consequences on endangered species, threatened species, and designated critical habitat.

Because this is a programmatic consultation, however, on an action with a broad geographic scope that encompasses many waters of the United States this environmental baseline serves a slightly different purpose. The environmental baseline for this consultation focuses on the status and trends of the aquatic ecosystems in the United States and the consequences of that status for listed resources that occur in a general region. Since our action area and the environmental baseline encompass a very broad spatial scale with many distinct ecosystems, wherever possible we have focused on common indicators of the biological, chemical, and physical health of the nation's aquatic environments. The environmental baseline for this consultation provides the backdrop for evaluating the effects of the action on listed resources under NMFS' jurisdiction.

We divided the environmental baseline for this consultation into five broad geographic regions: the Northeast Atlantic Region, the Southeast Atlantic Region, the Gulf Coast Region, the Southwest Region, and the Pacific Northwest Region. In some instances regions were further subdivided according to ecoregions, importance to

NMFS' trust resources or other natural features. In each section we described the biological and ecological characteristics of the region such as the climate, geology, and predominant vegetation to provide landscape context and highlight some of the dominant processes that influence the biological and ecological diversity of the region where threatened and endangered species reside. We then described the predominant land and water uses within a region to illustrate how the physical and chemical health of regional waters and the impact of human activities have contributed to current status of listed resources.

Summary of the Status of the Watersheds in the Action Area

All of the anadromous, estuarine, coastal, and marine endangered species, threatened species, and designated critical habitat under the jurisdiction of NMFS depend on the health of aquatic ecosystems for their survival and eventual recovery. All of these species were listed as endangered or threatened, at least in part, because of the consequences of human activities on the aquatic ecosystems — the estuaries, rivers, lakes, streams, and associated wetlands, floodplains, and riparian ecosystems — of the United States, its territories, and possessions. The status and trends of those aquatic ecosystems determines the status and trends of these species and the critical habitat that has been designated for them.

Over the past 30 to 40 years, the nation's aquatic ecosystem have improved substantially. In particular, pollution from point sources have been significantly reduced over the past 35 years. Sewage and industrial discharges into aquatic ecosystems have been controlled, some agricultural pesticides have been restricted or banned. Programs like the Conservation Reserve Program have taken highly erodible lands out of production. Despite this progress, however, many aquatic ecosystems remain highly polluted. Assessments conducted by the water quality and natural resource agencies of the States suggests that 61 percent of river and stream miles, 54 percent of the lake area, 49 percent of estuarine area, and 22 percent of Great Lakes shoreline fully support the water quality standards they evaluated (EPA 2000). Of the waters bodies they assessed -- 39 percent of the river and stream miles, 46 percent of the lake area, and 51 percent of the estuarine area, -- one or more designated uses are impaired. Non-point pollution from urban and agricultural land — Siltation, nutrients, bacteria, metals (primarily mercury), and oxygen depleting substances — that is transported by precipitation and runoff was the primary cause of the impairment.

These water quality problems, particularly the problem of non-point sources of pollution, has resulted from the changes humans have imposed on the landscapes of the United States over the past 100 – 200 years. One way of relating these changes in water quality to land uses relies on the surface area of a watershed that is covered by porous versus impervious surfaces. Most land areas that are covered by natural vegetation are highly porous and have very little sheet flow; precipitation falling on these landscapes infiltrates the soil, is transpired by the vegetative cover, or evaporates. The increased transformation of the landscapes of the United States into a mosaic of urban and suburban land uses has increased the area of impervious surfaces — roads, rooftops, parking lots, driveways, and sidewalks — in those landscapes. As the area of impervious surfaces increases, that increase is accompanied by reductions in air quality, loss and fragmentation of habitat for native flora and fauna, and reductions in water quality (Arnold and Gibbons 1996, Barnes *et al*. 2000, Benfield *et al*. 1999, Schueler 1994).

The amount of impervious surface in a watershed is a reliable indicator of a suite of phenomena that influence a watershed's hydrology (Center for Watershed Protection 2003, Schueler 1994). Above certain thresholds, landscapes with impervious surfaces respond to precipitation differently than other land-uses: rain that would normally infiltrate in forest, grassland, and wetland soils falls on and flows over impervious surfaces. That runoff is then channeled into storm sewers and released directly into surface waters (rivers and streams), which changes the magnitude and variability of water velocity and volume in those receiving waters.

The area of impervious surfaces in watersheds has been correlated with the response of stream flow to precipitation (Anderson 1968, Jennings and Jarnagin 2002), stream hydraulics, stream bank stability (Booth 1990, Hammer 1972, Henshaw and Booth 2000, Leopold 1973), stream temperature, and one of the primary mechanism by which non-point sources of water pollution are transported to surface waters (Galli 1991, Jones and Clark 1987, Klein 1979). A study of 39 coldwater trout streams in Minnesota and Wisconsin concluded that the amount of impervious area in a watershed was negatively correlated with indices of biotic diversity. When impervious surfaces represented less than 6 percent of a watershed, biotic diversity in these streams remained high. When the area of impervious surface rose to between 6 and 11 percent, minor changes in urban surface area could result in major changes in the diversity of the fish fauna in some streams; when the area of impervious surface rose above 11 percent, many species fell out of the fish fauna (Wang *et al*. 2003). Modeling estimates suggest that nutrient loads will increase above background levels once the impervious area of a watershed increases above 20 to 25 percent and concluded that increased solar radiation from pavement, removal of riparian vegetation, and deforestation related to urbanization would increase stream temperatures during summer months (Schueler 1995).

An assessment of the impacts of urbanization on water quality detected high concentrations of heavy metals (copper, lead, zinc, nickel, cadmium, arsenic, and beryllium), organic pollutants (fertilizers and pesticides), fecal coliform bacteria, nutrients, and total suspended solids in storm runoff that was being transported to rivers, streams, lakes, and other surface waters (EPA 1983, also Table 5). Many heavy metals exceeded Environmental Protect Agency's (EPA) water quality criteria and drinking water standards; copper, lead, and zinc were found in 91 percent of all samples and were detected in receiving waters at levels that would be harmful to aquatic life. Fecal coliform concentrations violated EPA water quality standards in many sample areas during every storm event.

In the 29 years that have passed since EPA's initial assessment of urban runoff, the pattern remains largely the same. Since 1995, States have listed more than 38,000 waters as impaired by pollutants that include mercury (13 percent), pathogens (13 percent), sediment (11 percent), other metals (10 percent), nutrient (9 percent), and oxygen depletion (7 percent), among other causes of impairment (EPA 2007). Pennsylvania reported the greatest number of impaired waters (6,957), followed by New Hampshire (5,192), Washington (1,714), Minnesota (1,500), Kansas, Indiana, and Idaho (each reporting slightly more than 1,300 impaired waters).

For example, between 1991 and 2001, the amount of impervious surface increased 10.4 percent throughout the Puget Sound region (Puget Sound Action Team 2007). By 2001, impervious surface covered 7.3 percent of the Puget Sound region below 1,000 feet elevation and was substantially higher in some counties and watersheds in the region. Over the same time period, about 190 square miles of forest (about 2.3 percent of the total forested area of the Puget Sound basin) was converted to other uses. In areas below 1,000 feet elevation, the change was more dramatic: 3.9 percent of total forest area was converted to other uses. By 2004, about 1,474 fresh and marine waters in Puget Sound were listed as "impaired waters" in Puget Sound. Fifty-nine percent of these waters tested were impaired because of toxic contamination, pathogens, low dissolved oxygen or high temperatures. Less than one-third of these impaired waters have cleanup plans in place. Chinook salmon from Puget Sound have 2-to-6 times the concentrations of PCBs in their bodies as other Chinook salmon populations on the Pacific Coast. Because of this contamination, the Washington State Department of Health has issued consumption advisories for Puget Sound Chinook (Puget Sound Action Team 2007). Nevertheless, between 2000 and 2006, counties in Puget Sound counties increased by 315,965 people or by more than 50,000 people per year, with associated increases in impervious surfaces and population density per square mile of impervious surface (Puget Sound Action Team 2007).

Pollutants founds in Puget Sound Chinook salmon have found their way into the food chain of the Sound. Harbor seals in south Puget Sound, which feed on Chinook salmon, have PCB levels that are seven times greater than those found in harbor seals from the Georgia Basin. Concentrations of polybrominated diphenyl ether (also known as PBDE, a product of flame retardants that are used in household products like fabrics, furniture, and electronics) in seals have increased from less than 50 parts per billion in fatty tissue to more than 1,000 ppb over the past 20 years (Puget Sound Action Team 2007).

Various pollutants from non-point sources have also resulted in over 2,000 fish consumption advisories and more than 2,500 beach closings and advisories being issued in 1996 alone. For example, toxic algae like *Pfiesteria piscicida*, which are associated with excessive amounts of nutrients (chemical elements such as nitrogen and phosphorus) in waters in Maryland, North Carolina, and Virginia, have resulted in millions of fish killed and have had adverse effects on human health.

Northeast Atlantic Region

This region encompasses Maine, New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Delaware, Pennsylvania, Maryland and Virginia. The region is ecologically diverse, encompassing several broad ecoregions—according to Bailey's (1995) *Description of the Ecoregions of the United States* this region encompasses the warm continental, the hot continental and the hot continental mountains divisions —these ecoregions can be further subdivided into provinces based on vegetation (Bailey 1995). This region encompasses the New England/Acadian mixed forests and the Northeastern Coastal Forests. The headwaters of the Connecticut River originate in New England/Acadian forests, and as the river descends, it transitions from boreal forest to temperate deciduous forest. As the river flows through the low gradient coastal region, the ecoregion transitions to Northeastern Coastal Forest. The headwaters of the Hudson River flow through Eastern Forest/Boreal Transition ecoregions. As the river descends, it transitions to Eastern Great Lakes Lowland Forest and then Northeastern Coastal Forest. The headwaters of the Delaware River originate in the Allegheny Highland Forest ecoregion, and then as the river descends, it transitions to Appalachian/Blue Ridge Forest and then Northeastern Coastal Forest ecoregions. The Chesapeake Bay watersheds originate in both Allegheny Highlands Forest and Eastern Forest/Boreal, through the Piedmont Province and empty into the Chesapeake in the Atlantic Coastal Plain.

No threatened or endangered species under NMFS jurisdiction occur on or adjacent to National Forest Lands in this region.

Southeast Atlantic Region

This region covers all the drainages that ultimately drain to the Atlantic Ocean between the states of North Carolina and Florida. This region includes all of South Carolina and parts of Georgia, North Carolina, Florida, and Virginia.

NMFS trust resources occupy two ecoregions in the South Atlantic – the hot continental division and the subtropical division.

The hot continental division is characterized by its winter deciduous forest dominated by tall broadleaf trees, moderately leached soils rich in humus (Inceptisols, Ultisols, and Alfisols), and rainfall totals that decrease with distance from the ocean (Bailey 1995). Most of the Southeast Atlantic Coast Region is contained within the subtropical ecoregion and is characterized by a humid subtropical climate with particularly high humidity during summer months, and warm mild winters. Soils are strongly leached and rich in oxides of iron and aluminum (Bailey 1995). The subtropical ecoregion is forested, largely by second growth forests of longleaf, loblolly, and slash pines, with inland areas dominated by deciduous trees. Rainfall is moderate to heavy with annual averages of about 40 inches in the north, decreasing slightly in the central portion of the region, and increasing to 64 inches in southern Florida. The savanna ecoregion has a tropical wet-dry climate, controlled by moist warm topical air masses and supports flora and fauna that is adapted to fluctuating water levels (Bailey 1995).

In the sections that follow we describe several basins and estuaries to characterize the general ecology and natural history of the area, and past and current human activities and their impacts on the area. The region contains more than 22 river systems that generally flow in a southeasterly direction to the Atlantic Coast. The diverse geology and climate ensures variability in biological productivity and hydrology. Major basins include the Albemarle-Pamlico Watershed and its tributaries, the Cape Fear River, Winyah Bay and the Santee-Cooper Systems, the Savannah, Ogeechee, and the St. Johns River, to name a few. The more northerly river, the Roanoke which is part of the Albemarle-Pamlico Watershed, is cooler and has a higher gradient and a streambed largely characterized by cobble, gravel and bedrock.

The southern rivers are characterized by larger portions of low gradient reaches, and streambeds that are composed of greater amounts of sand and fine sediments—are often high in suspended solids, and have neutral to slightly acidic waters with high concentrations of dissolved organic carbon. Rivers emanating entirely within the Coastal Plain are acidic, low alkalinity, blackwater systems with dissolved organic carbon concentrations often up to 50 mg/L (Smock *et al.* 2005). We described several river basins in detail to provide additional context for evaluating the influence of the environmental baseline on listed species under NMFS' jurisdiction and the health of the environment.

Albemarle-Pamlico Sound Complex

The Albemarle-Pamlico Sound Estuarine Complex, the largest lagoonal estuarine system in the United States, includes seven sounds including Currituck Sound, Albemarle Sound, Pamlico Sound and others (EPA 2006). The Estuarine Complex is separated from the Atlantic Ocean by the Outer Banks, a long barrier peninsula, and is characterized by shallow waters, wind-driven tides that result in variable patterns of water circulation and salinity. Estuarine habitats include salt marshes, hardwood swamp forests, and bald cypress swamps.

The Albemarle-Pamlico watershed encompasses four physiographic regions—the Valley and Ridge, Blue Ridge, Piedmont and Coastal Plain Provinces. The geology of the basin strongly influences the water quality and quantity within the basin. The headwaters of the basin tributaries are generally steep and surface water flowing downstream has less opportunity to pick up dissolved minerals. However, as the surface water flows reaches the Piedmont and Coastal Plain, water velocity slows due to the low gradient and streams generally pick up two to three times the mineral content of surface waters in the mountains (Spruill *et al.* 1998). At the same time, much of the upper watershed is composed of fractured rock overlain by unconsolidated and partially consolidated sands. As a result, of the basin's geology, as a general matter more than half of the water flowing in streams discharging to the Albemarle-Pamlico Estuarine Complex comes from ground water.

Primary freshwater inputs to the Estuary Complex include the Pasquotank, Chowan and Roanoke Rivers that flow into Albemarle Sound, and the Tar-Pamlico and Neuse Rivers that flow into Pamlico Sound. The Roanoke River is approximately 410 miles long and drains a watershed of 9,580 mi^2. The Roanoke River begins in the mountains of western Virginia and flows across the North Carolina border before entering the Albemarle Sound. The upper Roanoke River's geology is primarily a high gradient boulder-rubble bedrock system. The middle Roanoke River is primarily course sand and gravel. The lower section of the Roanoke is almost entirely organic-rich mud. The average precipitation is approximately 43 inches. At the mouth, the average discharge is 5.3 billion gallons each day, or 8,193 cubic feet per second (Smock *et al.* 2005). The Roanoke River is home to 119 fish species, and only seven of those are not native to the area (Smock *et al.* 2005). The Roanoke is also home to nine endangered fish species, two amphibians, and seven mussels, including several important anadromous fish species.

The Neuse River is 248 miles long and has a watershed of 6,235 mi^2 (Smock *et al.* 2005). The Neuse River watershed is also located entirely within the state of North Carolina, flowing through the same habitat as the Cape Fear River, but ultimately entering Pamlico Sound. The river originates in weathered crystalline rocks of the piedmont and crosses sandstone, shale, and limestone before entering Pamlico Sound (Turekian *et al.* 1967). The average precipitation is approximately 48 inches per year. At the mouth, the average discharge is 3.4 billion gallons each day, or 5,297 cubic feet per second (USGS 2005).

Land Use. Land use in the Roanoke River is dominated by forest (68%) and the basin contains some of the largest intact, least disturbed bottomland forest floodplains along the eastern coast. Only 3% of the basin qualifies as urban land uses, and 25% is used for agriculture (Smock *et al.* 2005). The only major town in the Roanoke watershed is Roanoke, Virginia. The population in the watershed is approximately 80 people per square mile (Smock *et al.* 2005). In contrast, the Neuse River watershed is described as 35% agriculture, 34% forested, 20% wetlands, and 5% urban, and 6% other, with a basin wide density of approximately 186 people per square mile (Smock *et al.* 2005). While the population increased in the Albemarle-Pamlico Complex more than 70% during the last 40 years, the rate of growth is relatively low for many coastal counties in the Southeast (EPA 2006). Much of the estuarine complex is protected by large amounts of state and federally protected lands, which may reduce development pressures.

Throughout the 20th century, mining, agriculture, paper and pulp mills, and municipalities contributed large quantities of pollutants to the Roanoke River and the Albemarle-Pamlico Estuarine Complex. Even so, today the Albemarle-Pamlico Estuarine Complex is rated in good to fair condition in the National Estuary Program Coastal Condition Report despite that over the past 40-year period data indicate some noticeable changes in the estuary, including decreased dissolved oxygen levels, increased pH, decreased levels of suspended solids, and increased chlorophyll *a* levels (EPA 2006).

Coal is mined from the mountainous headwaters of the Roanoke River in southwestern Virginia. Mining through the piedmont and coastal areas of North Carolina was conducted for limestone, lead, zinc, titanium, apatite, phosphate, crushed stone, sand, and fossils. Many active mines in these watersheds are still in operation today. These mines are blamed for increased erosion, reduced pH, and leached heavy metals.

Agricultural activities are major source of nutrients to the estuary and a contributor to the harmful algal blooms in summer, although according to McMahon and Woodside 1997 (cited in EPA 2006) nearly one-third of the total nitrogen inputs and one-fourth of the total phosphorus input to the estuary are from atmospheric sources. Primary agricultural activities within the watershed include corn, soybean, cotton, peanut, tobacco, grain, potato, and the production of chicken, hog, turkey, and cattle.

In general, the Roanoke River is much cleaner since the passage of the federal Clean Water Act, although mercury, arsenic, cadmium, chromium, copper, lead, nickel, zinc, and PCBs are still considered high (NCDENR 2000). Fish tissues sampled within the estuary also showed elevated concentrations of total PAHs and total PCBs—10% of the sampled stations exceeded risk-based EPA Advisory Guidance values (EPA 2006). Water quality studies in the mid-1990s showed the Neuse Basin contained the highest nitrogen and phosphorus yields, while the Chowan Basin had the lowest yields (Spruill *et al.* 1998).

The Neuse River entered the national spotlight during the early 1990s due to massive and frequent fish kills within the basin. Over one billion American shad have died in the Neuse River since 1991. The problem is persistent but the cause of the kills differs among events; in 2004 more than 700,000 estuarine fish died and more than 5,000 freshwater fish died within the basin. Freshwater species most commonly identified during investigations included sunfishes, shad, and carp, while estuarine species most commonly reported included menhaden, perch, and croaker. Atlantic menhaden have historically been involved in a majority of estuarine kill events and have exhibited stress and disease in conjunction with fish kills. Fish kill events may often have different causative agents, and in many cases the precise cause is not clear, but high levels of nutrients, harmful algal blooms, toxic spills, outbreaks of a marine organism, *Pfiesteria pescicida*, low DO concentrations and sudden wind changes that mix hypoxic waters, are some of contributing factors or causes to the basins persistent fish kills (NCDWQ 2004).

Both the Roanoke River and the Neuse Rivers are fragmented by dams. The reservoirs are used for flood control and recreation, but the amount of agricultural and urban runoff that collects behind the dams has caused sanitation problems in the recent past. Three dams were removed recently in an effort to improve environmental conditions and fish passage. Widespread stream modification and bank erosion were rated high within the greater watershed relative to other sites in the Nation (Spruill *et al.* 1998).

Commercial and Recreational Fishing. The Albemarle and Pamlico Sounds and associated rivers support a dockside commercial fishery valued at over $54 million annually. The commercial harvest includes blue crabs, southern flounder, striped bass, striped mullet, white perch, croaker, and spot, among others. About 100 species are fished commercially or recreationally in the region.

Commercial and recreational fisheries exist for oyster, crab, clam, American shad, American eel, shrimp, and many other species. Shellfish can be collected by dredging, which has adverse effects to benthic organisms, including

Atlantic and shortnose sturgeon that use estuarine areas for feeding. Commercial fisheries along the South Carolina coast use channel nets, fyke nets, gillnets, seines, and trawls. All of those methods must use some sort of turtle excluder device, but likely still have lethal and sub-lethal effects to Atlantic and shortnose sturgeon.

Major Southeast Coastal Plains Basins

Natural History. More than five major river basins flow through the Coastal Plains of the Southeast and directly enter the Atlantic Ocean including the Cape Fear, Great Pee-Dee, Altamaha, and the St. Johns Rivers (see Table 2 for a description of several basins within this region). Rainfall is abundant in the region and temperatures are generally warm throughout the year. Northern rivers originate in the Blue Ridge Mountains or the Piedmont Plateau, but all the rivers described in this section have sizeable reaches of slack water as they flow through the flat Coastal Plain. Two rivers, the Satilla River in Georgia and the St. Johns River in Florida, are located entirely within the Coastal Plain. The highest elevation of the St. Johns River is 26 feet above sea level, so the change in elevation is essentially one inch every mile, making it one of the most gradually flowing rivers in the country.

Smock *et al.* (2005) describe the mountains and plateau as areas of heavily dissected and primarily highly metamorphosed rock of Paleozoic age, with occasional areas of igneous and sedimentary rock. Underlying rock is varied with bands of limestone, dolomite, shale, sandstone, cherts, and marble, with a number of springs and caves scattered throughout the area. Where the Piedmont Plateau dips the sedimentary deposits of the coastal plain are termed the fall line. Here, steep changes in elevation result in rapids or falls before the rivers level off in their Coastal Plain reaches. In the Coastal Plain reaches of the area's rivers soils are acidic with a low cation exchange capacity and a sandy or loamy surface horizon, and a loamy or clay subsurface. The acidic characteristics, slow flowing water with poor flushing and high organic and mineral inputs gives these waters their characteristic "blackwater" (or "brownwater" for those that originate in the Piemont Plateau) appearance. The Satilla River is a blackwater river that has a naturally low pH (between 4 and 6) and white sandbars--due to the low pH it also has naturally lower productivity than other rivers that originate within the mountains or the Plateau.

Table 3. Rivers of the Southeast United States (data from NCDENR 1999 and Smock *et al*. 2005)

Watershed	Length (mi.)	Basin Size (mi^2)	Physiographic Provinces*	Mean Annual Precipitation (in.)	Mean Discharge (cfs).	No. Fish Species	No. Endangered Species
Cape Fear River	320	9,324	PP, CP	47	7,663	95	8 fish, 1 mammal, 15 mussels
Great Pee Dee River	430	10,641	BR, PP, CP	44	13,102	>100	6 fish, 1 reptile
Santee-Cooper River	440	15,251	BR, PP, CP	50	15,327	>100	5 fish, 2 reptiles
Savannah River	300	10,585	BR, PP, CP	45	11,265	>100	7 fish, 4 amphibians, 2 reptiles, 8 mussels, 3 crayfish
Ogeechee River	250	5,212	PP, CP	44	4,061	>80	6 fish, 2 amphibians, 2 reptiles, 1 mussel
Altamaha River	140 (>400)	14,517	PP, CP	51	13,879	93	1 mammal, 12 fish, 2 amphibians, 2 reptiles, 7 mussels, 1 crayfish
Satilla River	200	3,530	CP	50	2,295	52	2 fish, 1 amphibian, 2 reptiles, 1 mussel
St. Johns River	311	8,702	CP	52	7,840	>150	1 mammal, 4 fish, 2 reptiles, 2 birds

* Physiographic Provinces: BR = Blue Ridge, PP = Piedmont Plateau, CP = Coastal Plain

Land Use. Across this region, land use is dominated by agriculture and industry, and to a lesser extent timber and paper production, although more than half of most basins remain forested. Basin population density is highly variable throughout the region with the greatest density in the St. Johns River watershed with about 200 people per square mile of catchment, most of whom are located near Jacksonville, Florida. In contrast, there are only 29 people per square mile in the Satilla River watershed in Georgia (Smock *et al.* 2005). See Table 3 for a summary of land uses and population densities in several area basins across the region (data from Smock *et al.* 2005).

The largest population centers in the region include Miami and Jacksonville, Florida, and Savannah, Georgia. Major towns include Greensboro, Chapel Hill, and Wilmington, North Carolina and Fayetteville, South Carolina in the Cape Fear River watershed; Winston-Salem, North Carolina and Georgetown, Florence, and Sumter, South Carolina in the Great Pee-Dee River Watershed; Charlotte, Hickory, and Gastonia, North Carolina and Greenville and Columbia, South Carolina in the Santee-Cooper River watershed; Savannah and Augusta, Georgia, in the Savannah River watershed; Louisville, Statesboro, and Savannah, Georgia, in the Ogeechee River watershed; Athens, and Atlanta, Georgia, in the Altamaha River watershed; and Jacksonville, Florida in the St. Johns River watershed.

Several of the rivers in the region have elevated levels of metals including mercury, fecal coliform, bacteria, ammonia, turbidity, and low DO. These impairments are caused by municipal sewage overflows, mining, and non-point source pollution, waterfowl, urban runoff, marinas, agriculture, and industries including textile manufacturing, power plant operations, paper mills and chemical plants (Harned and Meyer 1983; Berndt *et al.* 1998; NCDENR 1998; Smock *et al.* 2005).

Several watersheds exhibit high nitrogen loads including the Cape Fear River, Winyah Bay, Charleston Harbor, St. Helena Sound, Savannah River, Ossabaw Sound, Altamaha River, and St. Mary's River and Cumberland Sound (Bricker *et al.* 2007). Nitrate concentrations (as nitrogen) tend to be higher in stream draining basins with agricultural and mixed land uses (Berndt *et al.* 1998). Based on studies in Georgia, however, nitrate loads did not vary with growing season of crops (periods of heaviest fertilizer application), but were influenced by high streamflow, which could be related to downstream transport by subsurface flows (Berndt *et al.* 1998).

Table 4. Land Uses and Population Density in Several Southeast Atlantic Basins (data from Smock *et al*. 2005)

Watershed	Land Use Categories (Percent)				Density (people/mi.^{2})
	Agriculture	Forested	Urban	Other	
Cape Fear River	24	56	9	11	80
The Great Pee-Dee	28	58	8	6	127
Santee-Cooper River	26	64	6	4	168
Savannah River	22	65	4	9	91
Ogeechee River	18	54	1	17 (wetlands)	78
Altamaha River	--	64	3	7	73
Satilla River	26	72	1	1	29
St. Johns River	25	45	6	24 (wetlands & water)	202

Sediment is the most serious pollutant in the Yadkin (Pee-Dee) River and has historically been blamed on agricultural runoff. In the mid 1990s, farmers in the region began using soil conservation techniques that have reduced sediment inputs by 77%. Unfortunately, the reduction in sediment inputs from farms did not translate to a reduction in sediment in the river, as during this period there was a 25% reduction in agricultural land and a 38% increase in urban development.

Mining. Mining occurs throughout the region. South Carolina is ranked 25th in the states in terms of mineral value and 13th among the eastern 26 states, and produces 1% of the total nonfuel mineral production value in the United States. There are currently 13 minerals being extracted from 485 active mines in South Carolina alone. Portland and masonry cement and crushed stone were the State's leading nonfuel minerals in 2004 (NMA 2007). In contrast, Georgia accounts for 4%, Florida accounts for 5%, and North Carolina accounts for 1.76% of the total nonfuel mineral production value in the United States. North Carolina's leading nonfuel minerals in 2004 were crushed stone, phosphate rock, and construction sand and gravel. Georgia produces 24% of the clay in the nation; other leading nonfuel minerals include crushed stone and Portland cement. Florida is the top phosphate rock mining state in the United States and produces about six times more than any other state in the nation. Peat and zirconium concentrates are also produced in Florida.

The first gold mine discovered and operated in the United States is outside Charlotte, North Carolina in the Pee Dee watershed. Mines through Georgia are also major producers of barite and crude mica, iron oxide, and feldspar. There is a proposed titanium mine near the mouth of the Satilla River. Unfortunately, mines release some toxic materials and negatively impact fish, as fish living around dredge tailings have elevated levels of mercury and selenium.

Hydromodification Projects. Several of the rivers within the area have been modified by dams and impoundments. In contrast to rivers along the Pacific Coast, we found considerable less information on other types of hydromodification projects in this area, such as levees and channelization projects. There are three locks and dams along the mainstem Cape Fear River and a large impoundment on the Haw River. The lower river and its tributaries are relatively undisturbed. The lower reach is naturally a blackwater river with naturally low dissolved oxygen, which is compounded by the reduced flow and stratification caused by upstream reservoirs and dams. The Yadkin (Pee Dee) River is heavily utilized for hydroelectric power. There are many dams on Santee-Cooper River system. The Santee River Dam forms Lake Marion and diverts the Santee River to the Cooper River, where another dam, St. Stephen Dam regulates the outflow of the Santee River. Lake Moultrie is formed by both St. Stephen Dam and Pinopolis Dam, which regulates the flow of the Cooper River to the ocean. NMFS, in a draft Opinion, recently determined the Federal Energy Regulatory Commission, the action agency responsible for insuring their dams are not likely to jeopardize listed species, was not able to adequately protect shortnose sturgeon. Below the fall line, the Savannah River is free-flowing with a meandering course, but above the fall line, there are three large dams that turn the piedmont section of the river into a 100-mile long stretch of reservoir. Although the Altamaha River is undammed, hydropower dams are located in its tributaries the Oconee and Ocmulgee Rivers above the fall lines. There are no dams, however, along the entire mainstem Satilla River. There are no major dams on the mainstem St. Johns River either, but one of the largest tributaries has a dam on it. The St. Johns River's flow is altered, however, by water diversions for drinking water and agriculture.

Commercial and Recreational Fishing. The region is home to many commercial fisheries targeting species like shrimp, blue crab, clams, American and hickory shad, oysters, whelks, scallops, channel catfish, flathead catfish, snapper, and grouper. Shortnose sturgeon can be caught in gillnets, but gillnets and purse seines account for less than 2% of the annual bycatch. Shrimpers are responsible for 50% of all bycatch in Georgia waters and often interact with sea turtles. There are approximately 1.15 million recreational anglers in the state.

Gulf Coast Region

This region encompasses states of Alabama, Arkansas, Illinois, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Oklahoma, South Dakota, Tennessee, the western portion of Florida including the Florida Keys, and parts of, Georgia, Texas, Minnesota, Montana, North Dakota, Nebraska, Colorado, Indiana, Ohio, New Mexico, North Carolina, Pennsylvania, Virginia, West Virginia, Wisconsin, Wyoming, Mexico, and two Canadian provinces. Almost 2/3 of the continental United States drains to the Gulf of Mexico through the Mississippi River Basin. The Gulf is roughly 800 nautical miles wide, and is connected with the Atlantic Ocean through the Florida Straits and the Caribbean Sea through the Yucatan Channel between Cuba and Mexico.

While the Mississippi River is the most notable basin that drains to the Gulf of Mexico in terms of overall size (and the largest river in the United States) more than ten major river basins flow through to the Gulf including the Atchafalaya, Mobile, Red, Brazos, Colorado, and Rio Grande Rivers. In the following sections, we describe several

basins and estuaries that enter the Gulf of Mexico to characterize the general ecology and natural history of the area, and past and current human activities and their impacts on the area.

There are no threatened or endangered species under NMFS jurisdiction on or adjacent to U.S. Forest Service Lands in this region. Because no species will be affected by U.S. Forest Service activities in this region, it will not be analyzed further.

Southwest Coast Region

The basins described in this section are encompassed by the state of California and parts of Oregon. Select watersheds described herein characterize the general ecology and natural history of the area, and the past, present and future human activities and their impacts on the area. Essentially, this region encompasses all Pacific Coast Rivers south of Cape Blanco, California through southern California. The Cape Blanco area marks a major biogeographic boundary and has been identified by NMFS as a DPS/ESU boundary for Chinook and coho salmon, and steelhead on the basis of strong genetic, life history, ecological and habitat differences north and south of this landmark. Major rivers contained in this grouping of watersheds are the Sacramento, San Joaquin, Salinas, Klamath, Russian, Santa Ana and Santa Margarita Rivers see Table 5).

California Coast

Natural History. The physiographic regions covered by the basins discussed herein, include: (a) the Cascade-Sierra Nevada Mountains province, which extends beyond this region as we have defined it and continue north into British Columbia, (b) the Pacific Border province, and (c) the Lower California province (Carter and Resh 2005). The broader ecoregions division, as defined by Bailey (1995) is the Mediterranean Division. Three major vegetation types are encompassed by this region: the temperate coniferous forest, the Mediterranean shrub and savannah, and the temperate grasslands/savannah/shrub. The area, once dominated by native grasses, is naturally prone to fires set by lightening during the dry season (Bailey 1995).

This region is the most geologically young and tectonically active region in North America. The Coast Range Mountains are folded and faulted formations, with a variety of soil types and nutrients that influence the hydrology and biology of the individual basins (Carter and Resh 2005). The region also covers the Klamath Mountains and the Sierra Nevada.

The climate is defined by hot dry summers and wet, mild winters, with precipitation generally decreasing in southern latitudes although precipitation is strongly influences by topography and generally increases with elevation. Annual precipitation varies from less than 10 inches to more than 50 inches in the region. In the Sierra Nevada about 50% of the precipitation occurs as snow (Carter and Resh 2005), as a result snowmelt strongly influences hydrological patterns in the area. Severe seasonal patterns of flooding and drought, and high interannual variation in total precipitation makes the general hydrological pattern highly predictable within a basin, but the constancy is low across years (Carter and Resh 2005). According to Carter and Resh (2005) this likely increases the variability in the annual composition of the fish assemblies in the region.

The San Joaquin River, drains the largest basin in the region, originates within the Sierra Nevada near the middle of California and flows in a northwesterly direction through the southern portion of the Central Valley. The alluvial fan of the Kings River separates the San Joaquin from the Tulare River basin.

Table 5. Select Rivers in the Southwest Coast Region (Carter and Resh 2005)

Watershed	Length (mi. [approx.)	Basin Size (mi^2)	Physiographic Provinces*	Mean Annual Precipitation (inches)	Mean Discharge (cfs).	No. Fish Species (native)	No. Endangered Species
Rogue River	211	5,154	CS, PB	38	10,065	23 (14)	11
Klamath River	287	15,679	PB, B/R, CS	33	17,693	48 (30)	41
Eel River	200	3651	PB	52	7416	25 (15)	12
Russian River	110	1439	PB	41	2331	41 (20)	43
Sacramento River	400	27,850	PB, CS, B/R	35	23,202	69 (29)	>50 T & E spp.
San Joaquin River	348	83,409	PB, CS	49	4,662	63	>50 T & E spp.
Salinas River	179	4241	PB	14	448	36 (16)	42 T & E spp.
Santa Ana River	110	2438	PB	13	60	45 (9)	54
Santa Margarita River	27	1896	LC, PB	49.5	42	17 (6)	52

* Physiographic Provinces: PB = Pacific Border, CS = Cascades-Sierra Nevada mountains, B/R=Basin & Range

Land Use. Land use is dominated by forest (and vacant land) in northern basins, and grass, shrubland, and urban uses dominate in southern basins (see Table 6). Overall, the most developed watersheds are the Santa Ana, Russian, and Santa Margarita Rivers. The Santa Ana Watershed encompasses portions of San Bernardino, Los Angeles, Riverside, and Orange counties. About 50% of coastal sub-basin of the Santa Ana watershed is dominated by urban land uses and the population density is about 1,500 people per square mile. When steep and unbuildable lands are excluded from this area, then the population density in the watershed is 3,000 people per square mile. However, the most densely populated portion of the basin is near the city of Santa Ana where density reaches 20,000 people per square mile (Burton 1998, Belitz *et al.* 2004). The basin is home to nearly 5 million people and the population is projected to increase two-fold in the next 50 years (Burton 1998, Belitz *et al.* 2004).

Not only is the Santa Ana watershed the most heavily developed watersheds in the region, the Santa Ana is the most heavily populated study site out of more than 50 assessment sites studied across the nation by the United States Geological Survey (USGS) under the National Water-Quality Assessment (NAWQA) Program. Water quality and quantity in the basin reflects the influence of the high level of urbanization. For instance, the primary source of baseflow to the river is the treated wastewater effluent; secondary sources--sources that influence peak flows—include stormwater runoff from urban, agricultural, and undeveloped lands (Belitz *et al.* 2004). Concentrations of nitrates and pesticides are elevated within the basin, and were more frequently detected than in other national NAWQA sites (Belitz *et al.* 2004). Belitz *et al.* (2004) found that total nitrogen concentrations commonly exceeded 3 mg/L in the Santa Ana basin. In other NAWQA basins with elevated total nitrogen concentrations across the country, the primary influencing factor was the level of agriculture and the application of manure and pesticides within the basin. In the Santa Ana basin the elevated nitrogen is attributed largely to the wastewater treatment plants, where downstream reaches consistently exceeding 3 mg/L total nitrogen. Samples of total nitrogen taken upstream of the wastewater treatment plants were commonly below 2 mg/L (Belitz *et al.* 2004). Other contaminants detected at high levels included volatile organic compounds (VOCs; including chlorform, which sometimes exceeded water quality standards), pesticides (including diuron, diazinon, carbaryl, chlophyrifos, lindane, malathion, and chlorothalonil), and trace elements (including lead, zinc, arsenic). As a result of the changes, the biological community in the basin is heavily altered (Belitz *et al.* 2004).

Table 6. Land Uses and Population Density in Several Southwest Coast Region (Carter and Resh 2005).

Watershed	Land Use Categories (Percent)				Density
	Agriculture	Forest	Urban	Other	(people/mi.^{2})
Rogue River	6	83	<1	9 grass & shrub	32
Klamath River	6	66	<1	24 grass, shrub, wetland	5
Eel River	2	65	<1	31 grass & shrub	9
Russian River	14	50	3	31 (23 grassland)	162
Sacramento River	15	49	2	30 grass & shrub	61
San Joaquin River	30	27	2	36 grass & shrub	76
Salinas River	13	17	1	65 (49 grassland)	26
Santa Ana River	11	57	32	---	865
Santa Margarita River	12	11	3	71 grass & shrub	135

In many basins, agriculture is the major water user and the major source of water pollution to surface waters. In 1990 nearly 95% of the water diverted from the San Joaquin River was diverted for agriculture, and 1.5% diverted for livestock (Carter and Resh 2005). During the same period, Fresno, Kern, Tulare, and Kings Counties ranked top in the nation for nitrogen fertilizer use. Nitrogen fertilizer use increased 500% and phosphorus use increased 285% in the San Joaquin River basin in a 40 year period (Knatzer and Sheton 1998 *in* Carter and Resh 2005). A study conducted by USGS in the mid-1990s on water quality within San Joaquin River basin detected 49 pesticides in the mainstem and three sub-basins--22 pesticides were detected in 20% of the samples and concentrations of seven exceeded water quality standards (Dubrovsky *et al.* 1998). Water chemistry in the Salinas River is strongly influence by intensive agriculture—water hardness, alkalinity, nutrients and conductivity are high in areas where agricultural uses predominate.

Mining. Famous for the gold rush of the mid 1800s, California has a long history of mining. In 2004, California ranked top in the nation for nonfuel mineral production with 8.23% of the total production (NMA 2007). Today, gold with silver and iron ore comprise only 1% of the production value. Primary minerals include construction sand and gravel, cement, boron and crushed stone. California is the only state to produce boron, rare-earth metals and asbestos (NMA 2007).

The State contains some 1,500 abandoned mines and roughly 1% are suspected of discharging metal-rich waters in the basins. The Iron Metal Mine in the Sacramento Basin releases more than 500 kg of copper and more than 350 kg of zinc to the Keswick Reservoir below Shasta Dam, as well as elevated levels of lead (Cain *et al.* 2000 in Carter and Resh 2005). Metal contamination seriously reduces the biological productivity within a basin, can result in fish kills at high levels and at low levels contributes to sub-lethal effects including reduced feeding, overall activity levels, and growth. The Sacramento Basin and the San Francisco Bay watershed is one of the most heavily impacted basins within the state from mining activities, largely because the basin drains some of the most productive mineral deposits in the region. Methylmercury contamination within San Francisco Bay, the result of 19th century mining practices using mercury to amalgamate gold in the Sierra Nevada Mountains, remains a persistent problem today. Based on sediment cores, we know that pre-mining concentrations were about 5 times lower than concentrations detected within the Bay today (Conaway *et al.* 2003 in EPA 2006).

Hydromodification Projects. Several of the rivers within the area have been modified by dams, water diversions and drainage systems for agriculture and drinking water, and some of the most drastic channelization projects within the nation. In all, there are about 1,400 dams within the State of California, more than 5,000 miles of levees, and more than 140 aqueducts (Mount 1995 *in* Carter and Resh 2005). While about 75% of the runoff occurs in basins in the northern half of the State, 80% of the water demand is in the southern half of the State. Two water diversion projects meet these demands—the Bureau of Reclamation's (BOR) Central Valley Project and the California State Water Project. The Central Valley Project, one of the world's largest water storage and transport systems, has more than 20 reservoirs and delivers about 7 million acre-feet each year to southern California. The State Water Project has 20 major reservoirs and holds nearly 6 million acre-feet of water, delivering about 3 million acre feet. Together these diversions irrigate about 4 million acres of farmland and deliver drinking water to about 22 million residents. NMFS recently determined the BOR was unable to insure this project was likely to avoid jeopardizing listed species or adversely modifying their critical habitat within the central valley of California and both parties have agreed to a set of Reasonable and Prudent Alternatives (RPAs) that will allow for the survival and recovery of listed species in this area.

Both the Sacramento River and the San Joaquin River are heavily modified, each with hundreds of dams. The Rogue, Russian, and Santa Ana Rivers each have more than 50 dams, and the Eel, Salinas, and the Klamath Rivers have between 14 and 24 dams. The Santa Margarita, considered one the last free flowing rivers in coastal southern California has 9 dams in its watershed. All major tributaries of the San Joaquin River are impounded at least once and most have multiple dams or diversions. The Stanislaus River, a tributary of the San Joaquin River has over 40 dams. As a result, the hydrograph of the San Joaquin River is seriously altered from its natural state, the temperature regime and sediment transport regime are altered, and such changes have had profound influences on the biological community within the basin—while the modifications generally result in a reduction of suitable habitat for native species, these changes frequently result in a concomitant increase of suitable habitat for nonnative species. The

Friant Dam on the San Joaquin River is attributed with the extirpation of spring-run Chinook salmon within the basin, a run once estimated as producing 300,000 to 500,000 fish (Carter and Resh 2005).

Commercial and Recreational Fishing. The region is home to many commercial fisheries. The largest in terms of total landings in 2006 were northern anchovy, Pacific sardine, Chinook salmon, sablefish, Dover sole, Pacific whiting, squid, red sea urchin, and Dungeness crab (CDFG 2007). Red abalone are also harvested off of the shores of California. Illegal poaching of abalone, including endangered white abalone continues to be of concern in the state, with the demand for abalone in local restaurants, seafood markets and international businesses (Daniels and Floren 1998). The first salmon cannery established along the west coast was located in the Sacramento River watershed in 1864 but it only operated for about two years because the sediment from hydraulic mining decimated the runs in the basin (Hittell 1882, and Goode and others, 1884-1887, cited in NRC 1996).

Pacific Northwest Region

This region encompasses Washington, Oregon, Idaho, and includes parts of Nevada, Montana, Wyoming, and British Columbia. The region is ecologically diverse, encompassing northern marine lowland forests, mountain forests, alpine meadows and Northern desert habitat. In this section we focus on three primary areas that characterize the region, the Columbia River Basin and its tributaries, the Puget Sound Region, and the Coastal Drainages north of the Columbia River. The broader ecoregion divisions, as defined by Bailey (1995), and encompassed within this region are the Marine and Marine Mountains Divisions, portions of the Temperate Dessert, and Temperate Steppe and Temperate Steppe Mountains. Puget Sound and the coastal drainages are contained within the Marine Division, while the Columbia River watershed encompasses portions of all five ecoregions.

Columbia River Basin

Natural History. The most notable of all basins within the region is the Columbia River. The largest river in the Pacific Northwest and the fourth largest river in terms of average discharge the United States drains an area over 258,000 square miles (making it the sixth largest in terms of drainage area), the Columbia River Basin includes parts of Washington, Oregon, Nevada, Utah, Idaho, Wyoming, Montana and British Columbia and encompasses 13 terrestrial and three freshwater ecoregions, including arid shrub-steppes, high desert plateaus, temperate mountain forests, and deep gorges (Hinck *et al.* 2004, Kammerer 1990; Stanford *et al.* 2005).

Major tributaries include the Snake, Willamette, Salmon, Flathead, and Yakima Rivers; smaller rivers include the Owyhee, Grande Ronde, Clearwater, Spokane, Methow, Cowlitz and the John Day Rivers (see Table 7 for a description of select Columbia River Tributaries). The Snake River is the largest tributary at more than 1,000 miles long; its headwaters originating in Yellowstone National Park, Wyoming. The second largest tributary is the Willamette River in Oregon (Kammerer 1990; Hinck *et al.* 2004). The Willamette River is the 19th largest river in the nation in terms of average annual discharge (Kammerer 1990). The basins drain portions of the Rocky Mountains, the Bitterroot Range, and the Cascade Mountain Range.

The average annual runoff at the mouth of the Columbia River is 265,000 cubic feet per second (cfs; Kammerer 1990). A saltwater wedge extends 23 miles upstream of the mouth with tidal influences extending up to 146 miles upriver (Hinck *et al.* 2004). The climate within the basin is a mix of arid, dry summers, cold winters, and maritime air masses entering from the west. It is not uncommon for air temperatures in the Rocky Mountains to dip below zero in mid-winter, but summer air temperatures can reach more than 100 °F in the middle basin.

Table 7. Select Tributaries of the Columbia River (Carter and Resh 2005)

Watershed	Length (mi. [approx.)	Basin Size (mi^2)	Physiographic Provinces*	Mean Annual Precipitation (inches)	Mean Discharge (cfs).	No. Fish Species (native)	No. Endangered Species
Snake/Salmon River	870	108,495	CU, NR, MR, B/R	14	55,267	39 (19)	5 fish (4 T, 1 E), 6 (1 T, 5 E) snails, 1 plant (T)
Yakima River	214	6,139	CS, CU	7	3,602	50	2 (T)
Willamette River	143	11,478	CS, PB	60	32,384	61 (~31)	5 fish (4 T, 1 E),

* Physiographic Provinces: CU = Columbia-Snake River Plateaus, NR = Northern Rocky Mountains, MR = Middle Rocky Mountains, B/R=Basin & Range, CS = Cascade-Sierra Mountains, PB = Pacific Border

The river and estuary were once home to more than 200 distinct runs of Pacific salmon and steelhead, and represented adaptation to the local environment within a tributary or segment of a river (Stanford *et al.* 2005). Salmonids within the basin include Chinook, chum, coho, sockeye salmon, steelhead and redband trout, bull trout, and cutthroat trout. Other fish species within the basin include sturgeon, eulachon, lamprey, and sculpin (Wydoski and Whitney 1979). According to a review by Stanford *et al.* (2005), the basin contained 65 native fish species and at least 53 nonnative fishes. The most abundant non-native fish is the American shad, which was introduced to the basin in the late 1800s (Wydoski and Whitney 1979).

Land Use. More than 50% of the United State's portion of the Columbia River Basin is in Federal ownership (most of which occurs in high desert and mountain areas), 39% is in private land ownership (most of which occurs in river valleys and plateaus), and the remainder is divided among tribes, state, and local governments (Hinck *et al.* 2004). See Table 8 for a summary of land uses and population densities in several sub-basins within the Columbia River watershed (data from Stanford *et al.* 2005).

Table 8. Land Uses and Population Density in Select Tributaries of the Columbia River (data from Stanford *et al*. 2005)

Watershed	Land Use Categories (Percent)				Density
	Agriculture	Forest	Urban	Other	(people/$mi.^2$)
Snake/Salmon River	30	10-15	1	54 scrub/rangeland/barren	39
Yakima River	16	36	1	47 shrub	80
Willamette River	19	68	5	--	171

The interior Columbia Basin has been altered substantially by humans causing dramatic changes and declines in many native fish populations. In general the basin supports a variety of mixed uses. Predominant human uses include logging, agriculture, ranching, hydroelectric power generation, mining, fishing and a variety of recreational activities, and urban uses.

The decline of salmon runs in the Columbia is attributed to loss of habitat, blocked migratory corridors, altered river flows and pollution, over harvest, and competition from hatchery fish. Critical ecological connectivity (mainstem to tributaries and riparian floodplains) has been disconnected by dams and associated activities such as floodplain deforestation and urbanization. The most productive floodplains of the watershed are either flooded by hydropower dams or dewatered by irrigation diversions. Portions of this basin are also subject to impacts from cattle grazing and irrigation withdrawals. In the Yakima River 72 stream and river segments are listed as impaired by the Washington Department of Ecology and 83% exceed temperature standards. In the Willamette River riparian vegetation was greatly reduced by land conversion. By 1990 only 37% of the riparian area within 120m was forested, 30% was agricultural fields and 16% was urban or suburban lands. In the Flathead River aquatic invasive plants such as pondweed, hornwort, water milfoil, waterweed, cattail and duckweed grow in the floodplain wetlands and shallow lakes and in the Yakima River non-native grasses and other plant are commonly found along the lower reaches of the river (Stanford *et al*. 2005).

Agriculture and Ranching. Roughly 6% of the annual flow from the Columbia River is diverted for the irrigation of 7.3 million acres of croplands within the basin. The vast majority of these agricultural lands are located along the lower Columbia River, the Willamette, Yakima, Hood, and Snake Rivers, and the Columbia Plateau (Hinck *et al.* 2004). The Yakima River Basin is one of the most agriculturally productive areas in the United States (Fuhrer *et al.* 2004). Croplands within the Yakima Basin account for about 16% of the total basin area of which 77% is irrigated.

Agriculture and ranching increased steadily but slowly within the Columbia River basin from the mid to late 1800. By the early 1900s, agricultural opportunities began increasing at a much more rapid pace with creation of more irrigation canals and the passage of the Reclamation Act of 1902 (NRC 2004). Today, agriculture represents the largest water use within the basin. More than 105,000 acre feet per day (more than 90 percent) is used for agricultural purposes. Agriculture, ranching, and the related services employ more than nine times the national average (19% of the households within the basin; NRC 2004).

Ranching practices have led to increased soil erosion and sediment loads within adjacent tributaries, the worst of these effects may have occurred in the late 1800s and early 1900s with deliberate burning to increase grass production (NRC 2004). Several measures are in use to reduce the impacts of grazing including restricting grazing in degraded areas, reduced grazing allotments, and lower stocking rates. Today agricultural impacts to water quality within the basin are second to large scale influences of hydromodification projects for both power generation and irrigation. Water quality impacts from agricultural activities include alteration of the natural temperature regime, and insecticide and herbicide contamination, and increased suspended sediments.

The USGS has a number of fixed water quality sampling sites throughout various tributaries of the Columbia River, many of which have been in place for decades. Water volumes, crop rotation patterns, crop-type, and location of within the basin are some of the variables that influence the distribution and frequency of pesticides within a tributary. Detection frequencies for a particular pesticide can vary widely. One study conducted by the USGS between May 1999 and January 2000, detected 25 pesticide compounds (Ebbert and Embrey 2001). Another study detected at least two pesticides or their breakdown products in 91% of the samples collected, with the median number of chemicals being eight, and the maximum was 26. The herbicide 2,4-D occurred most often in the mixtures, along with azinphos-methyl, the most heavily applied pesticide, and atrazine, one of the most mobile pesticides in water (Fuhrer *et al.* 2004). However, the most frequently detected pesticides in the Yakima River Basin are total DDT, as well as its breakdown products DDE and DDD, and dieldrin (Johnson and Newman 1983, Joy 2002, Joy and Madrone 2002, Furher *et al*. 2004). In addition to current use-chemicals these legacy chemicals continue to pose a serious problem to water quality and fish communities despite their cancellation in the 1970s and 1980s (Hinck *et al.* 2004).

Fish and macroinvertebrate communities exhibit an almost linear decline in condition as the level of agriculture intensity increases within a basin (Cuffney *et al*. 1997, Fuhrer *et al*. 2004). A study conducted in the late 1990s examining 11 species of fish, including anadromous and resident fish collected throughout the basin for a suite of 132 contaminants, which included 26 pesticides revealed organochlorines, specifically hexachlorobenzene,

chlordane and related compounds, and DDT and its metabolites, were the most frequently detected pesticides within fish tissues (Hinck *et al*. 2004).

Urban and Industrial Development. The largest urban area in the basin is the greater Portland metropolitan area, located at the mouth of the river. Portland's population exceeds 500,000 people, whereas the next largest cities, Spokane, Salem, Eugene, and Boise, have more than 100,000 people (Hinck *et al*. 2004). Overall, however the population within the basin is one-third the average, and while the basin covers about 8% of United States' land, only about 1.2% of the United States population lives within the basin (Hinck *et al*. 2004).

Discharges from sewage treatment plants, paper manufacturing, and chemical and metal production represent the top three permitted sources of contaminants within the lower basin according to discharge volumes and concentrations (Rosetta and Borys 1996). According to Rosetta and Borys (1996) based on their review of 1993 data, 52% of the point source waste water discharge volume is from sewage treatment plants, 39% from paper and allied products, 5% from chemical and allied products, and 3% from primary metals. However, suspended sediment loading is predominantly from point sources from the paper and allied products industry (71%), while 26% comes from sewage treatment plants and 1% is from the chemical and allied products industry. Non-point source discharges (urban stormwater runoff) account for more of the total pollutant loading to the lower basin for most organics and over half of the metals. Although rural non-point sources contributions were not calculated, Rosetta and Borys (1996) surmised that in some areas and for some contaminants rural areas may contribute a large portion of the load; this is particularly the case for pesticide contamination in the upper river basin where agriculture is the predominant land use.

A study conducted in the late 1990s examining 11 species of fish, including anadromous and resident fish collected throughout the basin for a suite of 132 contaminants, which included 51 semi-volatile chemicals, 26 pesticides, 18 metals, seven PCBs, 20 dioxins, and 10 furans revealed PCBs, metals, chlorinated dioxins and furans (products of wood pulp bleaching operations) and other contaminants within fish tissues—white sturgeon tissues contained the greatest concentrations of chlorinated dioxins and furans (Hinck *et al.* 2004).

Hydromodification Projects. More than 400 dams exist in the basin ranging from mega dams that store large amounts of water to small diversion dams for irrigation. Every major tributary of the Columbia except the Salmon River is totally or partially regulated by dams and diversions. More than 150 dams are major hydroelectric projects of which 18 dams are located on mainstem Columbia River and its major tributary, the Snake River. The Federal

Columbia River Power System encompasses the operations of 14 major dams and reservoirs on the Columbia and Snake Rivers, operated as a coordinated system. The Army Corps of Engineers operates nine of 10 major Federal projects on the Columbia and Snake Rivers, and Dworshak, Libby and Albeni Falls dams. The Bureau of Reclamation operates Grand Coulee and Hungry Horse dams. These Federal projects are a major source of power in the region, and provide flood control, navigation, recreation, fish and wildlife, municipal and industrial water supply, and irrigation benefits.

The Bureau of Reclamation has operated irrigation projects within the basin since the 1904. The irrigation system delivers water to about 2.9 million acres of agricultural lands; 1.1 million acres of land are irrigated using water delivered by two structures, the Columbia River Project (Grand Coulee Dam) and the Yakima Project. Grand Coulee Dam delivers water for the irrigation of over 670,000 acres of crop lands and the Yakima Project delivers water to nearly 500,000 acres of crop lands (BOR 2007).

The Bonneville Power Administration, an agency of the U.S. Department of Energy, wholesales electric power produced at 31 Federal dams (67% of its production) and non-hydropower facilities in the Columbia-Snake Basin, selling about half the electric power consumed in the Pacific Northwest. The Federal dams were developed over a 37-year period starting in 1938 with Bonneville Dam and Grand Coulee in 1941, and ending with construction of Libby Dam in 1973 and Lower Granite Dam in 1975.

Development of the Pacific Northwest regional hydroelectric power system, dating to the early twentieth century, has had profound effects on the ecosystems of the Columbia River Basin (ISG 1996). These effects have been especially adverse to the survival of anadromous salmonids. The construction of the Federal power system modified migratory habitat of adult and juvenile salmonids, and in many cases presented a complete barrier to habitat access. Both upstream and downstream migrating fish are impeded by the dams, and a substantial number of juvenile salmonids are killed and injured during downstream migrations. Physical injury and direct mortality occurs as juveniles pass through turbines, bypasses, and spillways. Indirect effects of passage through all routes may include disorientation, stress, delays in passage, and exposure to high concentrations of dissolved gases, warm water, and increased predation. Dams have also flooded historical spawning and rearing habitat with the creation of massive water storage reservoirs. More than 55% of the Columbia River Basin that was accessible to salmon and steelhead before 1939 has been blocked by large dams (NWPPC 1986). Construction of Grand Coulee Dam blocked 1,000 miles of habitat from migrating salmon and steelhead (Wydoski and Whitney 1979). The mainstem habitats of the lower Columbia and Willamette Rivers have been reduced primarily to a single channel. As a result, floodplain area is reduced, off-channel habitat features have been eliminated or disconnected from the main channel, and the amount of large woody debris in the mainstem has been reduced. Remaining areas are affected by flow fluctuations associated with reservoir management for power generation, flood control and irrigation. Overbank flow events, important to habitat diversity, have become rare as a result of controlling peak flows and associated revetments. Consequently, the dynamics of estuary has changed substantially.

Artificial Propagation. There are several artificial propagation programs for salmon production within the Columbia River Basin, many of which were instituted under Federal law to ameliorate the effects of lost natural production of salmon within the basin from the dams on fishing. The hatcheries are operated by Federal, state, and tribal managers. For more than 100 years, hatcheries in the Pacific Northwest have been used to produce fish for harvest and replace natural production lost to dam construction, and have only minimally been used to protect and rebuild naturally produced salmonid population (e.g., Redfish Lake sockeye salmon). In 1987, 95% of the coho salmon, 70% of the spring Chinook salmon, 80% of the summer Chinook salmon, 50% of the fall Chinook salmon, and 70% of the steelhead returning to the Columbia River Basin originated in hatcheries (CBFWA 1990). More recent estimates suggest that almost half of the total number of smolts produced in the basin come from hatcheries (Mann *et al.* 2005).

The impact of artificial propagation on the total production of Pacific salmon and steelhead has been extensive (Hard *et al.* 1992). Hatchery practices, among other factors, are a contributing factor to the 90% reduction in natural coho salmon runs in the lower Columbia River of the past 30 years (Flagg *et al.* 1995). Past hatchery and stocking practices have resulted in the transplantation of salmon and steelhead from nonnative basins, and the impacts of these practices are largely unknown. Adverse effects of these practices likely included: the loss of genetic variability within and among populations (Busack 1990 and Riggs 1990 cited in Hard *et al.* 1992; Reisenbichler 1997), disease transfer; increased competition for food, habitat, or mates; increased predation; altered migration; and displacement of natural fish (Steward and Bjornn 1990 *cited in* Hard *et al.* 1992, Fresh 1997); and species with extended freshwater residence are likely to face higher risk of domestication, predation, or altered migration than are species that spend only a brief time in fresh water (Hard *et al.* 1992) to name a few. Nonetheless, artificial propagation also may contribute to the conservation of listed salmon and steelhead although it is unclear whether or how much artificial propagation during the recovery process will compromise the distinctiveness of natural population (Hard *et al.* 1992).

NMFS was mandated by congress in 2005 to institute hatchery reform within the Columbia River Basin. This reform is a collaborative effort and review of how harvest and hatcheries, both federal and non-federal, are affecting the recovery of listed salmon and steelhead. This effort has resulted in some improvements in hatchery practices and in other cases, has yet to be implemented or the hatchery reform's success is yet to be determined. Eventually the goal is to have tribal, state, and federal managers effectively manage Columbia River Basin hatcheries in a way that will meet conservation and harvest goals consistent with their respective legal responsibilities.

Mining. Most of the mining in the basin is focused on minerals such as phosphate, limestone, dolomite, perlite, or metals such as gold, silver, copper, iron and zinc. Mining in the region is conducted in a variety of methods and places within the basin. Alluvial or glacial deposits are often mined for gold or aggregate, and ores are often excavated from the hard bedrocks of the Idaho batholiths. Eleven percent of the nation's output of gold has come from mining operations in Washington, Montana, and Idaho, and more than half of the nation's silver output has come from a few select silver deposits with 30% coming from two deposits located in the Columbia River Basin (the Clark Fork River and Coeur d'Alene deposits; Hinck *et al.* 2004, Butterman and Hilliard 2005). According to Wydoski and Whitney (1979) one of the largest mines in the region, located near Lake Chelan, once produced up to 2,000 tons of copper-zinc ore with gold and silver on a daily basis. Most of the phosphate mining within the basin occurs within the headwaters of the Snake River, but the overall output from these deposits accounts for 12% of the United States production of phosphate (Hinck *et al.* 2004).

Many of the streams and river reaches in the basin are impaired from mining and several abandoned and former mining sites are designated as superfund cleanup areas (Stanford *et al.* 2005, EPA 2007). According to the U.S. Bureau of Mines, there are about 14,000 inactive or abandoned mines within the Columbia River Basin of which nearly 200 pose a potential hazard to the environment (Quigley 1997 in Hinck *et al.* 2004). Contaminants that have been detected in the water include lead and other trace metals. Mining of copper, cadmium, lead, manganese, and zinc in the upper Clark Fork River have contributed wastes to this basin since 1880 (Woodward *et al.* 1994). Benthic macroinvertebrates and fish within the basin have bioaccumulated metals—the exposure and bioaccumulation of these metals in native fishes in the basin are suspected of reducing their survival and growth (Farag *et al.* 1994, Woodward *et al.* 1994). In the Clark River, several fish kills have occurred since 1984 and are attributed to contamination from trace metals such as cadmium, copper, lead and zinc (Hinck *et al.* 2004).

Commercial, Recreational, and Subsistence Fishing. Archeological records indicate that indigenous people caught salmon in the Columbia River more than 7,000 years ago. One of the most well known tribal fishing sites within the basin was located near Celilo Falls, an area in the lower river that has been occupied by Dalles Dam since 1957. Salmon fishing increased with better fishing methods and preservation techniques, such as drying and smoking, such that harvest substantially increased in the mid-1800s with canning techniques. Harvest techniques also changed over time, from early use of hand-held spears and dip nets, to river boats that used seines and gill-nets, eventually, transitioning to large ocean-going vessels with trolling gear and nets and the harvest of Columbia River salmon and steelhead off the waters of the entire west coast, from California to Alaska (Mann *et al.* 2005).

During the mid 1800s, an estimated 10 to 16 million adult salmon of all species entered the Columbia River each year. Large harvests of returning adult salmon during the late 1800s ranging from 20 million to 40 million pounds of salmon and steelhead annually significantly reduced population productivity (Mann *et al.* 2005). The largest harvest of Chinook salmon ever recorded occurred in 1883 when Columbia River canneries processed 43 million pounds of salmon (Lichatowich 1999). Commercial landings declined steadily from the 1920s to a low in 1993, when just over one million pounds were harvested (Mann *et al.* 2005).

Harvested and spawning adults reached 2.8 million in the early 2000s, of which almost half are hatchery produced (Mann *et al.* 2005). Most of the fish caught in the river are steelhead and spring/summer Chinook salmon, while ocean harvest consists largely of coho and fall Chinook salmon. Most ocean catches are made north of Cape Falcon, Oregon. Between 1999 and 2004, the number of spring and fall salmon commercially harvested in tribal fisheries has averaged between 25,000 and 110,000 fish (Mann 2004 in Mann *et al.* 2005). Recreational catch in both ocean and in-river fisheries varies around 140,000 to 150,000 fish (Mann *et al.* 2005).

Puget Sound Region

Natural History. The Puget Sound watershed defined by the crest lines of the Olympia Mountain Range (and the Olympic Peninsula) to the west and the Cascade Mountain Range to the east. The Olympic Mountains reach heights of about 8,000 feet above sea level, and are extremely rugged and steeply peaked with abrupt descents into the Puget Lowland. The Cascade Mountains on the east range in heights of 4-8,000 feet above sea level with the highest peak, Mount Rainer towering over the region at 14,410 feet above sea level. As the second largest estuary in the United States, Puget Sound has about 1330 miles of shoreline, extends from the mouth of the Strait of Juan de Fuca east, including the San Juan Islands and south to Olympia, and is fed by more than 10,000 rivers and streams.

Puget Sound is generally divided into four major geographic marine basins: Hood Canal, South Sound, Whidbey Basin, and the Main Basin. The Main Basin has been further subdivided into two sub-basins: Admiralty Inlet and Central Basin. Each of the above basins forms a depression on the sea floor in which a shallower ledge or sill separates the relatively deep water from the adjacent basin. The waters of Puget Sound function as a partially mixed, two-layer system, with relatively fresh water flowing seaward at the surface and salty oceanic water entering at depth.

The main ledge of Puget Sound is located at the north end of Admiralty Inlet where the water shoals to a depth of about 200 feet at its shallowest point (King County 2001). The deepest point in Puget Sound is found in the Central Basin and is over 920 feet. Approximately 43% of the Puget Sound's tideland is located in the Whidbey Island Basin. This reflects the large influence of the Skagit River, which is the largest river in the Puget Sound system and whose sediments are responsible for the extensive mudflats and tidelands of Skagit Bay.

Habitat types that occur within the nearshore environment include eelgrass meadows, kelp forest, mud flats, tidal marshes, sub-estuaries (tidally influenced portions of river and stream mouths), sand spits, beaches and backshore, banks and bluffs, and marine riparian vegetation. These habitats provide critical functions such as primary food production, support habitat for invertebrates and juvenile and adult fishes, and provide foraging and refuge opportunities for birds and other wildlife.

The Puget Sound ecoregion is a glaciated area consisting of glacial till, glacial outwash and lacustrine deposits with high quality limestone is found in the San Juan Islands (Wydoski and Whitney 1979). Relief in the valley is moderate with elevation ranging from sea level to about 1300 feet. Geology in the region consists of mostly Tertiary sedimentary bedrock formations.

The land and vegetation surrounding Puget Sound waters is classified as Puget Lowland Forest and occupies the depression or valley between the Olympic Peninsula on the west and the Cascade Mountains on the east (Franklin and Dyrness 1973). The alpine zone is expressly devoid of trees. Vegetation changes abruptly along the mountain slopes and across minimal horizontal distances as a result of steep topography, soil, and microclimate (sun exposure, temperature, and precipitation). Dominant vegetation types include from the Puget lowland region – the lowland forest, the mid-montane forest of Pacific silver fir (*Abies amabilis*) with Alaska yellow cedar (*Chamaecyparis nootkatensis*); the subalpine forest of mountain hemlock (*Tsuga mertensiana*)with subalpine fir (*Abies lasiocarpa*) and Alaska yellow cedar; and the alpine tundra or meadow above the tree line (Kruckeberg 1991).

The Puget Sound region has a Mediterranean-like climate, with warm, dry summers, and mild wet winters (Franklin and Dyrness 1973). Annual precipitation varies from 28-35 inches, and falls predominantly as rain in lowland areas. Annual snowpack in the mountain ranges is often high—although the elevation of the Olympia Mountains is not as high as that of the Cascade Mountain Range, abundant accumulation occurs, such that it will sometimes persist throughout much of the summer months. Average annual rainfall in the north Cascades at Mount Baker Lodge is about 110 inches, and at Paradise Station at Mount Rainer is about 105 inches, while average annual snowfall is 550 inches and 582 inches respectively--sometimes reaching more than 1,000 inches on Mount Rainer (Wydoski and Whitney 1979; Kruckeberg 1991).

Major rivers draining to Puget Sound from the Cascade Mountains include the Skagit River, the Snohomish River, the Nooksack River, the Puyallup/Green River, and the Lake Washington/Cedar River watershed. Major rivers from the Olympic Mountains include the Hamma Hamma, the Duckabush, the Quilcene, and the Skokomish Rivers. Numerous other smaller rivers drain to the Sound, many of which are significant producers of salmonids despite their small size.

The Puget Sound basin is home to more than 200 fish species, representing more than 50 families; and more than 140 mammals, of which less than a third are marine mammals. Salmonids within the region include coho salmon, Chinook salmon, sockeye salmon and kokanee, chum salmon, pink salmon, steelhead and rainbow trout, coastal cutthroat trout, bull trout, and Dolly Varden (Wydoski and Whitney 1979, Kruckeberg 1991). Important commercial fishes include the five Pacific salmon species and several rockfish species. A number of introduced species occur within the region including brown trout, brook trout, Atlantic salmon, bass, tunicates (sea squirts), and a saltmarsh grass (*Spartina*). Estimates suggest that more than 90 species have been intentionally or accidentally introduced in

the region (Ruckelshaus and McClure 2007). At present over 40 species in the region are listed as threatened and endangered under the ESA.

Land Use. Land use in the Puget Sound lowland is composed of agricultural areas (including forests for timber production), urban areas (industrial and residential use), and rural areas (low density residential with some agricultural activity). In the 1930s, all of Western Washington contained about 15.5 million acres of "harvestable" forest land and by 2004 the total acreage was nearly half that surveyed more than 70 years earlier (PSAT 2007). Forest cover in Puget Sound alone was about 5.4 million acres in the early 1990s and about a decade later the region had lost another 200,000 acres of forest cover with some watersheds losing more than half the total forested acreage. The most intensive loss of forest cover has occurred in the State's Urban Growth Boundary, which encompasses specific parts of the Puget Lowland; in this area forest cover declined by 11.1% between 1991 and 1999 (Ruckelshaus and McClure 2007). Projected land cover changes (reviewed in Ruckelshaus and McClure 2007) indicate that trends are likely to continue over the next several decades with population changes—coniferous forests are projected to decline at an alarming rate as urban uses increase.

The Puget Sound Lowland contains the most densely populated area of Washington. The regional population in 2003 was an estimated 3.8 million people, with 86% residing in King, Pierce and Snohomish Counties (Snohomish, Cedar-Sammamish Basin, Green-Duwamish, and Puyallup River watersheds), and the area is expected to attract four to six million new human residents in the next 20 years (Ruckelshaus and McClure 2007).

According to the State of the Sound report (PSAT 2007) in 2001, impervious surfaces covered 3.3% of the region, with 7.3% of lowland areas (below 1,000 feet elevation) covered by impervious surfaces. In one decade, 1991 – 2001 impervious surfaces increased 10.4% region wide. The Snohomish River watershed, one of the fastest growing in the region, increased 15.7% in the same period.

Much of the region's estuarine wetland losses have been heavily modified, primarily from agricultural land conversion and urban development (NRC 1996). Although most estuarine wetland losses result from conversions to agricultural land by ditching, draining, or diking, these wetlands are also experiencing increasing effects from industrial and urban causes.

The most extreme case of river delta conversion is observed in the Duwamish Waterway in Seattle. As early as the mid-1800s, settlers in the region began discussing the need for a ship canal that linked Lake Washington directly with Puget Sound. After several private and smaller attempts, by the early 1900s locks were built achieving this engineering feat. The resultant outcome was that the Black River, which formerly drained Lake Washington to the Green and White Rivers (at their confluence, these rivers formed the Duwamish River), dried up. The lower White River, which historically migrated sporadically between the Puyallup and the Green/Duwamish basins, was permanently diverted into the Puyallup River basin in 1914 with the construction of concrete diversion at river mile 8.5, resulting in a permanent increase of the Puyallup River flows by about 50% and a doubling of the drainage area (Kerwin 1999). The Cedar River, on the other hand was permanently diverted to Lake Washington. The oxbow in the lower Duwamish River was lost with the lower river dredging in the early 1900s reducing the lower nine miles of the river to 5 miles in length. Overtime the waterway has been heavily armored and diked, result in the loss of all tidal swamps, 98% of the tidal forests, marshes, shallows and flats and 80% of the riparian shoreline (Blomberg *et al.* 1988 in Ruckelshaus and McClure 2007).

By 1980, an estimated 27,180 acres of intertidal or shore wetlands had been lost at eleven deltas in Puget Sound (Bortleson *et al.* 1980). Tidal wetlands in Puget Sound amount to about 17-19% of their historical extent (Collins and Sheikh 2005). Coastal marshes close to seaports and population centers have been especially vulnerable to conversion with losses of 50-90% common for individual estuaries.

More than 100 years of industrial pollution and urban development have affected water quality and sediments in Puget Sound. Many different kinds of activities and substances release contamination into Puget Sound and the contributing waters. Positive changes in water quality in the region, however, are also evident. One of the most notable improvements was the elimination of sewage effluent to Lake Washington in the mid 1960s, which significantly reduced problems within the lake from phosphorus pollution and triggered a concomitant reduction in the cyanobacteria (see Ruckelshaus and McClure 2007 for a review).

Even so, as the population and industry has risen in the region a number of new and legacy pollutants are of concern. According to the State of the Sound Report (PSAT 2007) in 2004, more than 1,400 fresh and marine waters in the region were listed as "impaired." Almost two-thirds of these water bodies were listed as impaired due to contaminants, such as toxics, pathogens, and low dissolved oxygen or high temperatures, and less than one-third had established cleanup plans; more than 5,000 acres of submerged lands (primarily in urban areas; 1% of the study area) are contaminated with high levels of toxic substances, including polybrominated diphenyl ethers (PBDEs—flame retardants), and roughly one-third (180,000 acres) of the submerged lands within Puget Sound are considered moderately contaminated. PBDEs biomagnified in the food chain, and in the past 20 years the body burden in harbor seals has increased dramatically from 50 ppb to more than 1,000 ppb. Primary pollutants of concern in Puget Sound include heavy metals, organic compounds, PAHs, PCBs, dioxins, furans, DDT, phthalates, and PBDEs.

Areas of highest concern in Puget Sound are Southern Hood Canal, Budd Inlet, Penn Cove, Commencement Bay, Elliott Bay, Possession Sound, Saratoga Passage, and Sinclair Inlet (DOE 2002). Hypoxic dissolved oxygen concentration (<3 mg/L) were found at several (11 out of 54) stations. Dissolved oxygen concentrations less than 3 mg/L were measured in Hood Canal, Penn Cove, Saratoga Passage, Bellingham Bay, Discovery Bay, Elliott Bay, Strait of Georgia and West Point. Conditions in South Hood Canal were especially severe, with low DO concentration (<5 mg/L) evident year-round. Penn Cove also exhibited re-occurring hypoxia. Low DO was found at 18 other stations, including Saratoga Passage, Discovery Bay, Bellingham Bay, Elliott Bay, Budd Inlet, and Commencement Bay.

In 1989 the Washington State Department of Ecology (DOE) began a program to monitor marine sediment conditions called the Puget Sound Assessment and Monitoring Program (PSAMP). The PSAMP is a multi-agency partnership administered by the Puget Sound Action Team. From 1989-1995 the Marine Sediment Monitoring Program was implemented to characterize baseline sediment quality conditions and trends throughout the Greater Puget Sound area. This was the first large scale evaluation of Puget Sound sediment quality at ambient (i.e. away from point sources of contamination) stations through the Sound. Eighty-six stations were established throughout Puget Sound, Hood Canal, the Strait of Georgia, and the Strait of Juan de Fuca. Stations were grouped in two categories: core stations sampled annually, and rotating stations sampled once every three years alternating between North, Central, and South Puget Sound regions. At each station, replicate sediment samples were collected for the analysis of chemical contaminants, sediment variables, and benthic community structure.

Overall, contaminant concentrations at monitoring stations were generally low and below state sediment quality standards. Metals and semi-volatile organic compounds were most frequently detected. The highest metal and organic contamination was found in locations associated with urban and industrial centers. Low metal concentrations were also detected in some rural areas and in deep depositional environments. Contaminant concentrations occasionally exceeded state regulatory sediment quality standards. However, there was not a consistent pattern across years. An exception was mercury in Sinclair Inlet and Dyes Inlet, with concentrations above standards for each of the seven years monitored.

By 2000, annual monitoring of sediments at ten historical PSAMP stations showed mixed trends in recent years for some chemicals found in sediments (DOE 2005). Less than one third (32 percent) of almost 13,000 chemical measurements made were detected during testing. Those detected most often exceeded sediment quality guidelines in urban embayments: Sinclair Inlet (mercury), Thea Foss Waterway (PAHs).

In general, metals concentrations in 2000 were lower than in 1989 thru 1996 more often than they were higher, while the opposite was true of PAHs (DOE 2005). At the Port Gardner and Inner Budd Inlet station, concentrations of a number of priority pollutant and metals also decreased significantly. Individual PAH levels decreased at the Point Pully station, but increased significantly at the Bellingham Bay, Port Gardner, and East Anderson Island stations. Total HPAH and total PAH levels increased significantly at the Strait of Georgia, Bellingham Bay, East Anderson Island, and Budd Inlet stations. These changes may reflect changes in anthropogenic input of contaminants to the estuarine system over this 12-year study period. Also, changes in grain size and benthic infaunal community composition seen at the Strait of Georgia station were probably linked to increased precipitation and subsequent increased flow and sediment loading from the Fraser River in 1996 and 1997.

From 1997 to 1999, sediments were collected throughout Puget Sound as part of a joint monitoring program conducted by the DOE and NMFS (DOE 2003). Analyses were performed to quantify concentrations of potentially toxic chemicals, responses in laboratory toxicity tests, and the structure of benthic infauna communities in sediments.

Degraded conditions, as indicated by a combination of relative high chemical concentrations, statistically significant responses in one or more tests of toxicity, and adversely altered benthos, occurred in samples that represented about 1% of the total area (5,700 acres) (DOE 2003). These conditions occurred in samples collected within urbanized bays and industrial waterways, especially near the urban centers of Everett, Seattle, Tacoma, and Bremerton, where degraded conditions had been reported in previous studies. Sediments with high quality (as indicated by no elevated chemical concentrations, no significant responses in the toxicity tests, and the presence of abundant and diverse infauna and or pollution sensitive taxa) occurred in samples that represented a majority, 68% of the total study area (400,000 acres). Sediments in which results of the three kinds of analyses were not in agreement were classified as intermediate in quality and represented about 31% of the total area (179,000 acres).

Although the highly degraded sediments comprise a small percentage of Puget Sound's area these hot spots upload pollution into the food web, and the resulting damage to the ecological health and function of the Puget Sound ecosystem may be much greater than the small area suggest.

Researchers detected arsenic, copper, lead, and mercury throughout the Sound. They found cadmium at 59% of the stations and tributulin, an antifouling chemical found in ship hull paint, at 50% of the stations. PAHs were common while phthlalate esters, PCBs, DDTs and dibenzofurans appeared at fewer stations (PSAT 2004). Degraded sediments were most prevalent in the Whidbey Basin and Central Sound regions (Everett Harbor, Elliott Bay, Commencement Bay). A higher degree of degradation in critical nearshore habitat may disproportionately affect important fish, shellfish and aquatic plant species (DOE 1997-2003 posters).

The USGS assessed water quality of streams, rivers and groundwater in the Puget Sound Basin as part of the National Water-Quality Assessment (NAWQA) Program between 1996 and 1998. This assessment focused on the quality of surface and ground waters and biological indicators such as fish, algal, and invertebrate status in relation to land use. A widespread detection of pesticide compounds was observed in surface waters of the Puget Sound Basin (Bortleson and Ebbert 2000). Slightly more than half of the pesticide compounds (26 of 47 analyzed) were detected. The study found that large rivers in the Puget Sound Basin were more likely to meet Federal and state guidelines than were small streams (Ebbert *et al*. 2000). A total of 74 manmade organic chemicals were detected in streams and rivers, with different mixtures of chemicals linked to agricultural and urban settings including atrazine, prometon, simazine and tebuthiuron, carbaryl, diazinon, and malathion (Bortleson and Ebbert 2000). Commonly detected volatile organic compound in the agricultural land-use study area was associated with the application of fumigants to soils prior to planting (Ebbert *et al.* 2000). The average concentration of total nitrogen in small streams draining agricultural lands was twice the concentration in streams draining urban areas and over 40 times the concentration in streams draining undeveloped areas (Ebbert *et al*. 2000). The study concluded that contaminants in runoff from urban and agricultural land surfaces were major influences on the water quality of streams and rivers (Ebbert *et al.* 2000), and according to the State of the Sound report water quality impacts from stormwater and wastewater runoff is a major limiting factor in the recovery of salmon and bull trout (PSAT 2007).

Hydromodification Projects. More than 20 dams occur within the region's rivers and overlap with the distribution of salmonids, and a number of basins contain water withdrawal projects or small impoundments that can impede migrating salmon. The resultant impact of these and land use changes (forest cover loss and impervious surface increases) has been a significant modification in the seasonal flow patterns of area rivers and streams, and the volume and quality of water delivered to Puget Sound waters. Several rivers have been hydromodified by other means including levees and revetments, and bank hardening for erosion control, and agriculture uses. The first dike built in the Skagit River delta was built in 1863 for agricultural development (Ruckelshaus and McClure 2007), other basins like the Snohomish River are diked and have active drainage systems to drain water after high flows that top the dikes. Dams were also built on the Cedar, Nisqually, White, Elwha, Skokomish, Skagit and several other rivers in the early 1900s to supply urban areas with water, prevent downstream flooding and allow for floodplain activities (like agriculture or development), and to power local timber mills (Ruckelshaus and McClure 2007).

In the past month, dam removal on the Elwha River commenced and soon the river will no longer have obstructions to additional spawning habitat. The Elwha River was formerly a very productive salmon river and this improvement is expected to open more than 70 miles of high quality salmon habitat (Wunderlich *et al.* 1994 in Ruckelshaus and McClure 2007). Estimates suggest that nearly 400,000 salmon could begin using the basin within 30 years after the dams are removed (PSAT 2007).

About 800 miles of Puget Sound's shorelines are hardened or dredged (PSAT 2004 in Ruckelshaus and McClure 2007). The area most intensely modified is the urban corridor (eastern shores of Puget Sound0 from Mukilteo to Tacoma); here nearly 80% has been altered, mostly from shoreline armoring associated with the Burlington Northern Railroad tracks (Ruckelshaus and McClure 2007). Levee development within the rivers and their deltas has isolated significant portions of former floodplain habitat that was historically used by salmon and trout during rising flood waters.

Mining. Mining has a long history in the State of Washington, and in 2004 the state was ranked 13th nationally in total nonfuel mineral production value and 17th in coal production (Palmisano *et al*. 1993, NMA 2007). Metal mining for all metals (e.g., zinc, copper, lead, silver, and gold) peaked in the State between 1940 and 1970 (Palmisano *et al*. 1993). Today, construction sand and gravel, Portland cement and crushed stone are the predominant materials mined. Where sand and gravel is mined from riverbeds (gravel bars and floodplains) it may result in changes in channel elevations and patterns, instream sediment loads, and seriously alter instream habitat. In some cases, instream or floodplain mining has resulted in large scale river avulsions. The effect of mining in a stream or reach depends upon he rate of harvest and the natural rate of replenishment, as well as flood and precipitation conditions during or after the mining operations.

Commercial and Recreational Fishing. Most of the commercial landings in the region are groundfish, Dungeness crab, shrimp, and salmon. Many of the same species are sought by Tribal fisheries, and by charter, and recreational anglers. Nets and trolling are used in commercial and Tribal fisheries, whereas recreational anglers typically use hook and line, and may fish from boat, river bank, and docks. Entanglement of marine mammals in fishing gear is not uncommon and can lead to mortality or serious injury.

Oregon-Washington-Northern California Coastal Drainages

This region encompasses drainages originating in the Klamath Mountains, the Oregon Coast Mountains and the Olympic Mountains--the Coast Range ecoregion where elevations range from sea level to about 4,000 feet. More than 15 watersheds drain the region's steep slopes including the Umpqua, Alsea, Yaquina, Nehalem, Chehalis, Quillayute, Queets, and Hoh Rivers. Numerous other small to moderately sized streams dot the coastline. Many of the basins in this region are relatively small—the Umpqua River drains a basin of 4,685 sq. miles and is a little over 110 miles long and the Nehalem River drains a basin of 855 sq. miles and is almost 120 miles long—yet represent some of the most biologically diverse basins in the Pacific Northwest (Johnson 1999, Kagan ***et al***. 1999, Carter and Resh 2005).

The region is part of a coastal, temperate rainforest system, and is characterized by moderate maritime climate marked by long wet seasons with short dry seasons and mild to cool year-round temperatures. Average annual precipitation ranges from about 60 inches to more than 180 inches, much of which falls as rain, and supports a rich temperate forest. Vegetation is characterized by giant coniferous forests of Sitka spruce, western hemlock, Douglas fir, western red cedar, and red alder and black cottonwood

The Oregon Coast supports a unique coastal sand dune system. The sand dunes were largely created by the sand deposited from the coastal rivers, in particular the Umpqua and Columbia Rivers. North, steep headlands and cliffs are separated by stretches of flat coastal plain and large estuaries. Significant estuaries in the region (outside of the Columbia River estuary) include Coos Bay, Tillamook Bay and the Nehalem River Estuary in Oregon, and Grays Harbor, and Willapa Bay in Washington.

Land Use. The rugged topography of the western Olympic Peninsula and the Oregon Coastal Range has limited the development of dense population centers. For instance, the Nehalem River and the Umpqua River basins consist of less than 1% urban land uses. Most basins in this region have long been exploited for timber production, and are still dominated by forestlands. In Washington State, roughly 90% of the coastal region is forested (Palmisano *et al.* 1993). Approximately 92% of the Nehalem River basin is forested, with only 4% considered agricultural (Maser and Johnson 1999). Similarly, in the Umpqua River basin about 86% is forested land, 5% agriculture and 0.5% are considered urban lands—with about half the basin under Federal management (Carter and Resh 2005).

Tillamook County boasts about its dairy farming and cheese production—having a higher density of cows than people but even so, Tillamook County like many others in the region is dominated by forested lands (EPA 2006). Roughly 90% of Tillamook County is forestland, held by Federal and state governments and private entities. In the Nehalem Basin, state and private landowners own more than 90% of the forestlands, and about 80% of the private land holdings are large timber companies (Maser and Johnson 1999).

Hydromodification Projects. Compared to other areas in the greater Northwest Region, the coastal region has fewer dams and several rivers remain free flowing (e.g., Clearwater River). The Umpqua River is fragmented by 64 dams, the fewest number of dams on any large river basin in Oregon (Carter and Resh 2005). According to Palmisano *et al.* (1993) only about 30 miles of salmon habitat are permanently blocked by dams in the coastal streams of Washington.

In the past, temporary splash dams were constructed throughout the region to transport logs out of mountainous reaches. The general practice involved building a temporary dam in the creek adjacent to the area being logged, the pond was filled with logs and when the dam broke the floodwater would carry the logs to downstream reaches where they could be rafted and moved to market or downstream mills. Thousands of splash dams were constructed across the Northwest in the late 1800s and early 1900s. While the dams typically only temporarily blocked salmon habitat, in some cases they remained long enough to wipe out entire runs, the effects of the channel scouring and loss of channel complexity resulted in the long term loss of salmon habitat (NRC 1996).

Mining. Oregon is ranked 35^{th} nationally in total nonfuel mineral production value in 2004, while Washington was ranked 13^{th} nationally in total nonfuel mineral production value 2004 and 17^{th} in coal production (Palmisano *et al.* 1993, NMA 2007). Metal mining for all metals (e.g., zinc, copper, lead, silver, and gold) peaked in Washington between 1940 and 1970 (Palmisano *et al.* 1993). Today, construction sand and gravel, Portland cement and crushed stone are the predominant materials mined in both Washington and Oregon. Where sand and gravel is mined from riverbeds (gravel bars and floodplains) it may result in changes in channel elevations and patterns, instream sediment loads, and seriously alter instream habitat. In some cases, instream or floodplain mining has resulted in large scale river avulsions. The effect of mining in a stream or reach depends upon the rate of harvest and the natural rate of replenishment, as well as flood and precipitation conditions during or after the mining operations.

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Integration and Synthesis of the Environmental Baseline

In 2007, the population of the United States increased to more than 300 million people for the first time in its history. That population growth and increase in population density was accompanied by dramatic changes in the landscapes of the United States. By 2000, half of the population in the United States lived in the suburbs (Hobbs and Stoops 2002). About 75 percent of all Americans now live in areas that are urban or suburban in character; that is, about 75 percent of the people in the lower 48 States live in less than 2 percent of the land area of the lower 48 states. Most modern metropolitan areas encompass a mosaic of different land covers and uses (Hart 1991). The mosaic of land uses associated with urban and suburban centers has been cited as the primary cause of declining environmental conditions in the United States (Flather *et al*. 1998) and other areas of the world (Houghton 1994).

The direct and indirect effects of these changes in land-use and land-cover have had lasting effect on the quantity, quality, and distribution of every major terrestrial, aquatic, and coastal ecosystem in the United States, its territories, and possessions. Many native ecosystems exist as small isolated fragments surrounded by expanses of urban and suburban landscapes or "natural" areas that are dominated by non-native species. As a result, many of the native plant and animal species that inhabited those native ecosystems over the past have become extinct, extinct in the wild, endangered, or threatened over the past 200 years.

Beginning in the 1960s, a wide variety of programs undertaken by federal, state, and local governments, non-governmental organizations, and private individuals have been established to protect or restore our nation's forests, grasslands, wetlands, estuaries, rivers, lakes, and streams. Those programs have helped slow and, for many ecosystems, reverse declining trends that began in the past. However, those efforts have benefited some ecosystems and their associated flora and fauna more than other ecosystems. Despite the efforts of agencies at every level of government, non-governmental organizations, and private individuals, non-point sources of pollution still degraded our rivers, lakes, and streams; freshwater aquifers in coastal areas remain at risk from saltwater intrusion because of water withdrawals; nutrients transported down the Mississippi River remains sufficient to produce an hypoxic zone in the Gulf of Mexico that had more than doubled in size; and the acreage of wetland declined from slightly more than 274 million acres of wetlands to about 107.7 million acres between the 1980s and 2004 (Dahl 2006).

The status and trend of freshwater, estuarine, and coastal ecosystems of the United States and the effects of land use practices on those ecosystems has had substantial influence on patterns of extinction and endangerment. Our nation's rivers and streams have been altered by dams, stream channelization, and dredging to stabilize water levels in rivers or lakes eliminates seasonal and episodic flooding that interrupts or eliminates the delivery of nutrients and sediments to wetland ecosystems, which commonly depend on nutrient and sediment pulses as part of their natural ecology (Loucks 1989). Wetland ecosystems have been drained to make land available for agriculture; they have been filled to make land available for residential housing, commerce, and industry; they have been diked to control mosquitoes; and they have been flooded for water supply. Efforts to create and restore wetlands and other aquatic ecosystems by agencies of federal, state, and local governments, non-governmental organizations, and private individuals have dramatically reduced the rate at which these ecosystems have been destroyed or degraded, but many aquatic ecosystems continue to be destroyed and degraded each year.

The impact of these land use changes on endangered and threatened species has been substantial. Over the past 20 years, at least 58 species have been presumed to have become extinct, including the longjaw cisco (*Coregonus alpense*; estimated year of extinction: 1983), Amistad gambusia (*Gambusia amistadensis*; estimated year of extinction: 1987), Maryland darter (*Etheostoma sellare*), Sampson's pearly mussel (*Epioblasma sampsoni*; estimated year of extinction: 1984). Numerous other species have not been seen in decades despite extensive efforts to collect them and are, therefore, assumed to be extinct, including the Thicktail chub (*Gila grassicauda*; last collected 1950s), Scioto madtom (*Noturus trautmani*; last collected 1957), Maryland darter (*Etheostoma sellare*; last collected 1988), Phantom shiner (*Notropis orca*; last seen 1975), Shortnose cisco (*Coregonus reighardi*; last collected 1985), Catahoula salamander (*Plethodon ainsworthi*; last collected 1964), Moloka'i damselfly (*Megalagrion molokaiense*; last seen 1940s), and the Oahu treesnail (*Achatinella abbreviata*; last seen 1963). Many more native species of plants and animals continue to decline toward extinction as a result of these land use changes.

5. Effects of the Proposed Action

The *Description of the Proposed Action* summarized those elements of the U.S. Forest Service's proposed National Forest Service Land Management Planning Rule and directives that are relevant to our consideration of the Planning Rule's probable effects on endangered and threatened species under NMFS' jurisdiction and critical habitat that has been designated for those species. The *Status of the Listed Resources* identified the endangered species, threatened species, and designated critical habitat that may be affected by the Planning Rule, the *Status* also summarizes the status and trend of those species that occur on lands directly or indirectly influenced by activities on the National Forest System and other ecological information that might be relevant to our effects' analyses. The *Environmental Baseline* summarized the consequences of a variety of human activities on endangered species, threatened species, and designated critical habitat in the Action Area for this consultation.

The *Effects of the Action* is the primary focus of an Opinion because it articulates the reasoning and evidence that explains whether and to what degree a federal action complies with the requirements of section 7(a)(2) of the ESA. As we described in the *Approach to the Assessment* chapter of this Opinion, we use five critical components of a decision-making process as the basis for our assessment of whether and to what degree the Land Management Planning Rule insures that land management plans and projects or other activities the Forest Service undertakes in accordance with those plans are not likely to jeopardize the continued existence of endangered and threatened species under NMFS' jurisdiction or result in the destruction or adverse modification of critical habitat that has been designated for those species.

5.1 Effects of the Planning Rule

The kind of action we consider in this consultation is similar to the action we considered in NMFS' section 7(a)(2) consultations on (a) the Northwest Forest Plan and its associated Aquatic Conservation Strategy, (b) Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (also called PACFISH; NMFS 1995a); (c) Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests (also called INFISH NMFS 1995b); and (d) Interior Columbia Basin Ecosystem Management Project, among other consultations. Each of these efforts amended components of land management plans for several National Forests. NMFS' programmatic consultations on those actions acknowledged that the actions themselves did not directly affect the environment, endangered or threatened species, or designated critical habitat. Instead, they established broad management direction, goals, standards, and guidelines that would be contained in land management plans and would be potentially realized through site-specific actions (for example, NMFS 1995a and 1995b). NMFS' programmatic biological opinion on PACFISH concluded that "plan level consultation may reduce adverse effects at the site-specific level and increase agency efficiency by considering programmatic issues, identifying common characteristics of site-specific actions, and evaluating potentially cumulative effects…" (NMFS 1995, pages 17-18).

The National Forest System Land Management Planning Rule is similar to these earlier actions because it does not directly affect the environment, endangered or threatened species, or designated critical habitat. The Planning Rule results in effects by controlling the development of and setting standards and criteria that apply to land management plans and the site-specific actions that must comply with those management plans and that ultimately affect the environment endangered or threatened species, or designated critical habitat.

Despite similarities between the Planning Rule and earlier actions like the Northwest Forest Plan, Aquatic Conservation Strategy, PACFISH, INFISH, and ICBEMP, however, the Planning Rule does not modify specific land management plans. Instead, the Planning Rule sets forth regulations that prescribe what land management plans must contain, prescribe guidelines that must be followed when agency personnel prepare land management plans, and govern the development, revision, and amendment of land management plans.

The primary effect of the Planning Rule is that it constrains the range of decisions available to Forest Service officials as they develop, revise, or amend land management plans; as they complete environmental evaluations (pursuant to the National Environmental Policy Act of 1969; NEPA) on land management plans; as they approve biological assessments prepared for land management plans, and when they sign records of decision to conclude NEPA evaluations of land management plans.

For example, the Planning Rule requires land management plans to include address issues related to maintenance or restoration of the ecological integrity of terrestrial and aquatic ecosystems and watersheds in plan areas, maintenance or restoration of air quality, soil productivity, water quality, the ecological integrity of riparian areas, ecosystem integrity, ecosystem diversity, and provide ecological conditions that contribute to the recovery of federally-listed endangered or threatened species. These requirements would shape the Purpose and Need sections of NEPA documents the Forest Service prepares on land management plans, which will constrain the range of alternatives those NEPA evaluations consider.

Because site-specific actions or projects must be consistent with land management plans and because the land management plans must comply with the Planning Rule, the Planning Rule indirectly constrains site-specific planning and decision-making. For example, management plans developed consistent with the Planning Rule would influence the Purpose and Need sections of any NEPA documents the Forest Service prepares on those actions or projects. Any constraints on the Purpose and Need sections of NEPA documents also constrain the range of alternative those NEPA evaluations consider and influence the selection of the alternative that best fulfills this purpose and need. Therefore, the Planning Rule indirectly affects the site-specific actions and projects that are most likely to affect endangered or threatened species and designated critical habitat.

The Forest Service has a broad multiple-use mandate. A wide variety of activities occur on the various units of the National Forest System, and some of those activities precludes opportunities to undertake other activities. Therefore, by placing constraints on land management plans and NEPA alternatives developed for those plans, the Planning

Rule has substantial effects on the environment, endangered species and threatened species, and critical habitat that has been designated for those species even if those effects are not immediate.

The requirements, standards, and criteria established by the Planning Rule influence how land management plans developed, revised, or amended in the future consider wilderness designations, timber management and harvest plans, road construction, herbicide and pesticide applications, grazing activities, and recreational uses of national forests and grasslands, to cite only a few uses of national forests that are known to adversely affect endangered and threatened species and critical habitat that has been designated for those species. Therefore, although the Planning Rule does not directly affect endangered or threatened species under NMFS' jurisdiction or critical habitat that has been designated for these species, it indirectly affects listed species and designated critical habitat by influencing land management plans and the site-specific actions that must comply with those plans.

The narratives that follow examine the constraints the Planning Rule places on the development, revision, and amendment of land management plans and, through those plans, the set of decisions available to responsible officials when they make decisions about whether and how to take specific actions. We also consider constraints, standards, and criteria that Forest Service Directives also place on land management planning. We start by considering the structure of the decision-making process the Planning Rule establishes. Then we consider the standards the Planning Rule and Forest Service directives place constraints on this decision-making process, the information the Planning Rule and Forest Service directives require responsible officials to consider, and the process for ensuring that land management plans comply with the Planning Rule and Forest Service directives.

5.2 Structure of the Forest Service's Decision-Making Process

The Planning Rule establishes a decision-making framework that has elements similar to the normative decision-model that we described in the *Approach to the Assessment* Chapter of this Opinion (Figure 1.0). The Planning Rule requires land management plans to articulate desired conditions; that is, a description of specific social, economic, or ecological characteristics of the plan area, or a portion of the plan area, toward which management of the land and resources should be directed. It also requires land management plans to describe desired conditions in terms that are specific enough to allow progress toward their achievement to be determine. That requirement creates the ultimate benchmark that is critical to the decision-making process described in Figure 1.0.

The Planning Rule also incorporates all of the other elements of this decision-making process into the process of developing, revising, or amending land management plans. The Planning Rule prescribes standards that will be applicable to endangered and threatened species and designated critical habitat (as well as proposed and candidate species; see the discussion contained in the following subsection of this chapter).

Forest supervisors and their support staff use monitoring information and other information (Forest Service reports, litigation, results of appeal) as part of this monitoring process. If their analyses lead them to conclude that the implementation process has failed to achieve a plan's objectives or if new information (such as a decrease in wildlife habitat) indicates that the plan's objectives should be revised, the forest supervisor may amend or revise the management plan. Monitoring information creates a feedback loop that allows forest supervisors to determine whether their management actions are achieving desired conditions. The Forest Service's Planning Rule requires agency personnel to monitor the results of their planning and management activities so they can make adjustment necessary to produce the desired outcomes identified in land management plans.

5.3 Substantive Requirements That Apply to This Decision-Making Process

The National Forest Management Act does not provide explicit legislative standards that define the level of consideration the Forest Service should provide to wildlife as it balances competing resource demands (GAO 1991). Instead, the Planning Rule provides the substantive requirements that would apply to land management plans and that are applicable to the conservation of endangered and threatened species under NMFS' jurisdiction.

The draft final Planning Rule requires plan components — desired conditions, objectives, standards, guidelines, and suitability of lands — to meet requirements articulated in the *Sustainability* (§ 219.8) and *Diversity of plant and animal communities* (§219.9) subparts of the draft final Planning Rule. These subparts require land management plans to separately address ecosystems and species and provide social, economic, and ecological sustainability (within Forest Service authority and consistent with the inherent capability of a plan area).

The requirements of the *Sustainability* subpart of the Planning Rule (§ 219.8) that are most relevant to the assessment require land management plans to contain plan components to:

1. maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity, taking into account:

    a. interdependence of terrestrial and aquatic ecosystems in the plan area;

    b. contributions of the plan area to ecological conditions within the broader landscape influenced by the plan area;

    c. conditions in the broader landscape that may influence the sustainability of resources and ecosystems within the plan area;

    d. system drivers, including dominant ecological processes, disturbance regimes, and stressors, such as natural succession, wildland fire, invasive species, and climate change; and the ability of terrestrial and aquatic ecosystems on the plan area to adapt to change;

    e. wildland fire and opportunities to restore fire adapted ecosystems; and

    f. opportunities for landscape scale restoration.

2. maintain or restore air quality, soils and soil productivity, including guidance to reduce soil erosion and sedimentation; water quality; water resources in the plan area, including lakes, streams, and wetlands; ground water; public water supplies; sole source aquifers; source water protection areas; and other sources of drinking water (including guidance to prevent or mitigate detrimental changes in quantity, quality, and availability)

3. maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity, taking into account:

   a. water temperature and chemical composition;

   b. blockages (uncharacteristic and characteristic) of water courses;

   c. deposits of sediment;

   d. aquatic and terrestrial habitats;

   e. ecological connectivity;

   f. restoration needs; and

   g. floodplain values and risk of flood loss.

The requirements of the *Diversity of plant and animal communities* (§219.9) subpart of the draft final Planning Rule contains two separate but complementary requirements: a requirement to address ecosystem integrity and diversity and a requirement for components that address the needs of species whose ecological needs would not be met by components that address ecosystem integrity and diversity. The "Ecosystem integrity" requirement of the draft final Planning Rule requires land management plans to "include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore their structure, function, composition, and connectivity." The definition of "ecological integrity[4]" contained in the Planning Rule makes it clear that this requirement focuses on the ability of ecosystems to maintain their structure, composition, and ecological dynamics, even in the face of perturbation, which reflects current scientific thinking about the health of natural ecosystems (for example, see Ford 2010, Gunderson 2000, Holling 1973).

The "Ecosystem diversity" requirement of the draft final Planning Rule requires land management plans to "include plan components, including standards or guidelines, to maintain or restore the diversity of ecosystems and habitat types throughout the plan area. In doing so, the plan must include plan components to maintain or restore:

(i) Key characteristics associated with terrestrial and aquatic ecosystem types;

(ii) Rare aquatic and terrestrial plant and animal communities; and

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[4] The Planning Rule defines "ecological integrity" to mean "the quality or condition of an ecosystem when its dominant ecological characteristics (e.g., composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence."

(iii) The diversity of native tree species similar to that existing in the plan area."

If a responsible official determines that these plan components (ecosystem integrity and ecosystem diversity) are "insufficient to provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, or maintain a viable population of each species of conservation concern within the plan area" the draft final Planning Rule requires "additional, species-specific plan components, including standards or guidelines, must be developed to provide such ecological conditions in the plan area."

In addition, the Planning Rule requires plans to establish width(s) for riparian management zones around all lakes, perennial and intermittent streams, and open water wetlands, giving special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams and lakes. Finally, the draft final Planning Rule requires "plan components must ensure that no management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment that seriously and adversely affect water conditions or fish habitat shall be permitted within the riparian management zones or the site-specific delineated riparian areas."

These are requirements that NMFS recommended in its 1995 biological opinions on PACFISH (NMFS 1995, 1998) and numerous subsequent biological opinions on land management plans. More importantly, the draft final Planning Rule commits land management plans to contribute to the recovery of endangered and threatened species (that is, improvements in the status of listed species to the point at which listing as federally endangered or threatened is no longer appropriate; see Box 1). In addition, the Forest Service Manual direct the Forest Service to:

1. place top priority on conservation and recovery of endangered, threatened, and proposed species and their habitats through relevant National Forest System, State and Private Forestry, and Research and Development activities and programs;

2. avoid all adverse impacts on threatened and endangered species and their habitats, except when it is possible to compensate adverse effects totally through alternatives identified in a biological opinion rendered by the Department of the Interior, Fish and Wildlife Service (FWS) or Department of Commerce, National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries); when an exemption has been granted under the Act; or when the FWS or NOAA Fisheries biological opinion recognizes an incidental taking. Avoid adverse impacts on species proposed for listing during the conference period and while their federal status is being determined; and

3. identify and prescribe measures to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species. Protect individual organisms or populations from harm or harassment as appropriate (FSM Chapter 2670.3).

The combination of the requirements of the draft final Planning Rule and directives in relevant chapters of the Forest Service Manual (FSM Chapters 2620, 2630, and 2670) commits land management plans to maintain or restore terrestrial or aquatic ecosystems and watersheds in plan areas on which endangered or threatened species depend.

The combination of these requirements also commits land management plans to prevent critical habitat that has been designated for endangered and threatened species from being destroyed or adversely modified.

As part of our assessment, we compared the language contained in the Planning Rule, supplemented by the requirements of the directives in the Forest Service Manual, with the "viability" language of the 1982 Planning Rule, which establishes the requirements that currently apply to land management plans. Section 219.19 of the 1982 Rule (36 CFR 219.25) establishes the following requirement:

> **§219.19. Fish and wildlife resource**. Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.

The draft final Planning Rule replaces this viability requirement with a suite of requirements that are designed to insure that land management plans address the need to (1) maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area; (2) maintain or restore the diversity of ecosystems and habitat types throughout the plan area; and (3) contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, or maintain a viable population of each species of conservation concern within the plan area. Maintaining or restoring the ecological integrity of ecosystems and watersheds in plan areas should result in land management plans that address the need to conserve the ecosystems in plan areas upon which endangered and threatened species depend, which is the first purpose of the ESA (16 U.S.C. 1531(b)).

Supplementing this requirement with an additional requirement to provide conditions that contribute to the recovery of endangered or threatened species exceeds the commitment inherent in the "viability" language of the 1982 Rule, even given the limitations of the Forest Service's authority and ability to ensure the viability of populations of endangered or threatened species. We reach this conclusion for several reasons. First, the requirements in the draft final Planning Rule no longer focus on the viability of vertebrate species, which should result in plan components that explicitly address the ecological needs of populations of invertebrate and plant species that are essential to the ecology of plan areas. Second, restoring and maintaining the ecological integrity and diversity of the ecosystems and watersheds in plan areas should address the primary causes of endangerment, or at least those causes over which the Forest Service has management authority. Third, the new requirement shifts discussions to the recovery needs of endangered or threatened species, which is a more concrete target than species viability has been.

Finally, the new commitment imposes important constraints on the range of decisions available to Forest Service officials as they develop, revise, or amend land management plans; as they complete environmental evaluations (pursuant to the National Environmental Policy Act of 1969; NEPA) on land management plans; as they approve biological assessments prepared for land management plans, and when they sign records of decision to conclude NEPA evaluations of land management plans.

Based on our analyses, we believe the Planning Rule establishes requirements that reasonably insure that land management plans will contain components that contribute to the conservation of endangered or threatened species (as the term "conservation" is defined by the ESA) and maintain or improve the quantity, quality, or availability of designated critical habitat that make it valuable for the conservation of those species.

5.4 Information on Which Land Management Decisions Are Based

The Planning Rule requires responsible agency officials to use the best available scientific information to inform the planning process. The information responsible agency officials are required to consider includes the results of monitoring programs, which the Planning Rule requires management plans to articulate for terrestrial ecosystems, aquatic ecosystems, and watersheds and the status of a select set of ecological conditions required to contribute to the recovery of federally listed threatened and endangered species. In addition, the Habitat Planning And Evaluation chapter directs the Forest Service to "provide a sound base of information to support management decision-making affecting wildlife and fish, including endangered, threatened, and sensitive animal and plant species, and their habitats" (FSM Chapter 2620.3). However, the critical question is whether the Forest Service will be able to collect the information that would satisfy the Planning Rule's requirement.

In a 1991 review of whether the U.S. Forest Service appropriately considered the interests of wildlife in its planning and resource management activities, the GAO reported that data were not available to judge the overall effect of Forest Service policies and practices on wildlife conditions (GAO 1991). The GAO reported that although Forest Service regulations (the 1982 Planning Rule) required agency personnel to monitor how land use plans are carried out, the monitoring generally had not been performed and little data had been collected. The GAO concluded that without monitoring, the Forest Service and Bureau of Land Management did not have the information they would need to determine the effects of their actions on wildlife and make appropriate adjustments to their plans (GAO 1991).

In four separate reviews conducted between 2005 and 2009, the GAO identified several land management programs for which the Forest Service lacked sufficient data to allow the agency to effectively oversee its activities (GAO 2005, 2006, 2008, 2009). In 2005, the GAO reported on data problems in the Forest Service's program for reforestation — the planting and natural regeneration of trees — and treatments to improve timber stands, such as thinning trees and removing competing vegetation. Despite the importance of reforestation and timber stand improvement to improving the health of nation forest lands after timber harvests, the GAO concluded that the Forest Service lacked reliable data sufficient to accurately quantify its specific needs, establish priorities among treatments, or estimate a budget (GAO 2005).

The Forest Service's Planning Rule requires agency personnel to monitor the results of their planning and management activities so they can make adjustment necessary to produce the desired outcomes identified in land management plans. The requirements of the Planning Rule and Forest Service directives can only establish mandatory requirements; they cannot ensure that those requirements are satisfied. Nevertheless, we recommend Conservation Measures that are intended to help the Forest Service improve its record of monitoring.

5.5 Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

The U.S. Forest Service's biological evaluation did not identify future State, Tribal, local, or private actions that were reasonably certain to occur in the action area and that would not require Federal authorization, Federal funding, or the actions of a Federal agency. During this consultation, NMFS searched for information on future State, Tribal, local or private actions that were reasonably certain to occur in the action area. NMFS conducted electronic searches of business journals, trade journals and newspapers using *First Search*, Google and other electronic search engines. Those searches produced no evidence of future private action in the action area that would not require Federal authorization or funding and is reasonably certain to occur. As a result, NMFS is not aware of any actions of this kind that are reasonably certain to occur in the action area during the foreseeable future.

6. CONCLUSION

After reviewing the status of Cook Inlet beluga whale, southern resident killer whale, Steller sea lion (eastern population), Pacific eulachon (Southern population), California coastal Chinook salmon, Central Valley spring-run Chinook salmon, Lower Columbia River Chinook salmon, Puget Sound Chinook salmon, Snake River fall-run Chinook salmon, Snake River spring/summer-run Chinook salmon, Upper Columbia River spring-run Chinook salmon, Upper Willamette River Chinook salmon, Columbia River chum salmon, Hood Canal summer run chum salmon, Lower Columbia River Coho salmon, Oregon Coast Coho salmon, Southern Oregon Northern Coastal California Coho salmon, Snake River sockeye salmon, smalltooth sawfish, California Central Valley steelhead, Lower Columbia River steelhead, Middle Columbia River steelhead, Snake River Basin steelhead, South Central California coast steelhead, Southern California steelhead, Upper Columbia River steelhead, Upper Willamette River steelhead, green sturgeon (southern population), and shortnose sturgeon, the environmental baseline for the action area, the effects of the U.S. Forest Service's Land Management Planning Rule, and the cumulative effects, it is the National Marine Fisheries Service's biological opinion that the U.S. Forest Service has insured that the Planning Rule is not likely to jeopardize the continued existence of endangered or threatened species under the jurisdiction of NMFS.

After reviewing the status of critical habitat that has been designated for Cook Inlet beluga whale, southern resident killer whale, Steller sea lion (eastern population), California coastal Chinook salmon, Central Valley spring-run Chinook salmon, Lower Columbia River Chinook salmon, Puget Sound Chinook salmon, Snake River fall-run Chinook salmon, Snake River spring/summer-run Chinook salmon, Upper Columbia River spring-run Chinook salmon, Upper Willamette River Chinook salmon, Columbia River chum salmon, Hood Canal summer run chum salmon, Central California Coast Coho salmon, Oregon Coast Coho salmon, Southern Oregon Northern Coastal California Coho salmon, Snake River sockeye salmon, smalltooth sawfish California Central Valley steelhead, Central California Coast steelhead, Lower Columbia River steelhead, Middle Columbia River steelhead, Snake River Basin steelhead, South Central California coast steelhead, Southern California steelhead, Upper Columbia River steelhead, Upper Willamette River steelhead, and green sturgeon (southern population), the environmental baseline for the action area, the effects of the Land Management Planning Rule, and the cumulative effects, it is the National Marine Fisheries Service's biological opinion that the U.S. Forest Service has insured that the Land Management Planning Rule is not likely to result in the destruction or adverse modification of critical habitat that has been designed for endangered or threatened species under the jurisdiction of NMFS.

7. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibits the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The National Marine Fisheries Service is not exempting the "take" of endangered or threatened species incidental to the Planning Rule from the prohibitions of section 9 of the ESA in this Opinion. There are two reasons for this. First, the Planning Rule, by itself, would not result in the "take" of endangered or threatened species because the Forest Planning Rule, in the absence of implementation through development of land management plans and thereafter specific projects consistent with those plans, will not cause the incidental take of an listed species. Instead, the Planning Rule controls the development of land management plans, which control the development of site-specific actions. "Take" of endangered or threatened species would only occur when a site-specific actions or project is undertaken taken in compliance with land management plans. Each land management plan and approval document for site-specific actions goes through several stages of review, including consultations pursuant to section 7(a)(2) of the ESA, and each level of review creates an opportunity to cancel, delay, or modify an action before such action might result in the "take" of endangered or threatened species. As a result, in this consultation on the Planning Rule, it is impossible for us to identify the specific actions that might result in the "take" of endangered or threatened species or the number of individuals that might be "taken" by those actions, the proportion of populations of endangered or threatened species, or any surrogate.

Second, land management plans and approval documents for site-specific actions that might result in the "take" of endangered or threatened species would undergo separate formal consultation before any "take" would occur. Any biological opinion that resulted from one of those subsequent consultations would include an incidental take statement that exempted the incidental take of endangered or threatened species, if the opinion concluded that the action considered in the consultation was likely to "take" endangered or threatened species. Based on our interpretation of section 7(b)(4) and section 7(o)(2), deferring incidental take exemptions until subsequent consultations fulfills the letter and spirit of the obligations the ESA places on NMFS. It is also consistent with the approach to national consultations , which evaluate broad programs or planning documents, as described in the

Interagency Endangered Species Consultation Handbook (U.S. Fish and Wildlife Service and NMFS 1998; Chapter 5, Special Consultations and Reviews and Formal Consultation, page 4-50).

Reinitiation Notice

This concludes formal consultation on the U.S. Forest Service's National Forest System Land Management Planning Rule. As provided in 50 CFR 402.16, reinitiation of formal consultation is normally required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) new information reveals effects of the agency action that may affect endangered or threatened species under NMFS' jurisdiction or to designated critical habitat in a manner or to an extent not considered in this Opinion; (2) the agency action is subsequently modified in a manner that causes an effect to the ESA listed species or critical habitat not considered in this Opinion; and (3) if a new species is listed or critical habitat designated that may be affected by the identified action.

Action Agencies are normally required to reinitiate section 7(a)(2) consultation immediately in instances where the amount or extent of incidental take is exceeded (50 CFR 402.16(a)). However, because this Programmatic Opinion did not exempt the "take" of endangered or threatened species, any "take" of endangered or threatened species that might result from the proposed rule will be considered and exempted, as appropriate, in subsequent biological opinions that result from formal consultations that occur between NMFS and U.S. Forest Service on plan-level as well as project-level implementation of the Land Management Planning Rule.

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