

**A Biological Assessment of Impacts to
Aquatic Threatened Species
from Exotic Plant Management in
Redwood National and State Parks (RNSP)**

January 9, 2012

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I. INTRODUCTION

The purpose of this biological assessment (BA) is to review the proposed Redwood National and State Parks (RNSP or “parks”) action, exotic plant management, in sufficient detail to determine if the proposed action may affect any aquatic threatened or endangered species and/or their designated critical habitats. This biological assessment is prepared in accordance with legal requirements set forth under section 7 of the Endangered Species Act (19 U.S.C. 1536 (c), 50 CFR 402), and meets the criteria for informal consultation with the National Marine Fisheries Service (NMFS).

II. CONSULTATION TO DATE

Redwood National and State Parks obtained a list from the Arcata Fish and Wildlife Service Office website, identifying the aquatic endangered and threatened species that may be present or may be affected by park activities, dated January 5, 2012 (Document Number 821321421-1553).

Endangered

Black Abalone (*Haliotis cracherodii*)
Tidewater Goby (*Eucyclobius newberryi*)
Leatherback Turtle (*Dermochelys coriacea*)
Sei Whale (*Balaenoptera borealis*)
Blue Whale (*Balaenoptera musculus*)
Fin Whale (*Balaenoptera physalius*)
Humpback Whale (*Megaptera novaengliae*)
Killer Whale, S. Resident (*Orcinus orca*)
Sperm Whale (*Physeter macrocephalus*)

Threatened

Green Sturgeon (*Acipenser medirostris*)
Southern Oregon/ Northern California Coast Coho Salmon (*Oncorhynchus kisutch*)
Northern California Steelhead (*Oncorhynchus mykiss*)
California Coastal Chinook Salmon (*Oncorhynchus tshawytscha*)
Southern Eulachon DPS (*Thaleichthys pacifica*)
Loggerhead Turtle (*Caretta caretta*)
Green Turtle (*Chelonia mydas*)
Olive Ridley Sea Turtle (*Lepidochelys olivacea*)
Steller Sea Lion (*Eumetopias jubatus*)

Critical habitat for coho and Chinook salmon, and steelhead occurs within the parks. The 0.25 mi of offshore ocean included within the parks’ boundary falls within designated critical habitat for the green sturgeon. Proposed critical habitat for the southern eulachon Distinct Population Segment (DPS) occurs within lower Redwood Creek and the estuary. Critical habitats for the Steller sea lion and killer whale are not designated within the parks. Proposed revised critical habitat for the leatherback turtle would not include the parks.

The green sturgeon Southern DPS is listed in California south of the Eel River. The range of the southern DPS is defined by its distribution, including and beyond its natal waters, extending from Monterey Bay, California to Graves Harbor, Alaska. The offshore waters of RNSP are included within the designated critical habitat unit for this species.

Coho Salmon, Chinook Salmon, and Steelhead Trout

A biological assessment dated October 14, 1999 was submitted to the National Marine Fisheries Service (NMFS) evaluating impacts on threatened anadromous fish species from vegetation management program activities, including exotic plant management. A Letter of Concurrence (LOC) was received from NMFS on November 1, 1999 concurring with the BA's determination of "not likely to adversely affect" the listed species. This consultation had a 10-year life span, however, subsequent fish listings, changes to critical habitat designations, and modified program activities triggered a reassessment of the program.

The continuation of the exotic plant management program was discussed at an interagency consultation team (ICT) meeting on May 9, 2006. Most of the project descriptions from the original BA remained essentially unchanged, however, some minor modifications to the original project descriptions were discussed during the ICT meeting. A LOC on this phase of the program was received from NMFS on March 20, 2007 (Ref. no. 2006/07319). This consultation will expire at the end of 2011.

The need to extend the exotic plant management programmatic consultation for an additional 2 years was discussed at an ICT meeting on February 2, 2011. The Vegetation Management Branch is considering adjustments to the current program that would be effective in 2013 at the earliest; at that time a new consultation will be initiated. At the ICT meeting the group was informed that NMFS would no longer be issuing extension letters or approvals on expiring consultations, due to recent policy changes in that agency, and a new BA/informal consultation would be required to cover existing program activities for the next 2 years.

This BA incorporates project descriptions from the most previous BA (February 16, 2007), except in the case where a specific project has been completed. This consultation would be valid from completion of informal consultation through calendar year 2013.

III. CURRENT MANAGEMENT DIRECTION

Please refer to *Threatened, Endangered, Proposed, and Candidate Species in Redwood National and State Parks, Biological Assessment Reference Document* (RNSP 2011) for a detailed summary of laws and policies that influence management direction in RNSP.

Exotic Plant Management

Guidance for exotic plant management in RNSP is outlined in the *Exotic Plant Management Plan and Environmental Assessment* (USDI/NPS 1994), as approved through a Finding of No Significant Impact issued January 18, 1995. This plan was developed following NPS guidelines for natural resource management and integrated pest management (IPM) procedures (USDI

1991). Both NPS guidelines and direction provided in the California Department of Parks and Recreation's Department Operations Manual (DOM), Natural Resources Chapter 0300, direct the management of populations of exotic plant species, including eradication, wherever such species threaten park resources, and where control is prudent and feasible. Park managers are to take action whenever exotic species interfere with natural processes, the perpetuation of natural or cultural features, or the perpetuation of native species, especially those that are threatened, endangered, or otherwise unique. IPM procedures will be used to determine when to control exotic species and the method of control.

RNSP Management Policy Memorandum No. 98-04 (July 31, 1998) directed parks personnel on the procedures for use of pesticides and herbicides within the parks. Additionally, RNSP Standard Operating Procedure #12.01, *Spill Response and Emergency Procedures* and the parks' *Spill Contingency Plan*, provide direction to staff relative to managing hazardous material spills, including pesticides. These guidelines identify federal and state laws and regulations governing herbicide use, protection of non-target species, worker safety, storage and disposal of hazardous materials, documentation, and reporting.

Executive Order 13112 of February 3, 1999 outlined federal agency duties relative to actions that may affect the status of invasive species. Section 2(a)(2) of the executive order is particularly relevant. That section states:

(a) Each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them...

A Memorandum of Understanding (MOU) was signed in September 2000 by numerous local federal, state, and county agencies, and conservation organizations that formalized a cooperative relationship dedicated to effectively managing and coordinating noxious weed programs within Humboldt and Del Norte Counties as the Humboldt Del Norte Weed Management Area (HDNWMA). The MOU was revised in 2004, and in 2009 the HDNWMA split into the Humboldt WMA and the Del Norte WMA, representing Humboldt and Del Norte counties, respectively. Under the current MOUs the parties mutually agree to cooperate in the strategic planning for invasive species management in Humboldt County; share information among cooperators and provide assistance and expertise regarding invasive species management activities (e.g. control methods, introduction prevention measures, restoration tools, etc.) on their units, and; provide opportunities to outside interest groups, private landowners, and the public

for involvement in carrying out the invasive species management planning on lands within the Humboldt County. The 2009 MOU with the HWMA has been signed by the following entities: California Department of Fish and Game, Region 1; California Department of Food and Agriculture; California Department of Parks and Recreation, North Coast Redwoods District; California Department of Transportation, District 1; California Native Plant Society, North Coast Chapter; City of Arcata; City of Blue Lake; City of Eureka; Friends of the Dunes; Humboldt County Department of Agriculture; Humboldt County Resource Conservation District; Humboldt - Del Norte Cattlemen's Association; Humboldt Redwood Company; Mattole Restoration Council; McKinleyville Land Trust; Mid Klamath Watershed Council; National Park Service, Redwood National Park; Natural Resource Conservation Service; UC Cooperative Extension; U.S. Bureau of Land Management, Arcata Field Office; U.S. Fish and Wildlife Service, Humboldt Bay National Wildlife Refuge; U.S. Forest Service, Six Rivers National Forest and; the Yurok Tribe.

The 2009 MOU with the DNWMA has been signed by the following entities: Del Norte Resource Conservation District; Del Norte County Department of Agriculture; Del Norte County Farm Bureau; Natural Resource Conservation Service; Easter Lily Research Foundation; California Department of Transportation and; Redwood National Park

IV. DESCRIPTION OF THE PROPOSED ACTION

Background

The flora of Redwood National and State Parks includes over 200 exotic species, most of which entered the parks and became established within the past 150 years. The term "exotic" is defined as "a species occurring in a given place as a result of direct or indirect, deliberate or accidental actions by humans" (USDI 1991). Many exotic plants are ecologically harmful. They can alter the natural and/or historic scenery and impair the natural function of many native plant communities, thus, exotic plant management is a necessary part of our responsibility to protect our natural heritage (USDI/NPS 1994).

Exotic plant species are found throughout the park, in all vegetation types. The objectives of the exotic plant management program include the following:

- maintain a list of all known exotic plant species within the park and categorize each species as "innocuous," "invasive," or "to be watched";
- determine the species that are priorities for management based on the above categories, distribution, and feasibility of control;
- complete field surveys and develop distribution maps of each exotic species identified as a high priority for control; estimate numbers, population centers, and spreading centers;
- recommend specific control methods for selected species based on knowledge of their biology, ecology, habitat, and economic feasibility of control;
- establish a monitoring system, and consistently monitor populations of invasive and potentially invasive species to determine population growth trends, possible range expansions, and the effectiveness of control programs.

Exotic plants posing major biological/ecological/management threats at the species, community, or ecosystem level and that may significantly alter natural processes are identified as invasive. These species are designated high priorities for management. Species on the watch list are those that may develop community- or ecosystem-level effects if present populations are not controlled, or are known to occur outside of, but nearby, the parks. Exotic plant species were automatically categorized as invasive if they posed one of two critical threats: 1) they have the ability to displace rare, endangered, threatened, or sensitive species, or 2) they have the ability to cross-pollinate and produce viable offspring with native species. Exotic species are not always controlled in native plant communities if they do not obviously alter ecosystem functions, or are widespread throughout the region and would be impractical to control due to constant reintroduction from surrounding lands.

The number of exotic species and dominance by exotics varies widely by vegetation type within RNSP. In 1994, less than 1% of the plant cover within old growth redwood forests was from exotic species. In the Bald Hills prairies 50-75% of the plant cover was due to exotic species. RNSP staff set priorities for management of exotics that are dependent upon two independent factors:

- degree and kind of biological, ecological, economic, or health threat;
- cost and expectation of control, based on current distribution.

Exotic plant managers use the most recent, scientifically based knowledge of the biology of exotic plant species and network with others regionally in order to be effective at managing exotic species. The strategic approach to exotic plant management is included as Appendix A.

During the 10-year period between 2002 and 2011 several exotic plant management projects tied to the previous programmatic BAs were successfully completed at several high-priority sites, and significant progress toward control was made at others. Parks staff have nearly eradicated the following species from certain high priority sites, and these sites currently require only minor annual hand control of re-sprouts and seedlings (see Figs. 1 and 2 at the end of this document):

- English Ivy (*Hedera helix*) – 100 ac of dense English ivy were cleared out of old-growth redwood stands by hand between 2001 and 2003. Additional smaller sites also were controlled in several areas. Hand-pulling continued in 2008 at Wilson Creek. At Marshall Pond hand-pulling of re-sprouts in one population previously treated was accomplished. This population was the site of the original pilot study of English ivy removal in RNSP.
- Silver Wattle (*Acacia dealbata*) – Dense infestations along the Smith River at Hiouchi Flat were treated with glyphosate (Aquamaster) using the “drill and fill” method of direct application. Nearly all of the mature trees in these infestations were killed.
- Scotch Broom (*Cytisus scoparius*) and French Broom (*Genista monspessulana*) – Major infestations in the Bald Hills prairies were controlled by hand over the course of many years. Additional large infestations of mature individuals on Orick Hill and in Hiouchi Flat were pulled by hand in 2005-2006. Pulling of seedlings/yearlings with weed wrenches also began in the Jedediah Smith Meadow.

- Cape Ivy (*Delairia odorata*) – Controlled in several locations including Davison Ranch (Elk Meadow) and Wilson Creek and nearly eradicated at Requa.
- Periwinkle (*Vinca major*) – Very dense patches of periwinkle in 2 locations have been covered with tarps and treated by hand pulling for several years. At Lyons Ranch there were 2 separate populations, one of which is being controlled by hand-pulling. The second and larger population was tarped over to prevent photosynthesis, with hand-pulling of areas around trees, shrubs and fences where tarps cannot be secured. At Hiouchi Flat the tarped patches have been nearly eradicated.
- Spotted Knapweed (*Centaurea stoebe* ssp. *micranthos*; formerly *C. maculosa*) – A small infestation of this California Department of Food and Agriculture Class A noxious weed was pulled repeatedly and has not been seen in the parks for at least 3 years.
- Silver-leaf Cotoneaster (*Cotoneaster franchetti*) - At Lyons Ranch all of the spreading population was cut with chainsaws at the shrub bases, then a concentrated herbicide solution (Aquamaster) was applied with a paint sponge directly to the freshly cut stumps to kill the roots and prevent re-sprouting.
- Sea Fig (Iceplant; *Carpobrotus chilensis*) - Approximately half of the sea fig present at Freshwater Beach was hand-pulled. Sea fig also was hand-pulled from a rocky outcrop at Nickel Creek and nearby beaches.
- Himalayan Blackberry (*Rubus armeniacus*; formerly *R. discolor*) - 4.1 ac of this shrub were treated with Garlon 4 on Bald Hills and Lyons Ranch Roads.
- Giant Knotweed (*Fallopia sachalinensis*; formerly *Polygonum sachalinensis*) – Controlled at Hiouchi Flat and Crescent Beach Education Center with Aquamaster.

Significant progress has been made toward treating the following species at certain high priority sites:

- Jubata Grass (*Cortaderia jubata*) - Ongoing mechanical removal in the Redwood Creek estuary area.
- European Beachgrass (*Ammophila arenaria*) – 40 ac of European beachgrass were removed by hand pulling and by the use of heavy equipment from Ossagon north on Gold Bluffs Beach.
- Harding Grass (*Phalaris aquatic*) – Chemical control was initiated in 2006 and to date approximately 80 ac have been treated in the Bald Hills Prairies.

Exotic Plant Control

The exotic plant control program discussed in this assessment will be implemented over the next 2 years, beginning in early 2012 through 2013. Control activities may occur year round, but would be seasonally restricted where necessary to protect threatened and endangered species or their habitats (see “Measures to Minimize Impacts” below) or to protect other sensitive resources.

With the exception of ivy removal in Jedediah Smith Redwoods State Park, treatment of exotic plants would occur in various areas throughout Redwood National Park lands only. No treatments would occur on other California State Park (CSP) lands within the RNSP complex. Within the national park new locations could be discovered and treated within each year.

Total acres to be treated under the different treatment methods described below are difficult to estimate and will vary over time. Scotch broom occurs on at least 70 ac (28 ha) of prairie in the Bald Hills area. Canada thistle (*Cirsium arvense*) occurs extensively around the former South Operations Center (“old SOC”). Approximately 60 ac (24 ha) in the Bald Hills prairies are occupied by Harding grass. English ivy has infested more than 100 ac (40 ha) in Jedediah Smith Redwoods State Park and the nearby Hiouchi area of the national park. About 5 ac (2 ha) of silver wattle occurs around Hiouchi. Tansy ragwort (*Senecio jacobaea*) occurs sporadically throughout approximately 280 ac (113 ha) of coastal prairie around Enderts Beach Road. Although many of these infestations have been treated in the past, successful control relies upon many years of re-treatment. Reed canary grass (*Phalaris arundinacea*) forms extensive dense mats in the wetland and aquatic environments of Prairie Creek, Davison Ranch, Elk Meadow Day Use Area, and Strawberry Creek near the Redwood Creek estuary where it may be impacting anadromous fish rearing habitat. Eradication efforts are ongoing in Strawberry Creek that involve manual removal and removal with equipment, followed by planting with native riparian vegetation to shade out the grass.

When known, locations of exotic plant infestations and methods proposed for control are stated in the treatment method sections below. However, due to the nature of spread of exotic plants, it is difficult to describe where all of the locations in need of exotic plant management might occur in the park. Exotic plants invade new sites regularly making it difficult to detail all of the sites in need of management. The locations where exotic plants are known to occur and may be sites for management within the next 2 years include, but are not limited to, the following (see Figs 1-3):

Hiouchi Visitor Center and surrounding grounds
Hiouchi Flat
Jedediah Smith Redwoods State Park (JSRSP) including Jedediah Smith Campground
North Operations Center
Crescent Beach area
Crescent Beach Educational Center (CBEC)
Enderts Beach Road area
Enderts Beach and associated coastal bluffs
Nickel Creek Campground
Wilson Creek Hostel
Requa
Redwood Creek estuary to Mussel Point
Gold Bluffs Beach from Mussel Point north to the National Park/CSP boundary near Espa Creek
Wolf Creek Education Center
Elk Meadow (Davison area)
Redwood Creek Trailhead
Tall Trees Access Road
Bald Hills Road
Bald Hills (prairies and oak woodlands)
Lyons Ranch
Old SOC
Freshwater Spit
Kuchel Visitor Center and surrounding grounds

Methods

A variety of methods have been identified as feasible for controlling or eliminating exotic plants from an area. The methods used will depend on the biology of the exotic species, degree of effectiveness, cost, and consideration of threatened, endangered, or sensitive species (individuals or habitats) that may occur in the vicinity of an infested area. An adaptive management strategy that employs feedback information from monitoring previous control efforts also will be used to help determine choice of control methods. Following Integrated Pest Management (IPM) guidelines, one or a combination of methods may be used to control an exotic plant species.

Mechanical Control with Heavy Equipment

Heavy equipment including excavators, bulldozers, and backhoes would be used in areas where exotic plant densities are high, native species are few or insignificant, impacts to other natural or cultural resources from use of heavy equipment would be negligible, and manual removal is not feasible.

At developed sites and along roads, a backhoe would remain on a hardened or disturbed surface during exotic plant excavation. Species that could be removed in this way include cotoneaster (*Cotoneaster franchetti* and *C. pannosa*), English holly (*Ilex aquifolium*), jubata and/or Pampas grass (*Cortaderia jubata* and *C. selloana*), reed canary grass, Scotch broom, and French broom. An excavator or a backhoe also would be used to remove pole-sized black locust (*Robinia pseudacacia*) from approximately 100 ft (30 m) of road cut bank along Bald Hills Road at Counts Hill Prairie. The treated cut bank would be mulched with either locally collected straw from the prairies or certified weed-free alfalfa hay. The cut bank would be allowed to revegetate naturally, or a tarp would be used to prevent resprouting.

Regardless of the method used for exotic plant removal (mechanical or otherwise), a backhoe or loader and dump truck may be used to load and transport large amounts of exotic plant material to an appropriate burn or disposal site.

Mechanical Control with Power Tools

Power tools including chainsaws, weed whackers, mowers, wood chippers, and vehicle winches would be used where appropriate.

Chainsaws or other power tools may be used to remove thickets of Himalayan blackberry, jubata grass, or cotoneaster. A chainsaw, weed-eater, or other hand tool would be used to cut back the saw-toothed leaves of jubata grass and permit access to the roots.

Manual Control

Shovels, pulaskis, loppers, weed wrenches, grip hoists, and machetes would be used to manually remove herbaceous and shallow-rooted exotic species. Weed wrenches and grip hoists are designed to remove plants while causing minimal ground (soil) disturbance.

European beachgrass, along with jubata or pampas grass, would be manually removed between the Redwood Creek estuary and Mussel Point. The beachgrass would be manually dug up with

shovels, and rhizomes would be severed at a depth of about 8 inches. If necessary, driftwood logs would be manually moved to access individual grass clumps. Resprouting is most vigorous the first season after digging, therefore, crews would return to pull, dig, or burn resprouts as needed during the first season. Crews would return as needed in the second and third seasons after digging to continue pulling resprouts. It is estimated that at least 3 years would be necessary to completely eradicate European beachgrass at any site using manual control methods.

Jubata grass clumps would be dug up with shovels and/or pulaskis along coastal bluffs where heavy equipment could not be used. This work would begin in the spring when the ground is soft and plants are non-reproductive. Plants growing in sandy substrates (dunes versus bluffs) may also be dug out in early summer. Plants located along the bluffs would be removed on non-rainy days when soils are likely to be most stable. Detached plants would be turned upside down and left on site to decompose. Annual spring visits would be made to hand pull new seedlings.

Follow-up treatment of European beachgrass would continue at Freshwater Spit, where a large removal project occurred several years ago. Crews on foot would pull resprouts by hand, with use of a shovel where necessary. A number of other exotic species also would be removed by hand pulling or with hand tools at Freshwater spit including ice plant, yellow bush lupine (*Lupinus arboreus*), and Himalayan blackberry.

Burning is another manual control method that would be used to control silver wattle sprouts at Hiouchi Flat and a variety of species including Scotch broom, French broom, periwinkle, creeping St. John's wort, giant knotweed, and herb Robert (*Geranium robertianum*) at various locations in the park. Burning involves using a gas torch to pass intense heat over the leafy parts of a plant. The heat causes the cell walls to burst, killing the plant. A backpack housing a propane tank and a gas vapor torch is used to apply the flame; this method is effective at controlling resprouts and seedlings. It is used when the ground and vegetation are too wet to carry fire.

English ivy would be removed manually from within old-growth redwood forest, primarily in Jedediah Smith Redwoods State Park. Ivy plants are severed with a machete at the base of a tree, or pulled from the ground by hand. Ivy may be removed from a site, or left on trees to decay.

Reed canary grass would be controlled by manual removal and strategic planting of native overstory tree species to shade it out.

Tansy ragwort would be dug and pulled manually from the area around CBEC, Endert's Beach, and the Bald Hills.

Fennel (*Foeniculum vulgare*) will be manually treated along trails, roads, and parking lots by digging out the roots.

Areas where bare ground has been exposed after exotic plant removal by digging or hand-pulling would be covered with thatch consisting of dried grass stems and seeds gathered by hand from the adjacent area. This is to ensure that exotic plants, either the same or different species, do not

colonize the bare soil and provide an opportunity for native species to fill in the disturbed site. This thatch keeps exposed soil in place, preventing runoff and erosion. Covering exposed soil with heavy cloth (tarping) is another method used to prevent resprouting and also prevents soil erosion.

Cultural Control

Heavy equipment would be cleaned thoroughly and inspected before being used in a vulnerable ecosystem, such as the Bald Hills, to prevent introduction of exotic plants. Heavy equipment also would be cleaned as necessary to prevent the spread of the exotic pathogens *Phytophthora lateralis* (Port-Orford-cedar root disease), and *P. ramorum* (Sudden Oak Death).

Details of the exotic plant management program will be provided to the public and RNSP staff using printed material, displays, and interpretive programs in order to help limit the spread of exotics to and from park lands.

Biological Control

The only type of biological control proposed would be the collection and use of Klamath beetles (*Chrysolina quadrigemina*) to control klamathweed (*Hypericum perforatum*) at Gans Prairie. Beetles would be collected with nets in June and July from roadside klamathweed along Bald Hills Road. These beetles are species-specific biological control agents, affecting klamathweed only. *Chrysolina* larvae mine directly from the eggs into the leaves, causing eventual foliage and plant death. In areas where the beetles are established, they have been found to be >90% effective in killing adult plants.

Chemical Control

Herbicides would be considered for control of high-priority invasive species, but only when all other control techniques (mechanical, manual, cultural, and biological) were considered ineffective or not feasible. To the extent practicable, herbicides would be used only as a last resort. If chemical control is determined to be necessary, U.S. Environmental Protection Agency (EPA)-registered chemical herbicides may be approved for use. All proposals for herbicide use in the NPS must go through a review and approval process that includes the park's IPM coordinator and regional IPM coordinator. All herbicide use would be conducted in compliance with NPS IPM guidelines (e.g., USDI 1991) (see Section III above). Herbicides would be applied under the direction of personnel at RNSP that are Certified Pesticide Applicators or other qualified NPS personnel.

Herbicides may be the only way to effectively control Canada thistle, silver wattle, ornamental cherry (*Prunus* spp.), Cape ivy, and black locust. Also, where exotic plants such as jubata grass have invaded steep slopes, hand application of herbicides may be more effective, cause less soil erosion, and be a safer method than hand removal. Spot application that most effectively targets individual plants and prevents drift would be the method used for herbicide application in both upland and riparian areas. One spot application method involves using a backpack sprayer with an adjustable nozzle that allows a stream or coarse spray to be applied to individual plants. This method may be used to control Canada thistle, jubata grass, or cliff-dwelling exotics. In the Bald Hills, Harding grass, Canada thistle, and teasel (*Dipsacus fullonum*) would be controlled by this method. Another form of spot herbicide application is via paint brush or sponge used to treat the

cut stump of a tree, such as black locust or cherry. In upland and riparian areas near Hiouchi, herbicide would be used to control silver wattle by squirting it directly into holes drilled into the trunks or by foliar application to seedlings and resprouts. These methods eliminate ground and soil disturbance, since herbicide is applied directly to the plant.

The predominant need for herbicide use in upland areas is to control Harding grass in the Bald Hills. Prescribed fire is not effective for controlling this species and although hand-pulling or digging may effectively remove young plants, once the grass is established, hand-pulling becomes very difficult and creates a great deal of ground disturbance, including potential disturbance of numerous pre-historical and historical cultural resource sites. Using an herbicide will control Harding grass while minimizing ground disturbance.

Herbicides may be used to control exotic plants in difficult-to-access bluffs and cliffs wherever these occur in the National Park. Application of herbicides at beach bluffs would be away from the sandy beach and/or dunes.

Under this BA, park staff are proposing the use of 3 herbicides, glyphosate (trade name Aquamaster), aminopyralid (trade name Milestone), and triclopyr (trade name Garlon 4). Use of any other herbicides would require a reinitiation of consultation.

Glyphosate (Aquamaster)

“Aquamaster” is Monsanto’s trade name for the glyphosate compound that has been approved by the EPA for use in aquatic environments. Aquamaster has been used in RNSP for all glyphosate applications, including at upland sites, in order to err on the side of safety to the aquatic environment. Glyphosate is a non-selective herbicide that kills plants by inhibiting the formation of amino acids tyrosine, tryptophan and phenylalanine, all of which are necessary for protein formation in susceptible plants. While animals need these amino acids, they obtain them by ingesting plants or other animals; this makes glyphosate relatively non-toxic to animals. Glyphosate binds tightly to soil particles and tends to remain within the top 6 inches of soil, making it unlikely to end up in surface or sub-surface runoff except by direct soil erosion. If it does run off it remains bound to soil particles and unavailable to fish and aquatic invertebrates.

Glyphosate is short lived in the environment. According to the EPA (Patterson 2004) under aerobic soil conditions glyphosate degrades to aminomethyl phosphoric acid (AMPA) with a half life of 1.85-2.06 days, which then degrades into carbon dioxide. The principal degradation mechanism is microbial metabolism, as glyphosate is stable in terms of hydrolysis and photo degradation.

Glyphosate has been well-studied relative to its toxicity to fish and other animals. As a result of the low-levels of toxicity detected in studies, the EPA has labeled it as “practically non-toxic” to fish and aquatic invertebrates. When used according to the manufacturer’s label, it was determined “not likely to adversely affect” threatened and endangered salmon and steelhead by the EPA’s Office of Pesticide Programs (Patterson 2004).

Silver wattle, bird cherry, and other exotic plants in riparian areas that do not respond to mechanical or manual control methods would be considered for treatment with Aquamaster.

Park staff have already effectively controlled more than 85% of the silver wattle in the Hiouchi Flat area with Aquamaster since 2001, with just a small number of trees and resprouts remaining to be retreated. The spot application method ensures that herbicide does not come in contact with soil particles (painting and injection) or only minimally (direct spray, e.g., for Harding grass, and Canada thistle and other exotic plants growing on coastal bluffs).

Glyphosate application methods

Direct application

Much of the park's use of glyphosate would involve direct application of the herbicide onto a plant, either by dabbing or painting it directly onto a cut surface, or by injecting it directly into a drilled hole in a woody stem or cane with a specialized needle, where it is then transported through the phloem into the plant's root system. Because surfactants are intended to allow the herbicide to penetrate the waxy cuticle, they are not needed when applying Aquamaster directly to a cut surface. Hiouchi Flat is the primary location where glyphosate is proposed for use by direct application. Giant knotweed forms large mats of 10 ft tall (or greater) canes connected by extensive, vigorous rhizomatous root structures. Hand removal of large patches of this species is virtually impossible, as the rhizomes are stout and tenacious and any piece left remaining in the soil will re-sprout. At this time there are only 2 known patches of this species in the park, at Hiouchi Flat and the Endert's Beach/CBEC area. The direct application method reduces the potential for herbicide to run off into riparian habitat or watercourses.

Foliar application

Foliar application would be considered for control of grasses and some broadleaf woody and non-woody species (e.g., Harding grass, Himalayan blackberry) in various locations. Under the circumstances where glyphosate would be applied via foliar spray, a non-ionic surfactant also approved for use by the EPA, would necessarily be added to enable the glyphosate to penetrate the plant's waxy cuticle. When Aquamaster is applied to foliage, it is applied directly to each individual plant using a backpack sprayer with the spray nozzle set to produce a coarse spray or stream rather than a fine spray or mist, minimizing the potential for drift. Spraying is only conducted when wind is minimal or absent, and when rainfall is not expected within 48 hours after treatment. Spraying would not take place when the air is moist with fog. In the case of foliar application, some contact with soil may occur; however, given the localized nature of the application method, there would be minimal opportunities for the herbicide to reach surface water. Aquamaster was used in the Bald Hills in 2006-2011 to control Harding grass. Each year approximately 0.9 gal/ac of this herbicide was used in small, disjunct patches spread throughout a 25 ac (10 ha) area. By contrast, the EPA maximum allowable use for Aquamaster is 2.0 gallons per acre per year.

Aminopyralid (Milestone)

"Milestone" is Dow Agrosience's trade name for an aminopyralid compound that has been approved by the EPA under its "Reduced Risk Initiative" for use in upland habitats, seasonally dry wetlands, and "transitional" areas between upland and lowland sites. Aminopyralid is a growth regulator herbicide that mimics the action of auxin, a growth regulator found in all plants. Aminopyralid disrupts physiological processes related to the binding of auxin receptors which results in plant death in species that are sensitive to it. It is relatively immobile in soil and has a half life of 30 days. It is not approved for use in aquatic environments with standing surface

water. The EPA has classified it as “non-toxic” to fish and “practically non-toxic” to birds.

Milestone is a semi-selective herbicide that does not kill most grasses, but targets annual and perennial broad leafed plants which makes it preferable for use in rangeland and grassland environments. In terms of environmental risks, aminopyralid has a few significant advantages over other products used in similar settings. It is used at lower rates (a maximum of 7 oz per acre versus 2 gal per acre for glyphosate), and is relatively immobile in soil, with most of the chemical remaining within the upper 12" of the soil profile. Products containing aminopyralid cannot be applied directly to water, but can be used to treat banks of ditches or other channels that do not carry water used for irrigation or drinking (Hartzler 2006).

Aminopyralid was approved for use in California in October 2006; it appears to be a good weed control option for several reasons: it is lower in toxicity than glyphosate, it is effective at much lower application rates than glyphosate, it is selective and specific to some high priority species such as Canada thistle, teasel, and the knapweeds, and residual activity allows it to remain active for a longer duration after application.

Milestone application methods

Foliar application

Milestone would be applied by foliar application on broadleaved weeds such as Canada thistle and teasel in various upland locations, and along coastal bluffs. A non-ionic surfactant approved for use by the EPA would necessarily be added to enable the aminopyralid to penetrate the plant's waxy cuticle. When Milestone is applied to foliage, it would be applied directly to each individual plant using a backpack sprayer with the spray nozzle set to produce a coarse stream rather than a spray, minimizing the potential for drift. Spraying would only be conducted when wind is minimal or absent, and when rainfall is not expected within at least 48 hrs after treatment. In the case of foliar application, some contact with soil is inevitable; however, given the localized nature of the application method, and the upland locations where it would be used, there would be minimal opportunities for the herbicide to reach surface water.

Aquamaster and Milestone Annual Use Limits

Proposed use limits were determined by considering the extent of exotic plant infestations in various locations within the park and considering the likelihood of herbicide contacting surface water in those locations. Park staff propose to base annual herbicide usage on the type of area (watershed, uplands, coastal bluffs) where treatments would occur rather than impose park-wide limits (see Table 1), and have considered the number of acres that can be treated during a given time period using localized applications without causing damage to other resources. A maximum of 10 ac (4 ha) would be treated annually with Aquamaster in each of two riparian habitat types (small riparian and large riparian- with the exception of the Redwood Creek estuary where no herbicides would be used within 0.25 mi). Riparian zones were defined as 300 ft (91 m) either side of a perennial stream (whether fish-bearing or not) and 150 ft (46 m) either side of an intermittent stream. A maximum of 10 ac (4 ha) per coastal bluff area (bluffs backing Mussel Beach, the south (NPS) portion of Gold Bluffs Beach, and Enderts Beach) would be treated annually with either Aquamaster or Milestone.

A maximum of 30 ac (12 ha) would be treated with either Aquamaster or Milestone in the Bald

Hills annually, in upland areas outside of riparian zones.

Table 1. Proposed annual use limits for glyphosate (Aquamaster) and aminopyralid (Milestone) by habitat type.

Habitat Type	Direct Application (paint, swab, injection)	Foliar Application (coarse spray or stream setting)	Not to exceed in combination
Glyphosate			
Small Riparian Watershed (e.g. Prairie Cr., Wilson Cr., Lagoon Cr.)	10 ac	2 ac	10 ac
Large Riparian – Redwood Creek and Smith River	10 ac	5 ac	10 ac
Subtotal Glyphosate Maximum Use- Riparian	20 ac	7 ac	20 ac
Glyphosate or Aminopyralid			
Coastal Bluff (backing Mussel, Gold Bluffs S., and Enderts Beach)	30 ac (10 ac per beach bluff x 3)	30 ac (10 ac per beach bluff x 3)	30 ac (10 ac per beach bluff)
Upland (Bald Hills)	30 ac	30 ac	30 ac
Maximum Possible Use	80 ac (32.4 ha)	67 ac (27.1 ha)	80 ac (32.4 ha)

Triclopyr butoxyethyl ester- “triclopyr BEE” (Garlon 4)

“Garlon 4” is Dow Agrosciences’ trade name for triclopyr butoxyethyl ester (“triclopyr BEE”, not to be confused with Garlon 3A, a triethylamine salt with different properties). Garlon 4 is a selective, systemic herbicide that kills woody species by mimicking plant growth hormones then initiating rapid, poorly regulated cell growth, culminating in the death of the treated plant. It is commonly used in agricultural settings for control of brush and other undesirable woody species and does not affect grasses (Tu *et al.* 2001).

Within plants and in the soil, triclopyr BEE rapidly breaks down to triclopyr acid through microbial activity and photolysis (decomposition by sunlight), often within hours. Triclopyr acid has been deemed by the EPA to be “practically non-toxic” to freshwater fish, invertebrates, birds and small mammals. The average half life of triclopyr acid is 30 days, depending on environmental conditions such as temperature, light and soil pH (warmer, moister and less acidic soils allow for faster microbial breakdown). Triclopyr BEE is not water soluble; it adsorbs to soil and sediment particles and can be persistent in aquatic environments (Tu *et al.* 2001). Garlon 4 is not approved for use in aquatic environments, therefore, use would be restricted to a few very specific upland locations in the Bald Hills, well away from any perennial water sources and only in the dry summer season when no rain is in the forecast for at least 48 hrs post-application.

Garlon 4 would be used to control Himalayan blackberry under very limited circumstances and locations, to reduce the potential for spot fires and other fire safety concerns during prescribed burning operations. Himalayan blackberry foliage is highly volatile. Past experience has shown that when thickets are burned during fall prescribed burns, they tend to flare up and create

intense fire behavior. When thickets are located on a road or adjacent to a fire line, flare-ups have resulted in the ignition of spot fires outside of the burn unit. In some cases, these spot fires can end up on private property and in other cases they end up in unburned areas in the park with heavier fuels, creating a threat of wildfire. Other methods not involving herbicide would be used to control Himalayan blackberry when those methods are deemed effective.

Pre-burn Mowing

In some locations the Himalayan blackberry is mowed as part of the prescribed burn preparation. This is effective where:

- the thickets are less than 8 ft from the road
- the slope is relatively flat and low.

Locations that do not lend themselves to mowing include thickets that are:

- too far away from the road for the mower to reach, but close enough to the fire line to send flaming material out of the burn unit, or
- located on steep slopes, or
- growing in gullies or ravines.

Application of Herbicide

For those limited areas which cannot be mowed (approximately 4 ac [1.6 ha] total), control options include hand grubbing and the application of herbicide. Eradication of Himalayan blackberry without the use of herbicides requires initial grubbing out of the root crowns, followed by years of hand removal. Grubbing and digging in the prairies is largely prohibited due to sensitive archeological site constraints. There also are concerns about potential erosion if grubbing and digging is used at the sites with steep slopes and gullies. Hand grubbing is often not entirely successful.

Park staff would use a foliar spray application of Garlon 4 on Himalayan blackberry under limited circumstances. Garlon 4 is preferable to glyphosate for several reasons.

- It is specific to broadleaf species and would not kill the underlying grasses and herbaceous species. Glyphosate is non-specific and will kill grasses and herbs as well create an ecological 'void,' that encourages re-invasion by weeds.
- Because Garlon 4 is specific to broadleaved species, it has a higher likelihood of killing the plants after the first application. It is likely that several applications of glyphosate would be required to achieve the same result as one application of Garlon 4, resulting in a greater amount of herbicide use. In addition, maintaining cover of grasses keeps invading weeds out through competition.

Approximately 4 ac (1.6 ha) in total would be treated incrementally in the next 2 years as each prescribed burn unit is scheduled to be burned.

Methods Summary

Table 2 summarizes the various exotic plant treatment methods to be used, the target exotic plant species for each method, and the known locations where the methods will be applied. Note that

as new infestations are discovered new locations may be added to the list under this programmatic.

Table 2. Control methods, species that may be removed by each method, and locations identified where this could occur within Redwood National & State Parks

Control Method	Exotic Plant Species That May Be Removed	Location Where One or More Exotic Species May Be Removed
Heavy Equipment	Black locust Canada thistle Cotoneaster English holly French broom Himalayan blackberry Reed canary grass Jubata (or pampas) grass Ornamental cherry Scotch broom Silver wattle	Hiouchi Visitor Center Hiouchi Flat Aubell CBEC Former Wilson Creek Hostel Elk Meadow (Davison) Redwood Creek Trailhead Tall Trees Access Road Bald Hills Road
Power Tools	Bull thistle Canada thistle Cape ivy Creeping St. John's wort English holly French broom Giant knotweed Himalayan blackberry Jubata grass Periwinkle Scotch broom	Hiouchi Visitor Center Hiouchi Flat Hiouchi Gauging Station Aubell Crescent Beach CBEC Nickel Creek Campground Former Wilson Creek Hostel Requa Wolf Creek Education Center Elk Meadow (Davison) Redwood Creek Estuary Redwood Creek Trailhead Tall Trees Access Road Bald Hills Prairies

Control Method	Exotic Plant Species That May Be Removed	Location Where One or More Exotic Species May Be Removed
Hand Tools	Creeping St. John's wort Dalmatian toadflax (<i>Linaria genistifolia</i> ssp. <i>Dalmatica</i>) English Ivy European beachgrass Fennel French broom Giant knotweed Herb Robert Himalayan blackberry Ice plant Jubata grass Klamath weed Periwinkle Scotch broom Reed canary grass Silver wattle Spanish heath (<i>Erica lusitanica</i>) Tansy ragwort White sweet clover (<i>Melilotus alba</i>) Yellow bush lupine Teasel	Hiouchi Flat Hiouchi Gauging Station Jedediah Smith RSP CBEC Enderts Beach Road Nickel Creek Trail Requa Elk Meadow (Davison) Wolf Creek Education Center Gold Bluffs Beach- South Redwood Creek Estuary to Mussel Point Freshwater Spit Kuchel Visitor Ctr Bald Hills/Bald Hills Road Lyon's Ranch/Coyote Creek
Chemical Control- Glyphosate	Black locust Bull thistle Canada thistle Cotoneaster Eucalyptus European beachgrass Giant knotweed Harding grass Himalayan blackberry Jubata grass Milk thistle (<i>Silybum marianum</i>) Ornamental cherry Periwinkle Silver wattle Spotted knapweed Tall oat grass (<i>Arenaria elatius</i>) Teasel	Hiouchi Visitor Center Hiouchi Flat Hiouchi Gauging Station CBEC Enderts Beach Road Enderts Beach Bluffs Requa Elk Meadow (Davison) All NPS Beach Bluff Areas Freshwater Spit Bald Hills Road Tall Trees Access Road Bald Hills Prairies and Oak Woodlands
Chemical Control- Triclopyr	Bull thistle Canada thistle Himalayan blackberry	Bald Hills - specific locations along roads and firelines

Control Method	Exotic Plant Species That May Be Removed	Location Where One or More Exotic Species May Be Removed
Chemical Control- Aminopyralid	Canada thistle Milk thistle Spotted knapweed Teasel Yellow star thistle (<i>Centaurea solstitialis</i>) Giant knotweed	CBEC Enderts Beach Road All NPS Beach Bluff Areas Tall Trees Access Road Bald Hills Prairies and Oak Woodlands Bald Hills Road
Biological Control	Klamathweed	Bald Hills Prairies

Inter-related and Interdependent Activities

Access

Vehicle access to exotic plant removal sites would be via existing service roads; access would occur outside of the seasonal road closure on those roads that are closed during wet weather. Heavy equipment required for exotic plant removal would be moved in at the beginning of a project and expected to remain at the removal site until the project is completed. The equipment operator, project leader, and crews would make one round trip daily to and from a work site.

Disposal

Some of the actions described in this BA would necessitate disposal of the exotic plant material after treatment. This would be accomplished by chipping the material and leaving it on site to decompose, burning the material on site, or transferring the material to a designated disposal/burn area. Gas powered chippers and chainsaws, or heavy equipment such as bulldozers may be used to pile or prepare the material for removal. Designated disposal areas include Old SOC, the former Mitchell property at the south end of Freshwater Lagoon (east side of Hwy 101), North Operations Center, Jedediah Smith campground maintenance yard, and the former Hansen property at the junction of Elk Valley Road and Hwy 199. No burning would occur within riparian areas (e.g., within 300 ft [91 m] of perennial streams or 100 ft [30 m] of intermittent streams).

Hazardous Materials Treatment

In the event of a fuel, oil, or other hazardous material spill, a spill contingency plan would be in place. This plan is based on NPS existing spill plans, and was tailored to the type of hazardous spills that could be associated with exotic plant management activities. These plans are included as Appendices B and C at the end of this document.

Measures to Minimize Impacts on Listed Species

Steelhead, Chinook, and Coho - Herbicide use in riparian habitats, flow courses, or wet areas in watersheds with the potential to support listed steelhead, chinook, or coho would be restricted to Aquamaster (glyphosate). This herbicide would either be injected directly into a plant or applied

by spot application that targets individual plants and prevents drift. In each wetland type, in small and large watersheds, no more than 10 ac/yr (4.0 ha/yr) would be treated with herbicides, for a maximum total of 20 ac (8.1 ha) treated in RNSP in a year. This amount represents approximately 0.22% of the wetland habitat occurring within RNSP, and is partially based on the acreage that can feasibly be treated by RNSP staff under appropriate environmental conditions. No treatment of exotics using herbicides would occur within 0.25 mi of the Redwood Creek estuary; exotic plants in this area would be treated with mechanical or manual methods. The other herbicides considered for use in this document, Milestone and Garlon 4, would not be used in riparian habitats, the interface between riparian and upland habitats, or other wet areas. These herbicides would be restricted to dry upland (Garlon 4) or coastal bluff (Milestone) areas when no rain is forecasted for at least 48 hrs post-treatment.

No heavy equipment would be used in riparian habitats in watersheds with listed steelhead, chinook, or coho. No shade-producing exotic plant species would be removed from riparian habitats, all species slated for treatment in these areas are shade tolerant, e.g., English ivy, or do not contribute substantial amounts of shade to a stream bed, e.g., pampas grass.

Eulachon - Herbicide use in riparian habitats, flow courses, or wet areas in or near tributaries to Redwood Creek, or the mainstem Redwood Creek, would be restricted to Aquamaster (glyphosate). This herbicide would either be injected directly into a plant or applied by spot application that targets individual plants and prevents drift. Within these areas no more than 10 ac/yr (4.0 ha/yr) would be treated with herbicides; the likelihood of all riparian acres treated in a given year occurring within the Redwood Creek watershed is low. No treatment of exotic plants using herbicides would occur within 0.25 mi of the Redwood Creek estuary; exotic plants in this area would be treated with mechanical or manual methods. The other herbicides considered for use in this document, Milestone and Garlon 4, would not be used in riparian habitats, the interface between riparian and upland habitats, or other wet areas. These herbicides would be restricted to dry upland (Garlon 4) or coastal bluff (Milestone) areas when no imminent rain is forecasted for at least 48 hrs post-treatment.

Monitoring

All treated sites would be monitored regularly to document the level of success and identify the need for follow-up treatments. Monitoring will be the means by which the different methods are evaluated as to each one's effectiveness at reducing, eliminating, or controlling the numbers of exotic plants at a site. Monitoring provides the feedback necessary to determine if modification of treatment methods is required to improve effectiveness. Monitoring techniques that would be used include the following:

- 1) Aerial surveys and photography. Permanent photo points may be established; standardized timing of photographs will reduce physiological and morphological variability of the species among photo samplings.
- 2) Roadside and trail surveys of exotic species would be implemented.

- 3) Mapping and tracking the cover, density, distribution and acreage of high priority exotic species will continue with the use of GIS. This will help determine the effort required for control of a particular species.
- 4) Quadrat and point-line sampling will be used to follow trends in vegetation at beaches, prairies, oak woodlands, and other native plant communities.

Success criteria have been developed to guide objectives for a species at a particular site. Exotic plant management objectives are grouped into four categories representing different levels of control: prevention, reduction, containment, and eradication. The objective for a particular exotic species at a particular site depends on the extent of the infestation, the threat of the infestation to native plant communities and/or threatened, endangered, and sensitive species habitats, and feasibility of control of the infestation.

Success criteria vary among species and among sites, and are designed specifically for each site after determining the objective of the treatment. For example, the success criterion for European beachgrass at Freshwater Spit is eradication of isolated populations; from Redwood Creek to Mussel Point the criteria are reduction in the area of cover and number of individual infestations. At both sites photo points, GIS coverage, and tracking density of resprouts are the techniques used to monitor and evaluate success. Success criteria for Scotch broom in Bald Hills prairies and along park roadsides include reduction of area of cover, number of individual infestations, and the seed bank. However, in the prairies the monitoring methods will consist of monitoring resprouts and seedling densities and establishing photo points, but along roadsides the monitoring will use visual surveys, removal records, and GIS. Thus, monitoring techniques are also designed specifically for each particular site and exotic species.

Tiering

Specific exotic plant removal projects would be tiered to this BA through use of the tiering form attached at the end of this document. Tiered projects would be reviewed by a wildlife biologist to ensure consistency with the project description in this BA.

V. STATUS AND DISTRIBUTION OF LISTED SPECIES

1. Southern Oregon/ Northern California Coast Coho Salmon (*Oncorhynchus kisutch*), Threatened

A. Species Account

Coho or “silver” salmon are found in streams and rivers throughout much of the Pacific Rim, from central California to Korea and northern Japan. North American coho spawn in tributaries from the San Lorenzo River in Monterey Bay, California to Point Hope, Alaska, and throughout the Aleutian Islands. They are most abundant in coastal areas from central Oregon to southeast Alaska.

Coho salmon (hereafter “coho”) have shown substantial decreases throughout their range (Konkel and McIntyre 1987). In the U.S. Pacific Northwest, they are now extinct in the eastern half of their former range, and badly depleted over most of the western half (Frissell 1993). At

least 33 populations have been identified by agencies and conservation groups for being at moderate or high risk of extinction. Four of the seven west coast coho ESUs are listed as threatened (three) or endangered (one), and an additional one listed as a species of concern.

In California, current abundance, including hatchery stocks, could be less than 6% of estimates for the period 1940 to 1949. Brown and Moyle (1991) estimated that naturally-spawned adult coho returning to California streams were < 1% of their abundance at mid-20th century, and indigenous, wild coho populations in California did not exceed 100 to 1,300 individuals. Further, they stated that 46% of California streams which historically supported coho populations, and for which recent data were available, no longer supported runs. Populations now are at least 70% lower than during the 1960s (CDFG 1994). The Southern Oregon/Northern California Coast Coho ESU, which occurs within RNSP, was designated as threatened in 1997 (Federal Register 1997), and re-designated as a threatened distinct population segment in 2005 (Federal Register 2005a).

Coho generally exhibit a relatively simple 3-year life cycle, with the majority of juvenile fish entering the ocean at 1 year of age and returning 2 years later to spawn. However, in Prairie Creek approximately one-quarter of smolts reside in streams for 2 years (Bell 2001). Most coho return and enter rivers between September and February. Coho river entry timing is influenced by many factors, one of which appears to be river flow. Many small California stream systems, including Redwood Creek in RNSP, have their mouths blocked by sandbars for most of the year except winter which prevents entry until sufficiently strong freshets open passages through the bars (Weitkamp *et al.* 1995). Timing of the opening of Redwood Creek depends on a combination of wave action on the sand berm which can increase the elevation of the berm, the water elevation in the estuary, and the flow of water in the stream. Coho spawn from November to January (Hassler 1987), and occasionally into February and March (Weitkamp *et al.* 1995), with peak runs in Redwood Creek in November (RNSP unpub. data).

Although each native stock appears to have a unique time and temperature for spawning that theoretically maximizes offspring survival, coho generally spawn at water temperatures within the range of 50-55° F (10-13° C) (Bell 1991). Bjornn and Reiser (1991) found that spawning occurs in a few third-order streams, but most spawning activity was found in fourth- and fifth-order streams. Nickelson *et al.* (1992) found that spawning occurs in tributary streams with a gradient of 3% or less and in clean gravel ranging in size from that of a pea to that of an orange. Spawning is concentrated in riffles or in gravel deposits at the downstream end of pools featuring suitable water depth and velocity (Weitkamp *et al.* 1995). In Redwood Creek spawning is restricted to approximately 12 mi (20 km) of the lower mainstem and the larger low-gradient tributaries including Prairie Creek (RNSP unpub. data).

The favorable thermal range for coho salmon egg incubation is 50-55° F (10-13° C) (Bell 1991). Coho eggs incubate for approximately 35-50 days, and fry start emerging from the gravel 2 to 3 weeks after hatching (Hassler 1987, Nickelson *et al.* 1992). Following emergence, fry move into shallow areas near the streambanks. The early diets of emerging fry include chironomid larvae and pupae (Mundie 1969). As coho fry grow, they disperse upstream and downstream to establish and defend territories (Hassler 1987).

Juvenile rearing usually occurs in tributary streams with gradients of 3% or less, although they may move into streams of 4 or 5% gradient. Juveniles have been found in streams as small as 3 to 6 ft (~1 to 2 m) wide, including non-natal juveniles in Strawberry Creek, a small tributary to lower Redwood Creek (RNSP 2009). At a length of 1.5-1.75 in (3.8-4.4 cm), the fry may migrate upstream a considerable distance to reach suitable rearing areas (Nickelson *et al.* 1992). Rearing requires temperatures of 68°F (20°C) or less, preferably 53-58° F (12-14° C) (Reiser and Bjornn 1979, Reeves *et al.* 1987, Bell 1991). During spring, coho fry are most abundant in backwater pools featuring adequate cover such as LWD, undercut banks, and overhanging vegetation. During the summer, coho fry prefer deeper pools. Juvenile coho prefer to overwinter in large mainstem pools, backwater areas and secondary pools with LWD, and undercut bank areas (Hassler 1987, Heifetz *et al.* 1986). Juvenile coho are carnivorous opportunists that primarily eat aquatic and terrestrial insects. They do not appear to pick stationary items off the substratum (Mundie 1969, Sandercock 1991). .

In preparation for their entry into the ocean, juvenile salmonids undergo physiological transformations known as smoltification that adapt them for their transition to saltwater (Hoar 1976). These transformations include different swimming behavior and proficiency, lower swimming stamina, and increased buoyancy that also make the fish more likely to be passively transported by currents (Folmar and Dickhoff 1980). The ideal channel for maximum coho smolt production has shallow depth (3-24 in; 8-24 cm), fairly swift mid-stream flows (2 ft/sec; 0.6 m/sec), numerous marginal back-eddies, narrow width, copious overhanging mixed vegetation (to lower water temperatures, provide leaf litter, and contribute terrestrial insects), and banks permitting hiding places. In general, smoltification is timed to be completed as fish are near the freshwater to saltwater transition. Too long a migration delay after the process begins is believed to cause the fish to miss the window of optimal physiological condition for the transition (Walters *et al.* 1978).

Little is known about residence time or habitat use in estuaries during seaward migration, although it is usually assumed that coho spend only a short time in the estuary before entering the ocean (Nickelson *et al.* 1992). Growth is very rapid once the smolts reach the estuary (Fisher *et al.* 1984). In Redwood Creek downstream migration to the ocean from upstream rearing areas occurs in early spring (March-April). Survey data from RNSP indicate that these young salmon are present in the Redwood Creek estuary in June and gone by July (Anderson 1995). Migration through the Redwood Creek estuary is dependent upon the mouth being open to the ocean.

While living in the ocean, coho remain closer to their river of origin than do other salmon (Weitkamp *et al.* 1995). Nevertheless, coho have been captured several hundred to several thousand kilometers away from their natal stream (Hassler 1987). After about 12 months at sea, coho gradually migrate south and along the coast. Coho typically spend two growing seasons in the ocean before returning to their natal streams to spawn as 3 year-olds. Some precocious males, called "jacks," return to spawn after only 6 months at sea.

The anadromous fish populations of Redwood Creek have experienced a substantial reduction, in part due to severe flood events that moved large amounts of sediment from highly eroded hillslopes to the stream channels of the Redwood Creek basin (Madej *et al.* 2006). News accounts and recollections of longtime residents of the Redwood Creek watershed suggest that both the size and numbers of salmonids have declined in recent decades (Van Kirk 1994).

Within the last decade no juvenile coho have been observed in the main channel above river km 20 and juvenile coho were restricted to 9 side-pocket cold pool locations in the lower 20 km of the channel (Ozaki and Anderson 2005). Madej *et al.* (2006) stated that < 20% of the main Redwood Creek channel currently supports young coho during summer. In 2009, no 0+ or 1+ juvenile salmon were captured in the upper Redwood Creek down migration trap and both of these age classes' capture rates have showed steady declines between 2003 and 2009 with the 0+ age class exhibiting a particularly severe decline (Sparkman 2010). In 2010 at the lower Redwood Creek trap, only six 0+ and thirteen 1+ coho juveniles were captured (Sparkman 2011). The vast majority of coho juveniles are coming from the Prairie Creek subwatershed. In Prairie Creek Duffy (2011) estimated escapement of adult coho ranged from a high of 680 in 2002 to 28 in 2010.

B. Habitat Status

Currently occupied suitable coho habitat occurs in the lower 12 mi (20 km) of the mainstem of Redwood Creek and its low gradient tributaries, including the first 13 mi (21 km) of Prairie Creek. Suitable habitat in Redwood Creek also exists in the approximately 15 mi (25 km) upper most reach of Redwood Creek, however, coho no longer occur from here down to the lower reach below the Tall Trees Grove. Surface water and daily minimum temperatures in summer from Tall Trees to the O'Kane Bridge on Hwy 299 tend to be above the desired range for juvenile coho (i.e., < 18° C [64° F]) (Madej *et al.* 2006). These conditions are likely the result of intensive logging in the basin that began after 1950. Floods in the 1950s, 60s, and 70s, and in 1997 caused wide-spread road and stream-crossing failure that increased streambed aggradation and bank erosion. Also, the riparian vegetation changed from conifer-dominated to red alder-dominated, allowing for increased sunlight and an increase in stream temperatures (Madej *et al.* 2006). Non-natal coho habitat below Prairie Creek is restricted to the only two tributaries entering the estuary. Both, Sand Cache Creek and Strawberry Creek are low gradient but degraded due to land use activities and effects of the levee configuration; Sand Cache is generally isolated from the estuary embayment, but coho have been found in Strawberry Creek.

C. Critical Habitat

Critical habitat is defined in Section 3(5)A of the Endangered Species Act as "...the specific areas within the geographical area occupied by the species... on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection". Essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation. Structurally complex streams containing boulders, logs, brush, and aquatic macrophytes support larger numbers of rearing coho juveniles (Scrivener and Andersen 1982) than do streams that lack these structural features.

In southern Oregon and northern California, designated critical habitat for this ESU is between Cape Blanco, Oregon and Punta Gorda, California. The critical habitat unit is all stream and estuarine reaches accessible to the species and includes water, substrate, and the adjacent riparian zone. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of coho. The adjacent riparian zone is the area that provides shade, sediment transport, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter. Habitat quality in this zone is related to the quality of riparian areas, upland areas, and inaccessible or headwater or intermittent streams that provide key

habitat elements, such as large woody debris and gravel, that are crucial for coho in downstream reaches (Federal Register 1999a). Thus, the width of the riparian zone included as critical habitat is variable depending upon consideration of these factors.

Critical habitat is of variable quantity and quality depending on the condition of a watershed/sub watershed within RNSP. The condition of a watershed relative to critical habitat is primarily a function of past land use practices. That is, the level of logging and number of old or abandoned logging roads within a watershed or subwatershed influence the habitat in terms of fine sediment quantity, amount of instream LWD, amount of streamside shading, pool number and depth, and water temperature.

2. Northern California Steelhead (*Oncorhynchus mykiss*), Threatened

A. Species Account

Steelhead were historically distributed throughout the North Pacific Ocean from the Kamchatka Peninsula in Asia to the northern Baja California peninsula. Presently, the distribution extends from the Kamchatka Peninsula, east and south along the Pacific Coast of North America, to at least Malibu Creek in southern California. Steelhead likely inhabited most coastal streams in Washington, Oregon and California as well as many inland streams in these states and Idaho.

During this century, over 23 naturally reproducing stocks of steelhead are believed to have been extirpated, and many more are thought to be in decline in numerous coastal and inland streams in Washington, Oregon, California, and Idaho. Forty-three stocks have been identified as being at moderate or high risk of extinction. For these reasons, Northern California (NC) steelhead were federally listed as endangered in one environmentally significant unit (ESUs), threatened in 10 ESUs, and as a species of special concern in one ESU. The Northern California ESU, from Redwood Creek south, falls within the boundaries of RNSP; it was listed as threatened on June 7, 2000 and relisted as a distinct population segment (DPS) in 2006 (Fed. Reg 2006).

Biologically, steelhead can be divided into two basic run-types based on the state of sexual maturity at the time of river entry and duration of spawning migration (Burgner *et al.* 1992). The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature before spawning. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, while others only have one run-type. South of Cape Blanco, Oregon, summer steelhead are known to occur in the Rogue, Smith, Klamath, Trinity, Mad, and Eel Rivers, and in Redwood Creek (Busby *et al.* 1996), in addition to the winter runs present in these basins.

Summer steelhead enter freshwater between May and October in the Pacific Northwest (Busby *et al.* 1996, Nickelson *et al.* 1992). They require cool, deep holding pools during summer and fall, prior to spawning (Nickelson *et al.* 1992). As cited by Moyle *et al.* (1995), summer steelhead on the northcoast return to freshwater streams from April through June. They migrate up coastal streams and rivers during and soon after the final high flows of April, and migration continues through June. It may extend into July but declines presumably due to lower flows and warmer

water temperatures. The gonads of the migrating fish are immature and do not mature until the fish have spent 8-10 months in freshwater (Roelofs 1983). Spawning occurs from late December through April.

Winter steelhead enter freshwater between November and April in the Pacific Northwest (Nickelson *et al.* 1992, Busby *et al.* 1996), migrate to spawning areas, and spawn generally in April and May (Barnhart 1986). Some adults, however, do not enter some coastal streams until spring, just before spawning (Meehan and Bjornn 1991). On the northcoast, steelhead generally spawn earlier than those in areas to the north; both summer and winter steelhead in California generally begin spawning in December,

There is a high degree of overlap in spawn timing between populations within a DPS regardless of run type (Busby *et al.* 1996). Difficult field conditions during winter months and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning. Unlike Pacific salmon which die after spawning, steelhead are iteroparous, or capable of spawning more than one year before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Nickelson *et al.* 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996).

Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Everest 1973, Barnhart 1986). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity are required to reduce disturbance and predation of spawning steelhead (Giger 1973). It appears that summer steelhead occur where habitat is not fully utilized by winter steelhead, with summer steelhead usually spawning farther upstream than winter steelhead (Behnke 1992).

Steelhead require a minimum depth of 7 in (18 cm) and a maximum velocity of 8 ft/sec (2.5 m/sec) for active upstream migration (Smith 1973). Spawning and initial rearing of juvenile steelhead generally take place in small, moderate-gradient (generally 3-5 %) tributary streams (Nickelson *et al.* 1992). A minimum depth of 7 in (18 cm), water velocity of 1-3 ft/sec (0.3-0.9 m/sec), and clean substrate 0.25-4 in (0.6-10 cm) (Hunter 1973, Nickelson *et al.* 1992) are required for spawning. Steelhead spawn in 39-49° F (3.9- 9.4° C) water (Bell 1991). Depending on water temperature, steelhead eggs may incubate for 1.5-4 months before hatching, generally between February and June (Bell 1991). Nickelson *et al.* (1992) stated that eggs hatch in 35-50 days, depending upon water temperature.

After 2 to 3 weeks, in late spring, and following yolk sac absorption, alevins emerge from the gravel and begin actively feeding. After emerging from the gravel, fry usually inhabit shallow water along banks of perennial streams (Nickelson *et al.* 1992). Older fry establish and defend territories.

Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are

abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small in-stream wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al.* 1992).

Juvenile steelhead migrate little during their first summer and occupy a range of habitats featuring moderate to high water velocity and variable depths (Bisson *et al.* 1988). Rearing juveniles prefer water temperatures ranging from 54-59° F (12.2- 15.0° C) (Reeves *et al.* 1987). Juvenile steelhead feed on a wide variety of aquatic and terrestrial insects (Chapman and Bjornn 1969), and older juveniles sometimes prey on emerging fry. Steelhead hold territories close to the substratum where flows are lower and sometimes counter to the main stream. From these, they can make forays up into surface currents to take drifting food (Kalleberg 1958). Juveniles rear in freshwater from 1 to 4 years (usually 2 years in the California DPSs), then smolt and migrate to the ocean in March and April (Barnhart 1986). Winter steelhead generally smolt after 2 years in freshwater (Busby *et al.* 1996). The majority of juvenile steelhead in Redwood Creek spend their second year of life in the estuary and mainstem Redwood Creek (Anderson 1988). Steelhead smolts are usually 6-8 in (15-20 cm) total length and migrate to the ocean in the spring (Meehan and Bjornn 1991). Based on incidental purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer from whatever point they enter the ocean, rather than migrating along the coastal belt as salmon do. During the fall and winter, juveniles move southward and eastward (Hartt and Dell 1986).

Steelhead typically reside in marine waters for 2 or 3 years prior to returning to their natal stream to spawn as 4- or 5-year olds. Populations in Oregon and California have higher frequencies of returning age-1 ocean steelhead, (aka half-pounders) than populations to the north, but age-2 ocean steelhead generally remain dominant (Busby *et al.* 1996).

Steelhead are found in most small order, high and low gradient tributaries to Redwood Creek. They are able to leap above barriers that might impede coho salmon (D. Anderson pers. comm.). Whether logjams are barriers to fish movement depends upon stream dynamics such as the logjam size and height, pool depth immediately below, and the stream discharge as well as the timing and duration of the steelhead migration. These events change from year to year.

Redwood Creek summer steelhead snorkel surveys began in 1981 between Lacks Creek and Tom McDonald Creek, a 25.7 km (16 mi) index reach, and were expanded to 38.6 km (24 mi) in 1992. Survey data indicate a steady decline since that time, although numbers were low to begin with when the surveys began. In recent years the numbers have leveled off at approximately 10-20 adult fish observed annually (D. Anderson pers. comm.). Forty-four was the highest total number of adult fish observed (in 1984 and 1985); zero fish were observed in 1989 and 2001. In other years the count ranged from 1 to 19 (1991 through 2010). Including surveys upstream of the 38.6 km reach conducted from 1993 to 1998, covering between 53 and 85 river km (33 and 53 river mi) of the 109 km (67.7 mi) long Redwood Creek, the highest numbers of adult summer steelhead observed were 36 in 1994 and 37 in 1997.

No park tributaries in the Redwood Creek basin have been snorkel surveyed for summer steelhead; the smaller streams do not have large enough pools to support fish during the warm

summer months. In addition, adult summer steelhead have not been encountered in these streams during other survey and monitoring activities.

In Redwood Creek winter-run steelhead numbers are higher than summer steelhead numbers. Juvenile winter-run steelhead are the most common and widely distributed fish in the Redwood Creek basin. During sampling efforts in the summers of 1980 and 1981, steelhead occurred in 57 of the 111 Redwood Creek tributaries surveyed (Anderson 1988, Brown 1988). Sparkman's (2010) upper basin down migrant rotary trap catches for the 9 years between 2000-2008 averaged 81,179 0+ steelhead, 9,212 1+ steelhead, and 866 2+ steelhead. There were declines in all of these age classes in 2009, and significant declines in 0+ and 2+ age classes for reasons not easily explained. Results for the lower Redwood Creek trap show a similar negative decline for 1+ and 2+ juvenile steelhead; the decline was significant for 2+ age class (Sparkman 2011). Sparkman (2010) hypothesized that over-summer conditions (e.g., lethally high water temperatures) could be limiting the production of older (2+) age classes in upper Redwood Creek. He goes on to cite numerous studies from other areas that indicate a positive linear relationship between out-migrating 2+ smolts and returning adult steelhead (percent returning in the cited studies were between 84 and 98%), and that this age class is the best class for assessing steelhead status, trends, and abundance when information on adult steelhead is not available. In addition, he states "[t]he 2+ steelhead trout are also an excellent indicator of watershed and stream conditions because they spend the longest amount of time in freshwater habitat."

Duffy (2011) estimated escapement in Prairie Creek between 1999 and 2010 to be 4-142 adults; the wide range was influenced by uncertainty in run timing in the earlier years and precipitation in all years. Beginning in 2005 a weir was installed in Prairie Creek that revealed a migration of steelhead beginning in late February through mid-April. Numbers of estimated adults in 2005 through 2008 were 70-142 fish (Duffy 2011). Downstream migrant traps in Prairie Creek caught between 505 (2001) and 8 (2004) juvenile steelhead (Duffy 2011). When unidentified 0+ and 1+ trout (which could include juvenile coastal cutthroat trout) are added, the numbers ranged between 201 in 2008 and 4,745 in 2003.

All ages of juvenile steelhead rear in the Redwood Creek estuary during the summer and fall. Population estimates show a seasonal decline in numbers, to a mean of 3,300 (range 540 to 9,350) in the fall (1997 through 2007) before the estuary opens to the ocean. The numbers indicate a lowered carrying capacity of the estuary in the fall.

B. Habitat Status

The Redwood Creek watershed is listed as impaired for high water temperatures and sediment under Section 303(d) of the Clean Water Act. As an example, data from a temperature logger (Tidbit) located on mainstem Redwood Creek upstream of Tom McDonald Creek/Tall Trees Grove for July and August 2009 had maximum and minimum water temperatures of 22.6° C (72.7 ° F) and 16.2° C (61.2° F), respectively. Maximum diurnal range was 4.9° C (40.8° F). The average water temperature was 19.4° C (66.9° F). Maximum weekly average temperature (MWAT) was 20.6° C (69.0° F). Hours of temperature of 18° C (64.4° F) and above were 1,193 hrs (RNPS unpub. data).

Lower Redwood Creek, closer to the ocean, has lower temperatures relative to upstream, but it is still warm. 2009 data for a logger located in lower Redwood Creek upstream of the Redwood Creek trailhead for July and August 2009 had maximum and minimum water temperatures of 22.1° C (71.8° F) and 15.1° C (59.2° F), respectively. Maximum diurnal range was 6.7° C (44.1° F). The average water temperature was 17.7° C (63.9° F). MWAT was 18.3° C (64.9° F). Hours of temperature of 18° C (64.4° F) and above were 492 hrs (RNSP unpub. data).

What these recent data indicate is that water temperatures in mainstem Redwood Creek are high for salmonid fish, above the preferred temperature range for steelhead of 7.3° C (45.1° F) to 14.6° C (58.3° F), reported by Reiser and Bjornn (1979).

Tributaries to Redwood Creek have lower water temperature. Water temperatures of 63 east and westside tributaries entering Redwood Creek measured during a late July/early August summer steelhead survey in 2005 ranged from 12° C (53.6° F) to 17° C (62.6° F) (Anderson 2005). Water temperatures of all tributaries were cooler than the corresponding temperature of mainstem Redwood Creek measured at the same time. Westside tributaries were generally cooler than eastside tributaries. The mean water temperature of westside tributaries was 14.3° C (57.7° F) (n = 43) and the mean water temperature of eastside tributaries was 15.3° C (59.5° F) (n = 20). The 2005 year tributary water temperatures are similar to temperatures and patterns that have been recorded in past summer steelhead surveys. Where these tributaries enter Redwood Creek there may be deeper, colder pools that may sustain steelhead, although these pools are relatively few (D. Anderson pers. comm.).

C. Critical Habitat

Designated critical habitat for NC steelhead was defined by NMFS (Federal Register 2005b) to include the stream channels within the stream reaches and a lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined pursuant to the lateral extent, it is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence level of 1 to 2 years on the annual flood series. Critical habitat in estuaries is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater.

In designating critical habitat, NMFS focuses on the known primary constituent elements (PCEs) essential for the conservation of the species. These PCEs are those sites and habitat components that support one or more life stages, including: (1) freshwater spawning, (2) freshwater rearing, (3) freshwater migration, (4) estuarine areas, (5) nearshore marine areas, and (6) offshore marine areas. Within the PCEs, essential elements of NC steelhead critical habitat include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, (10) safe passage conditions, and (11) salinity conditions.

Critical habitat is of variable quantity and quality depending on the condition of a watershed/sub watershed within RNSP. The condition of a watershed relative to critical habitat is primarily a function of past land use practices. That is, the level of logging and number of old or abandoned

logging roads within a watershed or subwatershed influence the habitat in terms of fine sediment quantity, amount of instream LWD, amount of streamside shading, pool number and depth, and water temperature.

3. California Coastal Chinook Salmon (*Oncorhynchus tshawytscha*), Threatened

A. Species Account

Chinook salmon populations have declined along the Pacific coast to the degree that certain evolutionarily significant units (ESUs) were listed as threatened by the National Marine Fisheries Service (NMFS) under the Endangered Species Act (Federal Register 1999). In 2005 the California Coastal (CC) Chinook salmon was “re-listed” (i.e. reaffirmed) as threatened after a status review in response to a court order directing the Service to consider the contribution of hatchery fish to species viability (Federal Register 2005). Chinook historically ranged as far south as the Ventura River, California, and north as far as the Russian Far East (Federal Register 1999). The California Coastal ESU falls within the southern boundaries of Redwood National and State Parks and stretches from Redwood Creek south through the Russian River.

Of the Pacific salmon, Chinook exhibit the most diverse and complex life history strategies. Two generalized freshwater life-history types were described by Healey (1991): “stream-type” Chinook that reside in freshwater for a year or more following emergence, and “ocean-type” Chinook that migrate to the ocean within their first year.

Chinook mature in the ocean between 2 and 6+ years of age (Myers *et al.* 1998). Freshwater entry and spawning timing are generally thought to be related to local water temperature and flow regimes (Miller and Brannon 1982). Distinct runs differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and actual time of spawning (Myers *et al.* 1998).

Run timing for spring-run Chinook in the CC Chinook ESU typically begins in March and continues through July, with peak migration occurring in May and June. Spawning begins in late August and can continue through October, with a peak in September. Historically, spring-run Chinook spawning areas were located in the river headwaters (generally above 1,300 feet). Run timing for fall-run Chinook varies depending on the size of the river.

Post-emergent fry seek out river/stream shallow areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. As they grow to 2 to 3 in (5 to 7.6 cm) in length, the juvenile salmon move out into deeper, swifter water, but continue to use available cover to minimize the risk of predation and reduce energy expenditure. The optimum water temperature range for rearing Chinook fry is 50-55° F (10–12.8° C) (Seymour 1956, Rich 1997) and for fingerlings is 55-61° F (12.8-16° C) (Rich 1997). Data from the Mad River (Sparkman 2002) and Redwood Creek (Sparkman 2004) indicate that emergent Chinook fry develop rapidly following emergence. Over a 15-week period in the spring of 2001, Chinook fry increased in average length from 1.6 to 2.6 in (4.0 to 6.6 cm) with the bulk of this riverine growth occurring during a 10-week period in May and June (Sparkman 2002).

The majority of Chinook juveniles emigrate to the ocean as sub-yearlings, although yearling

smolts can constitute up to approximately one-fifth of out-migrants from the Klamath River Basin. The proportion of fish which smolt as sub-yearling vs. yearling varies from year to year (Busby and Barnhart 1995). This fluctuation in age at smoltification is more characteristic of an ocean-type life history. Furthermore, the low flows, high temperatures, and barrier bars that develop in smaller coastal rivers (such as Redwood Creek) during the summer months would favor an ocean-type (sub yearling smolt) life history (Kostow 1995).

Ocean-type juveniles enter saltwater during one of three distinct phases. Immediate fry migrate to the ocean soon after yolk resorption at 1.2-1.8 in (3.0-4.6 cm) in length (Lister *et al.* 1971, Healey 1991). In most river systems, however, fry migrants, that migrate at 50-150 days post-hatching, and fingerling migrants, that migrate in the late summer or autumn of their first year, represent the majority of ocean-type emigrants. In upper Redwood Creek the months of May and June accounted for 91.5% of the total captures of migrating young-of-the-year Chinook in 2001 (Sparkman 2002). Stream-type Chinook migrate during their second or, more rarely, their third spring (Healey 1991). Under natural conditions, stream-type Chinook appear to be unable to smolt as sub-yearlings (Healey 1991).

Winter-run Chinook constitute the main Chinook run in RNSP streams. Adult fish return to spawn after 3 to 6 or more years in the ocean, although 2 year old male spawners (“jacks”) are commonly observed (Myers *et al.* 1998). These fish begin their upstream migration into the park around November, if access through the Redwood Creek estuary is possible. Entry into Redwood Creek is dependent on the mouth being open to the ocean. The sand bar that blocks the mouth usually breaks open as a result of winter rain events increasing stream flow that fills the estuary and breaches the sand bar. Chinook have spawned and died by the end of January. Spring-run Chinook are not typically considered to use the Redwood Creek watershed. Adult spring-run Chinook have been observed in mainstem Redwood Creek once (6 in the summer of 1988) in the 31 years since 1981 when the park began summer steelhead (*O. mykiss*) snorkel surveys (RNSP unpub.data).

In upper Redwood Creek, almost all of the juvenile Chinook migrants are 0+ fry or fingerlings; only 0.01% (92 fish) of the juveniles captured in 10 years of downstream migration study consisted of 1+ juveniles (Sparkman 2010). The estimated population of 0+ juveniles has varied over 10 years of trapping (Sparkman 2010); production was greater than 350,000 individuals in the first 3 years, less than 1,000 in the fourth year (cohort failure) and in the fifth year there was a peak of 630,000 juvenile fish. The 9-year average (2000-2008) for the study was 244,894. A 10-year trend in population abundance over time (2000-2009) showed a significant negative decline (Sparkman 2010). This decline could have been the result of flood flows; studies cited in Sparkman (2010) indicated that scour of redds by high stream flows or floods can cause severe decreases in the production of juvenile salmonids. One study indicated a mortality estimate of 90% due to redd scour. Greene *et al.* (2005; cited in Sparkman 2010) showed that flood recurrence interval during Chinook intergravel development was the second most important variable in their models used to predict the return rate of adult Chinook. Three of 10 years of study in upper Redwood Creek documented flows capable of scouring spawning redds, which was deemed a likely explanation for the poor production of cohorts in each of the following spring seasons. High, potentially damaging stream flows in upper Redwood Creek are not uncommon, estimated to occur on average every 3.1 years (Redwood National Park unpub. data).

Salmonid surveys in Redwood Creek and its tributaries (e.g., Prairie Creek) show juvenile Chinook do not spend time rearing in upstream areas (Anderson and Brown 1982), but instead, utilize the Redwood Creek estuary. In spring, Chinook fry migrate downstream to rear in the estuary before and after the mouth closes. After the mouth closes, Chinook entry into the ocean is in the fall when the mouth opens. Thus, the Redwood Creek estuary is important as the sole rearing habitat for these ‘ocean-type’ juveniles. Research shows that if given the opportunity the juveniles will spend an extended period (to late summer) in the estuary before entering the ocean. Based on scales of returning adult Chinook spawners it was determined that there may be a survival advantage favorable to the fish that remain in the estuary and grow to a larger size before entering the ocean (Reimers 1973). Redwood Creek estuary Chinook juvenile population estimates for 1997 through 2007 show a seasonal decline in numbers. The September mean estimate was 2,260 Chinook, the minimum and maximum numbers 50 and 6,660, respectively (RNSP unpub. data). The limited carrying capacity of the estuary cannot accommodate the Chinook juvenile production occurring in the watershed. However, this extended estuary rearing affords size increases to 100 mm forklength of those fish surviving in the Redwood Creek estuary in the fall.

In Prairie Creek, the escapement of adult Chinook ranged from a high of 710 in 2002 to a low of 38 in 2008 for 1999 through 2011. Escapement of Chinook has been relatively low in this tributary since 2005. Juvenile fish abundance in the downstream migrant trap varied considerably among years. Chinook fry were very abundant during 1999-2004 but decreased after that (Duffy 2011).

The low numbers of returning adult Chinook are probably related in part to the conditions in the Redwood Creek estuary (D. Anderson pers. comm.). Chinook spawning in the RNSP tributaries may be impeded by stream barriers, but they may be able to surmount some barriers depending on flow conditions when the fish are present.

B. Habitat Status

Chinook estuary rearing habitat was degraded when flood control levees that bisected and altered the historical configuration of the Redwood Creek estuary were constructed in 1968. The levees altered the physical and biological functions of the estuary and adjacent wetlands and confined the lower 3.4 mi (5.5 km) of Redwood Creek stream channel to a width of 300 ft (91 m). The flood control project reduced the amount of riparian vegetation and tree cover, reduced adjacent wetlands, altered valley drainage patterns, decreased the amount of instream woody debris, and caused decreased pool depths along lower Redwood Creek. The levees bypassed and isolated the last downstream meander of Redwood Creek (now called the South Slough), reduced circulation into the North and South Sloughs, and contributed to 50% of the lower estuary between 0 and 4 ft Mean Sea Level filling with sediment or becoming isolated from the embayment (Ricks 1983). Adjacent land uses, e.g., cattle grazing on the flood plain and uncontrolled breaching of the sand berm (which forms a seasonal barrier to the ocean across the mouth), also have contributed to habitat degradation of the estuary.

The Redwood Creek watershed is listed as impaired for high water temperatures and sediment under Section 303(d) of the Clean Water Act. An example of Chinook rearing temperatures,

July/August 2009 data from a temperature logger (Tidbit) located at the ends of the levees in the embayment of the Redwood Creek estuary, show the average temperature as 15.1° C (59.2° F) and minimum and maximum temperatures as 21.3° C (70.3° F) and 11.5° C (52.7° F), respectively. Maximum weekly average temperature (MWAT) was 20.2° C (68.4° F). Hours of temperature of 18° C (64.4° F) and above were 227 hrs. Some periods in the estuary are above the optimum rearing temperatures for Chinook.

C. Critical Habitat

Critical habitat for California Coastal Chinook salmon was designated in 2005 (Fed. Reg 2005a). Designated critical habitat for California Coastal Chinook salmon includes the stream channels within the stream reaches and includes a lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence level of 1 to 2 years on the annual flood series. Critical habitat in estuaries is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater.

In designating critical habitat, NMFS focuses on the known primary constituent elements (PCEs) essential for the conservation of the species. These PCEs are those sites and habitat components that support one or more life stages, including: (1) freshwater spawning, (2) freshwater rearing, (3) freshwater migration, (4) estuarine areas, (5) nearshore marine areas, and (6) offshore marine areas. Within the PCEs, essential elements of CC Chinook salmon critical habitat include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, (10) safe passage conditions, and (11) salinity conditions.

Critical habitat is of variable quantity and quality depending on the condition of a watershed/sub watershed within RNSP. The condition of a watershed relative to critical habitat is primarily a function of past land use practices. That is, the level of logging and number of old or abandoned logging roads within a watershed or subwatershed influence the habitat in terms of fine sediment quantity, amount of instream LWD, amount of streamside shading, pool number and depth, and water temperature.

4. Southern Eulachon DPS (*Thaleichthys pacificus*), Threatened

A. Species Account

Eulachon (also called Columbia River smelt, candlefish, and hooligan) are members of the smelt family (Osmeridae). They are endemic to the northeastern Pacific Ocean and range from northern California to southwest and south central Alaska. The Southern Distinct Population Segment (DPS) occurs from the Skeena River in British Columbia south to the Mad River in northern California. South of the U.S./Canada border most eulachon production occurs in the Columbia River Basin and in major river tributaries of the Columbia (Federal Register 2009).

Large spawning aggregations have been documented in the Klamath River and infrequently in other coastal California rivers including the Smith River, Redwood Creek, and the Mad River,

which is considered by many to be the southern extent of the range; the current population abundance in the Mad River is unknown (citations in Federal Register 2009). Vincik and Titus (2007) reported capture of a single mature male in a screw trap in the Sacramento River. The southern eulachon DPS was listed as threatened by the National Marine Fisheries Service in March, 2010 (Federal Register 2010).

The significance of the spawning runs in the Klamath River and Redwood Creek were revealed in newspaper accounts of great numbers of spawners in February 1919, March 1968, and April 1963 and 1969 (Klamath River) and April 1963 and 1967 (Redwood Creek) (Federal Register 2009). Eulachon are of great cultural and subsistence importance to the Yurok Tribe on the Lower Klamath River (Trihey and Associates 1996) and the Yurok People consider eulachon to be a Tribal Trust Species along with Chinook and coho salmon, steelhead, Pacific lamprey, and green sturgeon (Trihey and Associates 1996, Larson and Belchik 1998). Eulachon once supported popular recreational fisheries in Northern California rivers, but the only reported commercial catch of eulachon in Northern California occurred in 1963 when a combined total of 56,000 lbs (25 mt) was landed from the Klamath River, the Mad River, and Redwood Creek (Odemar 1964).

A California Department of Fish and Game (CDF&G) memo dated May 1, 1973 described surveys in Redwood Creek from April 23-25 of that year. The surveys were conducted after CDF&G received word that eulachon were running in Redwood Creek and a fisherman had delivered 2,500 lbs of the fish to a local fish processor. The surveyors stated in their memo "...The fish were running in such numbers that can only be described as 'millions'." This is the last indication of a large run of this species in Redwood Creek.

The last noticeable runs of eulachon by Yurok Tribal elders in the Klamath were in the late 1980s. By the mid-1990s, despite numerous hours of sampling at sites along the lower Klamath, no eulachon were caught (Larson and Belchik 1998). Around this same time they were also considered "rare or absent" in the Mad River and Redwood Creek (Sweetnam *et al.* 2001). The Tribe conducted sampling for this species beginning in January 2011 (NMFS 2010); this effort may provide some indication of whether eulachon is still present in Redwood Creek.

Eulachon typically spend 3-5 years in the ocean before returning to freshwater to spawn from late winter through March or April. The timing of eulachon entry into spawning rivers is likely tied to water temperature and tidal cycles. Spawning normally occurs when water temperatures are between 39° F (3.9° C) and 50° F (10° C) (citations in NMFS 2010). Spawning grounds are mainly in the lower reaches of larger rivers and may be limited to the portion of the river influenced by tides (Lewis *et al.* 2002), though in some river systems spawners migrate well above the tidal influence. In extreme cases, adults may migrate up to 100 mi (160 km) upstream to reach spawning grounds (Hart and McHugh 1944). RNSP has documentation of eulachon observed where U.S. Hwy 101 crosses Redwood Creek in Orick, approximately 2.5 mi (4.0 km) from the ocean. The surveys referred to in the 1973 CDF&G memo attempted to determine the upstream limits of the "migration". Eulachon were noted passing the mouth of Tom McDonald Creek, 12.5 mi (20.1 km) upstream from the ocean "in greatly reduced numbers". The memo went on to say that although Eulachon were not observed at a point 4 miles upstream of Tom McDonald Creek "...it was assumed that they probably got as far as Bridge Creek, 15 miles from the ocean."

Spawning occurs at night (Federal Register 2009c). After spawning the eggs, 1 mm in size, drift before their sticky outer covering adheres to sand grains and small gravels. Number of days of incubation is dependent upon stream temperatures. After hatching, the larval fish, 0.16-0.3 in (4-8 mm) long, are transported downstream to the ocean and may rear in estuaries. Juvenile eulachon move to nearshore areas in waters with depths to 50 ft (15 m), then to deeper waters of the continental shelf (Hay and McArter 2000). Prey includes crustaceans such as copepods and euphausiids, phytoplankton, mysids, and barnacle and worm larvae (citations in Federal Register 2009). After 3 to 5 years at sea eulachon return as adults to spawn, however, it is not known whether or not eulachon return to natal streams to spawn.

Several aspects of eulachon biology indicate that large aggregations of adult eulachon are necessary to maintain their normal reproductive output. Eulachon are a short-lived, high fecundity, high-mortality species, the like of which typically have extremely large population sizes. It is thought high population numbers are necessary for viability because there is a critical threshold density of adults that must be present for successful reproduction. There must be enough offspring to counteract high in-river egg and larval mortality and larval ocean mortality and enough viable offspring to buffer against variation in local environmental conditions (Federal Register 2010).

NMFS and others identified the main threats to this species are changes in ocean and river conditions due to climate change. Changes in ocean conditions are the most significant threats to eulachon and its habitats, with changes in freshwater conditions considered a moderate threat (Federal Register 2010). Warming of marine, estuarine, and freshwater habitats in the Pacific Northwest over the past 50-100 years may be causing problems for eulachon spawning, primarily in the northern portion of the range where glacier size is decreasing, resulting in decreased snow melt and increased water temperatures. In the marine environment increased water temperatures may be affecting prey abundance and composition, particularly of zooplankton communities.

Other threats to eulachon include dams, water diversions, and flood control including the dams on the Klamath River which have caused increased water temperatures and increased sedimentation (NMFS 2010e). Although Redwood Creek was not mentioned in the regulatory sources specifically, it is possible that the flood control levees in the lower river and sedimentation negatively altered the habitat for eulachon. Fish sampling in the Redwood Creek estuary occurs in the summer months, thus, would be unlikely to detect eulachon if they were present. However, eulachon runs are highly noticeable due to an abundance of predatory birds and marine mammals that tend to accompany these runs in coastal rivers (Federal Register 2010). Given the altered condition of lower Redwood Creek it is possible that eulachon may no longer be able to persist in this environment.

B. Habitat Status

All park water temperature monitoring has taken place in summer and fall (June through September) to document the high water temperatures that are affecting salmonids. No winter monitoring is done, therefore, data on winter temperatures are lacking. It is unknown if temperature is a factor affecting eulachon entering Redwood Creek, spawning, egg incubation, and larval outmigration. The tidal influence in Redwood Creek appears limited to at most 1 mi (0.6 km) upstream from the mouth (RNSP unpub. data).

The nearshore area of the parks out to the 0.25 mi boundary constitutes approximately 9 mi² (23 km²) of ocean habitat. Depths in this area range from 10 ft (~ 3 m) to 60 ft (~19 m). All of this could be considered habitat that is potentially available to juvenile eulachon.

C. Proposed Critical Habitat

The area proposed for designated critical habitat in RNSP is Redwood Creek, between the ocean and the mouth of Prairie Creek. Redwood Creek is listed as impaired for water temperature and sediment under Clean Water Act section 303(d). High summer water temperatures are a problem as well as turbidity and sedimentation of the channel.

Levees of the Redwood Creek Flood Control Project constrict the lower 3.4 mi (5.5 km) of Redwood Creek, almost the entire length of the proposed critical habitat unit. The levees, completed in 1968, have negatively impacted the biological and physical functions of the Redwood Creek estuary and lower river. There are fewer deepwater pools, decreased wetland and riparian habitats, and reduced water circulation and increased sedimentation in the estuary due to channelization caused by the levees. Approximately 50 percent of the estuary has filled in with ocean derived sediment and/or become isolated from the embayment.

Annual maintenance to maintain the flood capacity of the Redwood Creek Flood Control Project is permitted by the US Army Corps of Engineers (Corps). Maintenance consists of riparian vegetation removal and gravel removal (skimming of the gravel bars only, no dredging of the wet channel). It is done in the fall (September-October), the period of lowest river flow and when it would least affect listed salmonids.

Another activity regulated by the Corps that has occurred in the past was the excavation of the north slough channel connecting the north slough to the embayment of the Redwood Creek estuary. The current configuration of the levees has caused a continual buildup of sand and driftwood in the north slough channel which affects drainage and elevates the water table on adjacent private lands. Periodic excavation, which releases anoxic water, has been done in the spring prior to the barring-over of the Redwood Creek mouth. The distance downstream from the channel confluence to the ocean is about 0.15 miles (240 meters). It was scheduled at a time as not to impact salmonid juveniles or smolts that would be migrating downstream to the ocean or estuary to rear. Scheduling it later would send the released water into a closed lagoon, impacting rearing salmonids. There could be possible impacts to eulachon habitat from this activity (D. Anderson pers. comm.).

VI. IMPACTS TO THREATENED AND ENDANGERED SPECIES

Chinook Salmon, Coho Salmon, and Steelhead

Most of the exotic plant program activities described in this document would not impact the three species of listed salmonids. Removal of exotic plants by manual methods including hand pulling, the use of hand tools, and burning is unlikely to mobilize any measurable amount of sediment into creeks and wet areas. The majority of exotic plant species slated for manual removal are in upland locations away from streams, and in places that tend to be level in slope. Where manual removal of exotics would occur in riparian areas very minor amounts of sediment

could be generated due to digging with hand tools. Such minor amounts of sediment, if mobilized into a watercourse, would not be great enough to result in measurable impacts to the species or their habitat. Some equipment used in manual removal (e.g., weed wrenches and grip hoists) are specifically designed to minimize soil disturbance, further reducing the likelihood of sediment mobilization.

Removal of exotic plants using mechanical methods also would not have measurable effects on salmon and steelhead. Heavy equipment would remain on hard surfaces and be used to dig up roadside weeds and exotic shrubs such as cotoneaster and Himalayan blackberry, Scotch and French broom, and black locust. These species mainly occur at upland locations, away from riparian areas. Heavy equipment has a slightly increased possibility of generating sediment should work occur adjacent to (but outside of) a riparian area, as compared to hand tools. However, as with any digging (manually or with equipment) a tarp or native mulch would be applied to the bare ground to prevent erosion.

With any heavy equipment and power tool use there is always the slight possibility of petroleum products entering the environment should a spill occur. Spill plans and best management practices for managing petroleum products should minimize the probability of runoff of hazardous materials in the unlikely event of a spill associated with power tool or heavy equipment use (see Appendix B).

The use of chemical herbicides has the potential to impact riparian habitats should a chemical make its way into ground water in a riparian area. However, restricting chemical use in riparian habitats to Aquamaster (glyphosate) would minimize the potential for adverse impacts. Glyphosate is a plant-specific compound that targets enzymes found only in plants, not animals. It has been approved for use by the EPA in aquatic environments, and has been determined by an EPA assessment not likely to adversely affect salmon and steelhead when used according to the manufacturer's instructions. Glyphosate that comes in contact with soil binds tightly to particles and tends to remain within the top 6 inches of soil which makes it unlikely to end up in surface or sub-surface runoff except where direct soil erosion is a factor. The direct application methods used by park staff will minimize or eliminate contact with soil, except in the Bald Hills where the chemical is applied with a backpack sprayer to Harding grass. However, it is short-lived in the environment and degrades to aminomethyl phosphoric acid (AMPA) with a half life of 1.85-2.06 days. Glyphosate application would only occur when wind is minimal and no rain is forecasted within at least 48 hrs after application, further reducing the likelihood of this chemical making its way into watercourses and impacting salmon and steelhead or their habitats.

Exotic vegetation covering a maximum of 10 ac (4 ha) per year in large and small watersheds would be treated by direct application of glyphosate throughout all of RNSP. Indirect (foliar) application maximums of 2 ac (0.8 ha) and 5 ac (2 ha) would be allowed annually in small and large riparian habitats, respectively. Together these 2 methods could result in a maximum total of 20 ac (8.1 ha) treated throughout all of RNSP in a year, equating to 0.22% of perennial and intermittent streamside riparian acres within the parks. This level of chemical use park-wide is not likely to cause an adverse impact to salmon and steelhead populations or their habitats.

Aminopyralid would be applied only via foliar application to control woody and non-woody

broad-leaved species in upland areas away from riparian habitats and riparian/upland interfaces. Application by this method would use a backpack sprayer with a nozzle set to a coarse stream applied directly to each leaf surface to prevent the potential for drift. This method would only be used when wind is minimal and no rain is forecasted within at least 48 hrs after application.

The other herbicide proposed for use, Garlon-4, is not approved for use in aquatic environments where it may persist due to its lack of water solubility. In the terrestrial environment it breaks down rapidly in soil to triclopyr acid which is considered by the EPA to be “practically non-toxic” to freshwater fish, invertebrates, and terrestrial vertebrates. This herbicide would only be used in a very few specific upland locations in the Bald Hills, well away from any perennial water sources and only in the dry summer season when rain is not anticipated, thereby further reducing the likelihood of this chemical impacting salmon and steelhead habitat.

With chemical use there is always the slight possibility of the substance entering the environment should a spill occur. Spill plans and best management practices for managing chemical products should minimize the probability of runoff of hazardous materials in the unlikely event of a spill associated with control activities (see Appendix C). A spill, in the unlikely event of an occurrence, would be low in volume, readily contained, and would be unlikely to have an adverse impact on Chinook and/or coho salmon and/or steelhead.

Critical Habitat

Most of the exotic plant program activities described in this document would not impact critical habitat for the 3 species of listed salmonids. Only minor amounts of sediment resulting from manually digging or heavy equipment could potentially enter riparian areas; the likelihood of sediment entering actual stream courses is even further reduced. Chemical application of herbicides, especially glyphosate used in small doses in riparian areas, could enter waterways. However, given the low amount of annual use, and the measures that will be taken to minimize impacts, it is unlikely that chemical use for exotic plant management activities will result in a negative impact on critical habitat for Chinook and coho salmon and/or steelhead.

No significantly increased light levels and water temperatures would result from proposed exotic plant management activities taking place in critical habitat. Most of the exotic plants to be removed from stream banks and adjacent areas are shade tolerant. Minor amounts of stream bank vegetation, e.g., pampas grass would be removed but not in amounts that would alter stream shading or temperature.

Essential Fish Habitat

Essential fish habitat would not be impacted, or would be impacted only minimally by the activities described in this document, for the same reasons provided above relative to impacts on Chinook and coho salmon and/or steelhead and their critical habitats.

Southern Eulachon

Most of the exotic plant program activities described in this document would not impact Redwood Creek, the only potentially suitable habitat for eulachon within the parks. Removal of exotic plants by manual methods including hand pulling, the use of hand tools, and burning is unlikely to mobilize any measurable amount of sediment into Redwood Creek or its tributaries.

and/or adjacent wet areas. The majority of exotic plant species slated for manual removal are in upland locations away from streams and in places that tend to be level in slope. Where manual removal of exotics would occur in riparian areas very minor amounts of sediment could be generated due to digging, however, such minor amounts of sediment, if mobilized into a watercourse, would not be great enough to result in impacts to spawning gravels.

Removal of exotic plants using mechanical methods also would not have any impact on eulachon habitat. Heavy equipment would remain on hard surfaces and be used to dig up roadside weeds and exotic shrubs such as cotoneaster and Himalayan blackberry, Scotch and French broom, and black locust. These species mainly occur at upland locations, away from riparian areas. Heavy equipment has a slightly increased possibility of generating sediment should work occur adjacent to (but outside of) a riparian area. This is due to the greater amount of soil that can be disturbed by heavy equipment as compared to hand tools. However, as with any digging (manually or with equipment) a tarp or native mulch would be applied to the bare ground to prevent erosion.

The use of chemical herbicide has the potential to impact riparian habitats should it make its way into ground water in a riparian area. However, restricting chemical use in riparian habitats to Aquamaster (glyphosate) would minimize the potential for adverse impacts. Glyphosphate is a plant-specific compound that targets enzymes found only in plants, not animals. It has been approved for use by the EPA in aquatic environments, and has been determined by an EPA assessment not likely to adversely affect salmon and steelhead when used according to the manufacturer's instructions. Although there is no available information on this chemical's potential impacts on eulachon, due to its nature it is unlikely that there would be appreciable impacts to eulachon if the species were to occur in Redwood Creek. Herbicide use is not allowed within 0.25 mi of the Redwood Creek estuary at any time, therefore, the likelihood of this chemical entering the lower creek and impacting eulachon, if they were present, is extremely low.

Aminopyralid would be applied only via foliar application to control woody and non-woody broad-leaved species in upland areas away from riparian habitats and riparian/upland interfaces. Application by this method would use a backpack sprayer with a nozzle set to a coarse stream applied directly to each leaf surface to prevent the potential for drift. This method would only be used when wind is minimal and no rain is forecasted within 48 hrs after treatment.

The other herbicide proposed for use, Garlon-4, is not approved for use in aquatic environments where it may persist due to its lack of water solubility. In the terrestrial environment it breaks down rapidly in soil to triclopyr acid which is considered by the EPA to be "practically non-toxic" to freshwater fish, invertebrates, and terrestrial vertebrates. This herbicide would only be used in a very few specific upland locations in the Bald Hills, well away from any perennial water sources and only in the early, dry summer season when rain is not anticipated.

With any chemical use there is always the slight possibility of the substance entering the environment should a spill occur. Spill plans and best management practices for managing chemical products should minimize the probability of runoff of hazardous materials in the unlikely event of a spill associated with program activities (see Appendix C). A spill, in the unlikely event of an occurrence, would be low in volume, readily contained, and is unlikely to

have an adverse impact on eulachon, if they were in fact present.

Proposed Critical Habitat

Proposed critical habitat is not likely to be impacted by the proposed program activities. No herbicides would be used within 0.25 mi of the Redwood Creek estuary, and the likelihood of herbicides negatively impacting the intervening area to the mouth of Prairie Creek is very low. Most activities described in this document would generate immeasurable amounts of sediment that could ultimately end up deposited in Redwood Creek.

Cumulative Effects

Cumulative effects are defined as all those state, tribal, local, and private actions that are reasonably certain to occur in the future that have the potential to impact listed species in the park. Weed management activities on adjacent private timber lands including, but not limited to, chemical herbicide use, may cause additional impacts to the species considered in this document, as well as salmonid critical habitat, especially if such activities occur in the vicinity of tributaries to Redwood Creek

VII. DETERMINATION

Based on the nature and timing of the proposed actions, it is the National Park Service's determination that exotic plant management in RNSP:

may affect, but is not likely to adversely affect Chinook salmon, coho salmon, or steelhead, nor is it likely to result in destruction or adverse modification of designated critical habitat for these species;

may affect, but is not likely to adversely affect the southern eulachon DPS, nor is it likely to result in destruction or adverse modification of proposed critical habitat.

VIII. MANAGEMENT (CONSERVATION) RECOMMENDATIONS

There are no management recommendations.

VIX. CONTRIBUTORS

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PERSONAL COMMUNICATIONS

Anderson, David. Fishery Biologist. Redwood National and State Parks, Orick, CA

Appendix A. Exotic Plant Control Strategy outline used to guide RNSP staff in setting priorities for exotic plant management.

1. *Present in region but not in park.*
 - Ask whereabouts from cooperating agencies and landowners.
 - Place on a Watch List -- Educate park staff to seek and report.
 - Track spread if near park.
 - Prevent establishment inside park.
 - Avoid need for later control.
2. *Present in park as individuals or small, localized populations.*
 - If infestation is new, alert cooperating agencies and landowners.
 - Remove by appropriate technique.
 - Maintain a record of actions.
 - Monitor removal sites.
 - Follow up as needed.
 - Diligence keeps costs low.
3. *Present as large infestations in parts of park. Native plant communities are disrupted and native species displaced from infested areas.*
 - Remove outliers first.
 - Eliminate seed bank in outlier areas after removing plants.
 - Map large infestations. Develop long-term control strategy. Cost and compliance permitting, implement one or more large-scale projects, as follows:
 - Contain spread to within infested areas.
 - Reduce the number and size of infestations.
 - Restore native species to bared sites.
 - Minimize dispersal and re-infestation.
 - Treat smallest, furthest outlying areas first.
 - Eliminate larger infestations, moving from fringes toward the source of seed dispersal.
4. *Present as continuous infestations within and beyond park boundaries. Displaces many or all native plants in areas of infestation.*

Complete control may be possible, but only by a coordinated, comprehensive effort between parks and neighboring agencies and land managers. Extensive planning and provision for public comment are needed. New and applied research may be required before control is possible or cost effective. Ways to share costs of eradication on a regional scale will be pursued. If costs are unreasonable, it may be possible only to restore and protect certain critical park areas from infestation. Control steps will be similar to 3.

Appendix B

HAZARDOUS SUBSTANCE CONTINGENCY PLAN- PETROLEUM

1. Precautions or preventative measures to be taken:

Heavy Equipment

Prior to daily operations, all equipment operators will visually inspect their machinery to identify potential sources for spills. Hoses, caps, etc. will be inspected to assess integrity. Any and all suspect situations will be remedied before the equipment is operated.

Equipment will be cleaned and repaired (other than emergency repairs) at an established maintenance facility. All contaminated water, sludge, or other hazardous compounds will be disposed of at a lawfully permitted or authorized destination.

Lubricating Oils

All lubricating oils and hydraulic fluids will be stored in proper, approved containers. All containers will be securely capped or sealed when in storage, and protected from the rain. Because of the presence of residuals, all empty hydrocarbon containers, oily rags, etc. are to be disposed of in accordance with existing hazardous material regulations.

Fuel

All fuel containers will be located in stable, secure locations that are chosen to minimize the potential for a spill and the impact to resources should a spill occur. Valves, caps, hoses, etc. will be routinely inspected. Any identified problems (or potential problems) will be promptly fixed.

Streams and Waterways

No maintenance or fueling activities shall be permitted within 200 ft of a stream.

Fueling and Servicing

Absorbent materials will be placed on the ground beneath the equipment to catch any fuel or lubricants that may leak during fueling.

2. If a spill occurs:

A spill kit will be readily available (on hand) in the event of a spill, and appropriate materials provided in the kit will be used to contain and absorb the spill. These materials will continue to be used until such time as the hazardous material is completely removed or a HAZMAT specialist takes over the spill treatment. Spills in the sand will be quickly contained by shoveling contaminated sand into large buckets. Once the spill is treated, all material used during cleanup will be removed from the site and disposed of in accordance to proper handling guidelines for hazardous material.

In the event of equipment breakage which results in a spill, repairs will be carried out in such a way as to prevent further spillage. Containers and absorbent materials will be used to capture fluids during hose removal and replacement, filter replacement, routine maintenance, etc.

If equipment breaks proximal to or within a watercourse, the equipment is to be removed, if possible, from its proximity to the waterway before initiating repairs. If equipment cannot be removed, devices for total containment of potential spills associated with repairs will be in place to insure the protection of the watercourse. All captured material will be properly contained and disposed of.

Notification Requirements

The following authorities (as appropriate) shall be immediately notified of the release of hazardous substances into the environment. Notifications will normally be made by a Chief Ranger or project manager.

Redwood National & State Parks (707) 464-6101

Park Personnel Notification List (707)-

NPS Superintendent	465-7301
CSP Superintendent	465-7332
Chief Ranger	465-7302
Supervisory Ranger	465-7750
Chief of Maintenance	465-7303
Chief of Resources	465-7700
HAZMAT Coordinator	465-7375

County Agencies

Del Norte Sherriff, Crescent City, CA **911** or 707-464-4191

Humboldt Sherriff, Eureka, CA **911** or 707-445-7251

Del Norte County Health Dept. 707-464-7227

Humboldt County Health Dept. 707-445-6200

Fire Departments

Del Norte and Humboldt Fire Departments are dispatched by dialing **911**

Eureka FD (only public HAZMAT unit on North Coast) 707-441-4044

State Agencies:

California Highway Patrol (Arcata Dispatch) 707-822-5981

California Dept. of Fish and Game (M-F, 8-5) (Eureka) 707-445-6493

CDF&G OSPR Dispatch (Office of Spill Prevention and Response) 916-445-0045

CALTRANS (Crescent City) 707-464-1751

DPR Northern Communications Center (NORCOM) 916-988-9830

Regional Water Quality Control Board 707-576-2220

California Office of Emergency Service 800-852-7550

Federal Agencies:

1. National Response Center 800-424-8802

2. Pacific Great Basin Support Office Environmental Management Program Coord. (EMPC)
510-817-1376

3. Support Office Facilities Manager 510-817-1384
4. DOI- Office of Environmental Policy and Compliance 510-817-1476
5. Deputy Regional Director 510-817-1305
6. U.S. Coast Guard 707-464-2172 (day) 707-455-2055 (night)

Notification Information

To the extent possible, the following information should be obtained and provided to assisting agencies:

- 1) Date and time the incident occurred or was discovered.
- 2) Specific location of the spill.
- 3) Name (or placard number) of material spilled or released.
- 4) Source of the spilled material.
- 5) Cause of the release.
- 6) Total quantity released.
- 7) Whether the material was released to the air, ground, water or subsurface.
- 8) Amount spilled into water, if applicable.
- 9) Water conditions.
- 10) Weather conditions.
- 11) Name, address, and telephone number of reporting party.
- 12) Name of party and or individual responsible for the incident.
- 13) Mailing address of the responsible party.
- 14) Telephone number of the responsible party.
- 15) Identifying numbers of responsible vehicle, and vehicle information including the driver's name and address.
- 16) Name of carrier.
- 17) Number and type of injuries or fatalities, and expected exposure.
- 18) Whether evacuations have occurred or should occur.
- 19) Estimated dollar amount of property damage, and extent of damage.
- 20) Description of cleanup action taken and future plans.
- 21) Other agencies that have been notified or will be notified.

Appendix C

CONTAINMENT PROCEDURES FOR HERBICIDE USE

PRINCIPLE STEP	HAZARDS	CONTROL STEP
Best Management Practices for Handling Herbicides in Redwood National and State Parks.	Mixing Solutions and Filling Tanks, “Paint Buckets” and Injection Tools	- Assure that containers are securely situated on the ground and will not tip and spill during filling. - Use accurately measured amounts by using proper measuring devices. - Protect against spills and splashes by slowly mixing / filling all components.
	Leaky Tanks	- Ensure that the lid is tightly secured and that the o-ring is in place and not broken or cracked. - Test the lid by vigorously shaking the full sprayer prior to wearing backpack sprayer.
	Spray Drift	- Do not spray if breeze exceeds 10mph (gentle breeze). - Spray between gusts if breeze is gusting above 10mph). - Work in a direction toward the breeze (downwind to upwind).
	Painting / Wicking Application	- Do not use food/drink containers for herbicide “paint bucket” – use a properly labeled container. - Take extra caution when walking around with an open “herbicide paint bucket.” - Do not leave open “herbicide paint buckets” unattended. - Use a properly labeled, closed, non-food/drink container for temporary storage of herbicide “painting” solutions.
	Clean Up and Storage	Store all herbicide chemicals in properly labeled and secured locations, within properly labeled and closed containers. Absolutely no unlabeled or open containers are to be stored, even temporarily.
	Herbicide Spill	- Keep herbicide spill kit at hand and know how to use it. - Keep others away from the spill, unless help is needed.

**Redwood National and State Parks
Exotic Plant Management Program
Project Tiering Form**

Today's Date:

Project Name:

Project Location:

Proposed Implementation Date(s):

Brief Description of Methods (include access, disposal, or any associated activities):

Project Leader (name and phone extension):

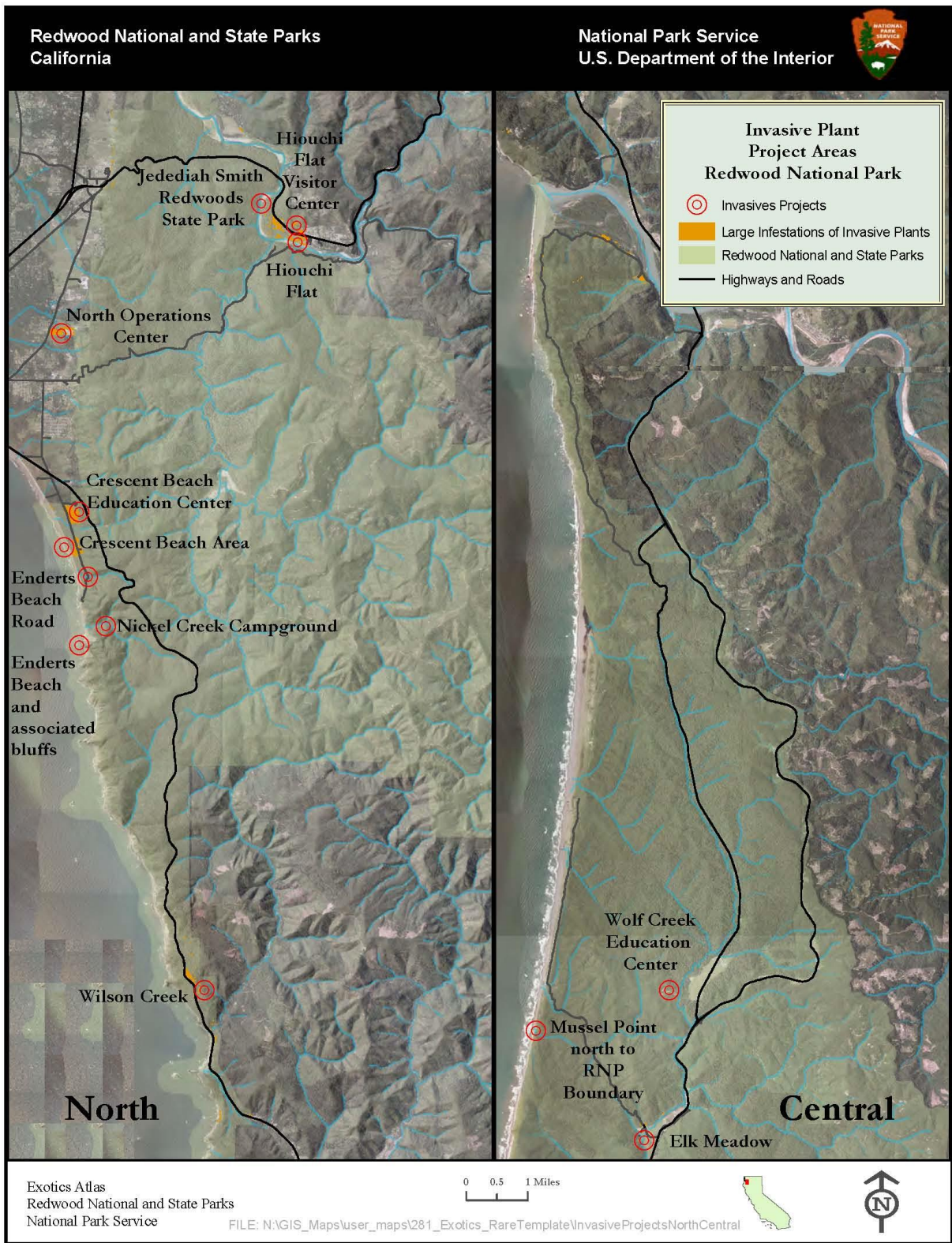


Figure 1. Exotic plant management project areas identified in this biological assessment in the northern and central areas of the parks.

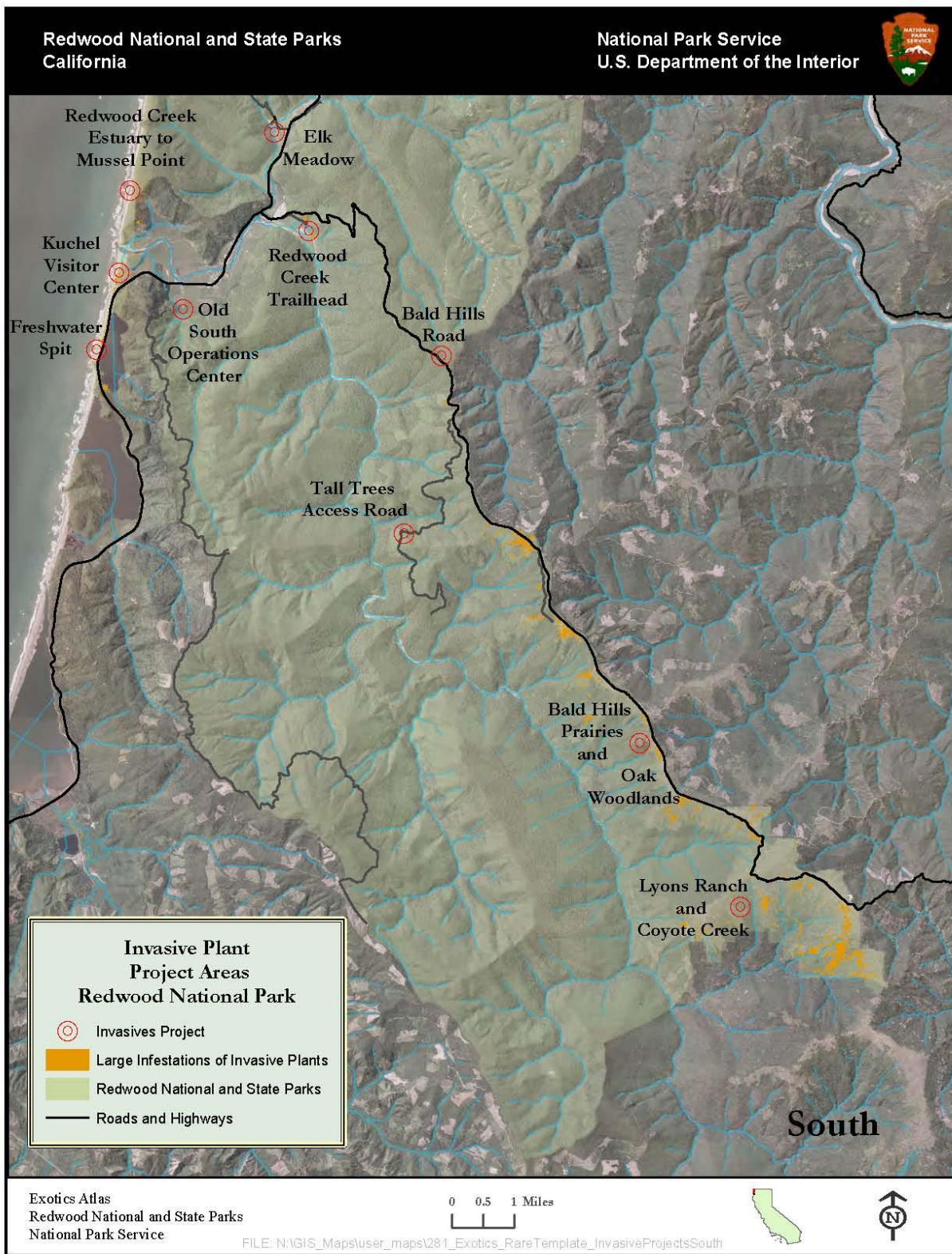


Figure 2. Exotic plant management project areas identified in this biological assessment in the southern portion of the National Park.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

MAY 17 2012

In response refer to:
2012/00032

Mr. Steve Chaney
Superintendent, Redwood National Park
Redwood National and State Parks
1111 Second Street
Crescent City, California 95531

Dear Mr. Chaney:

On January 20, 2012, NOAA's National Marine Fisheries Service (NMFS) received your January 17, 2012, letter requesting informal consultation pursuant to section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 *et seq.*) and its implementing regulations (50 C.F.R. Part 402). Your request concerns the effects of the Exotic Plant Management Program (program) on threatened salmonid species, Pacific eulachon, and their habitats in Redwood National and State Parks (RNSP). We have also included consultation on the effects of the program on essential fish habitat (EFH) for species managed under the Pacific Coast Salmon Fishery Management Plan, pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA), 16 U.S.C. § 1855 (b).

The purpose of the program is to manage populations of exotic plant species, including eradication, wherever exotic species interfere with natural processes, the perpetuation of natural or cultural features, or the perpetuation of native species, especially those that are threatened, endangered, or otherwise unique. Integrated Pest Management (IPM) procedures will be used to guide the program, determine when to control exotic species, and the method of control. The RNSP proposes to apply the program throughout Redwood National Park and Jedediah Smith State Park in Humboldt and Del Norte Counties, California, during years 2012 and 2013.

This letter concludes informal consultation for the following threatened species and their critical habitats: (1) Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*; 76 FR 50447, August 15, 2011), (2) California Coastal (CC) Chinook salmon (*O. tshawytscha*; 76 FR 50448, August 15, 2011), (3) Northern California (NC) steelhead (*O. mykiss*;



76 FR 76306, December 7, 2011), (4) Southern DPS of Pacific eulachon (*Thaleichthys pacificus*; 75 FR 13012, March 18, 2010), (5) SONCC coho salmon critical habitat (64 FR 24049, May 5, 1999), (6) CC Chinook salmon critical habitat (70 FR 52488, September 2, 2005), (7) NC steelhead critical habitat (70 FR 52488, September 2, 2005), and (8) Southern DPS of Pacific eulachon critical habitat (76 FR 65324, October 20, 2011). In addition, this letter completes EFH consultation, in accordance with the MSA and serves as consultation under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (FWCA) of 1934, as amended.

ACTION AREA

Treatment of exotic plants would occur in small areas throughout Redwood National Park lands and in Jedediah Smith Redwoods State Park. Exotic plant treatments would not occur on other California State Park (CSP) lands within the RNSP complex. Within Redwood National Park new locations could be discovered and treated each year. Based on the treatment methods proposed, and areas of known infestations that are described in the January 9, 2012, Biological Assessment (BA) (RNSP 2012) the action area is the Redwood Creek watershed, including the Prairie Creek sub-watershed, within Redwood National Park boundaries, and portions of the Smith River near Hiouchi, within Jedediah Smith Redwoods State Park [Figures 1 through 3 in the Biological Assessment (BA) for this program (RNSP 2012)].

DESCRIPTION OF THE PROPOSED ACTION

Guidance for the program is outlined in the *Exotic Plant Management Plan and Environmental Assessment* (USDI/NPS 1994). This plan was developed following National Park Service (NPS) guidelines for natural resource management and IPM procedures (USDI 1991). Both NPS guidelines, and direction provided in the California Department of Parks and Recreation's Department Operations Manual (DOM), Natural Resources Chapter 0300, direct the management of populations of exotic plant species, including eradication, wherever such species threaten park resources, and where control is prudent and feasible. IPM procedures (RNSP 2012) will be used to determine when to control exotic species and the method of control. In addition, RNSP Management Policy Memorandum No. 98-04 (July 31, 1998) directs parks personnel on the procedures for use of pesticides and herbicides within the parks, and RNSP Standard Operating Procedure #12.01, *Spill Response and Emergency Procedures* and the parks' *Spill Contingency Plan*, provide direction to RNSP personnel relative to managing hazardous material spills, including herbicides. These guidelines identify federal and state laws and regulations governing herbicide use, protection of non-target species, worker safety, storage and disposal of hazardous materials, documentation, and reporting.

Exotic plant species are found throughout the parks, in all vegetation types. The objectives of the program include:

- maintain a list of all known exotic plant species within the parks and categorize each

- species as “innocuous,” “invasive,” or “to be watched”;
- determine the species that are priorities for management based on the above categories, distribution, and feasibility of control;
- complete field surveys and develop distribution maps of each exotic species identified as a high priority for control; estimate numbers, population centers, and spreading centers;
- recommend specific control methods for selected species based on knowledge of their biology, ecology, habitat, and economic feasibility of control;
- establish a monitoring system, and consistently monitor populations of invasive and potentially invasive species to determine population growth trends, possible range expansions, and the effectiveness of control programs.

Staff from RNSP will prioritize management of exotic plants based on two factors, 1) degree and kind of biological, ecological, economic, or health threat, and 2) cost and expectation of control, based on current distribution. Exotic plant managers from the parks use the most recent, scientifically based knowledge of the biology of exotic plant species and network with others regionally in order to be effective at managing exotic species. The strategic approach to exotic plant management is included as Appendix A in the BA (RNSP 2012). During 2002 through 2011, several exotic plant management projects were successfully completed at several high-priority sites within the parks and significant progress toward control was made at others. The proposed exotic plant control program will be implemented during 2012 and 2013. Control activities may occur year round, but would be seasonally restricted where necessary to protect threatened and endangered species or their habitats, or to protect other sensitive resources.

Methods

A variety of methods are proposed for controlling or eliminating exotic plants from the parks. Following Integrated Pest Management (IPM) guidelines, one or a combination of methods may be used to control an exotic plant species.

Manual Control

Shovels, pulaskis, loppers, weed wrenches, grip hoists, and machetes would be used to manually remove herbaceous and shallow-rooted exotic species. Weed wrenches and grip hoists are designed to remove plants while causing minimal ground disturbance. Burning is another manual control method that would be used to control several species at various locations in the parks. Burning involves using a gas torch to pass intense heat over the leafy parts of a plant. The heat causes the cell walls to burst, killing the plant. A backpack housing a propane tank and a gas vapor torch is used to apply the flame; this method is effective at controlling re-sprouts and seedlings. This method would be used when the ground and vegetation are too wet to carry a fire, so that just the exotic plants can be targeted for burning. In addition, burning of foliage would not occur within riparian areas (i.e., within 300 feet of perennial streams or within 100 feet of intermittent streams). To prevent erosion, areas where bare ground has been exposed after exotic plant removal by digging or hand-pulling would be covered with locally collected thatch, mulch or heavy cloth (tarping).

Mechanical Control with Power Tools

Power tools including chainsaws, weed whackers, mowers, wood chippers, and vehicle winches would also be used for control. Chainsaws or other power tools may be used to remove thickets of Himalayan blackberry, jubata grass, or cotoneaster. A chainsaw, weed-eater, or other hand tool would be used to cut back the saw-toothed leaves of jubata grass and permit access to the roots.

Mechanical Control with Heavy Equipment

Heavy equipment including excavators, bulldozers, and backhoes would be used in areas where exotic plant densities are high, native species are few or insignificant, and manual removal is not feasible. At developed sites and along roads, heavy equipment would remain on a hardened or disturbed surface during exotic plant excavation. The treated surface would be mulched with either locally collected straw or certified weed-free alfalfa hay. Treated surfaces would be allowed to revegetate naturally, or a tarp would be used to prevent resprouting. Heavy equipment would not be used in riparian areas.

Prior to daily operations, all equipment operators will visually inspect their machinery to identify potential sources for spills. Any and all suspect situations will be remedied before the equipment is operated. Equipment will be cleaned and repaired (other than emergency repairs) at an established maintenance facility. All contaminated water, sludge, or other hazardous compounds will be disposed of at a lawfully permitted or authorized destination. All fuel and lubricating material containers will be located in stable, secure locations. Equipment maintenance and fueling activities would not occur within 200 feet of a stream and absorbent materials will be placed on the ground beneath the equipment to catch any fuel or lubricants that may leak during fueling.

Cultural Control

Heavy equipment would be cleaned thoroughly and inspected before being used to prevent introduction of exotic plants. Heavy equipment also would be cleaned as necessary to prevent the spread of the exotic pathogens *Phytophthora lateralis* (Port-Orford-cedar root disease), and *P. ramorum* (Sudden Oak Death).

Biological Control

The only type of biological control proposed would be the collection and use of Klamath beetles (*Chrysolina quadrigemina*) to control klamathweed (*Hypericum perforatum*) at Gans Prairie. Beetles would be collected with nets in June and July from roadside klamathweed along Bald Hills Road. These beetles are species-specific biological control agents, affecting klamathweed only. *Chrysolina* larvae mine directly from the eggs into the leaves, causing eventual foliage and plant death. In areas where the beetles are established, they have been found to be greater than 90 percent effective in killing adult plants.

Chemical Control

Herbicides would be considered for control of high-priority invasive species, but only when all other control techniques (mechanical, manual, cultural, and biological) were considered ineffective or not feasible. If chemical control is determined to be necessary, U.S. Environmental Protection Agency (EPA) registered chemical herbicides may be used. All proposals for herbicide use in the National Park Service (NPS) must go through a review and approval process that includes the park's IPM coordinator and regional IPM coordinator. All herbicide use would be conducted in compliance with NPS IPM guidelines as described in the BA (RNSP 2012). Herbicides would be applied under the direction of personnel at RNSP that are Certified Pesticide Applicators or under the direction of other qualified NPS personnel. Herbicides would be stored and handled in accordance with containment procedures that are based on NPS Best Management Practices (BMPs) and on spill contingency plans that are based on NPS standards (RNSP 2012).

RNSP is proposing the use of 3 herbicides, glyphosate (trade name Aquamaster), aminopyralid (trade name Milestone), and triclopyr (trade name Garlon 4). "Aquamaster" is Monsanto's trade name for the glyphosate compound that has been approved by the EPA for use in aquatic environments. Silver wattle, bird cherry, and other exotic plants in riparian areas that do not respond to mechanical or manual control methods would be considered for treatment with Aquamaster. The spot application method (painting and injection) is proposed for riparian areas so that the herbicide does not come in contact with soil particles, and the direct spray method is proposed for coastal bluff or upland locations. When the direct spray method is used, the spray is applied directly to each individual plant using a backpack sprayer with the spray nozzle set to produce a coarse spray or stream rather than a fine spray or mist, minimizing the potential for drift. Spraying is only conducted when wind is minimal or absent, and when rainfall is not expected within 48 hours after treatment. Spraying would not take place when the air is moist with fog.

"Milestone" is Dow Agrosience's trade name for an aminopyralid compound that has been approved by the EPA under its "Reduced Risk Initiative" for use in upland habitats, seasonally dry wetlands, and "transitional" areas between upland and lowland sites. Milestone is not approved for use in aquatic environments with standing surface water. Milestone would be applied by foliar application using the direct spray method.

Proposed use limits for Aquamaster and Milestone were determined by considering the extent of exotic plant infestations in various locations within the parks and considering the likelihood of herbicide contacting surface water in those locations. Parks staff would base annual herbicide usage on the type of area (watershed, uplands, and coastal bluffs) where treatments would occur. A maximum of 10 acres would be treated annually with Aquamaster in each of two riparian habitat types, small riparian and large riparian (with the exception of the Redwood Creek estuary where no herbicides would be used within 0.25 miles). Riparian zones were defined as 300 feet on either side of a perennial stream (whether fish-bearing or not) and 150 feet on either side of an intermittent stream. A maximum of 10 acres of coastal bluff area would be treated annually with either Aquamaster or Milestone. A maximum of 30 acres would be treated with either

Aquamaster or Milestone in upland areas outside of riparian zones.

“Garlon 4” is Dow Agrosiences’ trade name for triclopyr butoxyethyl ester (triclopyr BEE). Garlon 4 is not approved for use in aquatic environments; therefore, use would be restricted to a few very specific upland locations, away from the stream channel network, well away from any perennial water sources, only in the dry summer season when ephemeral streams do not contain surface water and when no rain is in the forecast for at least 48 hours post-application. Garlon 4 would be used to control Himalayan blackberry to reduce the potential for spot fires and other fire safety concerns during prescribed burning operations in the Bald Hills; approximately 4 acres of Himalayan blackberry would be treated.

Other important elements of the proposed program include: 1) vehicle access would be restricted to existing service roads, 2) access would occur outside of the seasonal road closure on those roads that are closed during wet weather, and 3) disposal of exotic plant material would be at upland locations. In addition, prior to treatment, specific exotic plant removal projects would be reviewed by a wildlife biologist to ensure consistency with the project description found in the BA.

ESA CONSULTATION

Coho salmon, Chinook salmon, steelhead, and Pacific eulachon are ESA-listed as threatened within the Redwood Creek watershed. Coho salmon are currently distributed within the lower and middle sections of Redwood Creek, but are mostly found in the Prairie Creek sub-watershed and the lower sections of tributaries to lower/middle Redwood Creek. Chinook salmon are distributed throughout the mainstem of Redwood Creek and Prairie Creek. Steelhead are distributed throughout the Redwood Creek basin, however tributaries to mainstem Redwood Creek often contain steep channel gradients which limit steelhead distribution to the lower sections of most tributaries. Pacific eulachon have not been observed in Redwood Creek since the 1970s, however if they were to re-colonize Redwood Creek we would expect Pacific eulachon to be distributed within the estuary and the lower section of mainstem Redwood Creek. The Redwood Creek watershed contains migratory, rearing and spawning habitat for coho salmon, Chinook salmon and steelhead and spawning habitat for Pacific eulachon. Coho salmon are the only ESA listed salmonid in the Smith River watershed and are found in the section of the Smith River near Hiouchi, which contains migratory and rearing habitat for coho salmon. The Smith River near Hiouchi is upstream of Pacific eulachon distribution.

Effects of the Action on Listed Species

The exotic plant management program has the potential to result in: 1) sediment delivery to the stream channel network through ground disturbing activities, 2) the delivery of petroleum products to the stream network through the use of power tools within riparian zones, and heavy equipment outside of, but adjacent to, riparian zones, and 3) herbicide delivery to the stream network through the use of Aquamaster within riparian zones. However, the program

incorporates numerous BMPs, and national, regional and local standards and guidelines. The program has been designed to prevent or minimize sediment, herbicide or petroleum product delivery to the stream network. In addition, the parks have implemented a similar program since 2002, and implementation monitoring indicates that the parks have successfully implemented BMPs, standards, guidelines and specific program design features aimed at preventing or minimizing the risk of sediment, herbicide and petroleum products from entering the stream network.

Sediment

The majority of exotic plants slated for manual removal are in upland locations away from streams, and in places that tend to be level in slope. Where manual removal of exotic plants would occur in riparian areas, very small amounts of sediment could be generated due to digging with hand tools, however, ground that is disturbed will be covered with mulch or a tarp to prevent or minimize erosion. The likelihood of sediment being delivered to the stream network from manual removal activities is low and the potential amount of sediment generated from manual removal activities would be very small.

Heavy equipment would remain on hard surfaces and be used to dig up roadside weeds and exotic shrubs in mostly upland areas. Heavy equipment may generate sediment when removing exotic plants adjacent to (but outside of) a riparian area. However, as with any digging (manually or with equipment) a tarp or native mulch would be applied to the bare ground to prevent or minimize erosion. Since heavy equipment is not proposed for use in riparian areas and any disturbed ground would be covered with mulch or a tarp, the likelihood of sediment delivery is low, and the amount of sediment that could be generated and delivered to the stream network by digging with heavy equipment outside of riparian zones would be small. In addition, we do not expect that related activities, such as road use, will generate sediment that reaches the stream network since most of the work is in upland locations, and seasonal road closures will prevent native surface road use during the wet weather season. Thus, the potential for exposing salmonids of all species and life stages, and adult, egg or larval Pacific eulachon, to elevated turbidity caused by sediment generated from program activities is negligible, and the expected response of salmonids and Pacific eulachon to a negligible increase in turbidity is insignificant.

Petroleum Products

With any heavy equipment and power tool use there is the possibility that petroleum products may enter the stream network, either through spills or leaks. Spill plans and best management practices for managing petroleum products should prevent or minimize the probability of runoff of hazardous materials in the unlikely event of a spill or leak associated with power tool or heavy equipment use. In addition, heavy equipment is proposed for use outside of riparian areas, in upland locations. Therefore, the potential for exposing salmonids (all species and life stages), and adult, egg or larval Pacific eulachon to petroleum pollutants is negligible, and the expected response of salmonids and Pacific eulachon to a negligible exposure to petroleum products is insignificant.

Herbicide Use

Chemical herbicides are proposed for use in this program and have the potential to enter the aquatic environment if a chemical makes its way into surface water or ground water. Only Aquatmaster (glyphosate) is proposed for use in riparian areas. Glyphosate is a plant-specific compound that targets enzymes found only in plants, not animal and has been approved for use by the EPA in aquatic environments. Glyphosate that comes in contact with soil binds tightly to particles and tends to remain within the top 6 inches of soil which makes it unlikely to end up in surface or sub-surface runoff except where direct soil erosion is a factor. The direct application methods proposed by the parks minimize or eliminate contact with soil, except in the Bald Hills, an upland location, where the chemical is applied with a backpack sprayer to Harding grass. Glyphosate application in the Bald Hills would only occur when wind is minimal and no rain is forecasted within at least 48 hours after application, further reducing the likelihood of this chemical making its way into watercourses. RNSP proposes to treat a maximum total of 20 acres of exotic vegetation throughout all of RNSP each year, which equals 0.22 percent of perennial and intermittent streamside riparian acres within the parks. Based on the sensitivity of the habitat, herbicide use is not proposed to occur within 0.25 miles of the Redwood Creek estuary as part of this program.

With any chemical use there is always the slight possibility of the substance entering the aquatic environment should a spill occur. Spill plans and best management practices for managing chemical products should minimize the probability of runoff of hazardous materials in the unlikely event of a spill associated with program activities. A spill, in the unlikely event of an occurrence, would be low in volume and readily contained. Thus, based on: 1) the limits on herbicide use within riparian areas, 2) the use of only glyphosate in riparian areas, 3) the methods of glyphosate application, and 4) the use of best management practices for handling chemicals and spill plans, the potential for salmonids or Pacific eulachon to be exposed to herbicides from program activities is negligible and the expected response of salmonids and Pacific eulachon to a negligible exposure to herbicides is insignificant.

Effects of the Action on Critical Habitat

The program will have limited effects to critical habitat from ground disturbing activities causing a negligible increase in turbidity, and from the small possibility of petroleum products or herbicides entering the stream network and decreasing water quality. However, the likelihood of sediment entering the stream network is low and the amount of sediment would be small, and the likelihood of small amounts of petroleum products or herbicides entering the stream network is also low. Therefore, the effects to critical habitat from the program are expected to be insignificant.

ESA Conclusion

Based on our review of the documents provided by RNSP, and based on our review of site conditions within the action area, NMFS concurs with RNSP's determination that the program is not likely to adversely affect threatened SONCC coho salmon, CC Chinook salmon, NC

steelhead or their designated critical habitat, and that the program is also not likely to adversely affect threatened Pacific eulachon or their designated critical habitat.

This concludes informal consultation for the program. Reinitiation of consultation may be necessary 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 action that may affect listed species or critical habitat in a manner or to an extent not previously considered, 2) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered, or 3) a new species is listed or critical habitat designated that may be affected by the action.

EFH CONSULTATION

The project area is located within an area identified as EFH for Pacific salmon (coho salmon and Chinook salmon) managed under their respective Fishery Management Plans (FMP) under the MSA.

NMFS has evaluated the proposed project for potential adverse effects to EFH pursuant to Section 305(b)(2) of the MSA. Under the EFH implementing regulations [50 C.F.R. 600.810(a)], the term “adverse effect” is defined as any impact that reduces quality and/or quantity of EFH and may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce quantity and/or quality of EFH.

The potential adverse effects to EFH from the program would be from ground disturbing activities causing a small and temporary increase in turbidity and from the risk of petroleum products and herbicides entering the stream network. Therefore, NMFS has determined that the proposed program would adversely affect EFH for Pacific salmon. However, the proposed program contains adequate measures to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. NMFS has no additional EFH conservation recommendations to provide at this time. This concludes EFH consultation for the proposed program. Pursuant to 50 CFR 600.920(l), RNSP must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH.

FWCA CONSULTATION

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 U.S.C. 661). The FWCA establishes a consultation requirement for Federal departments and agencies that undertake any action that proposes to modify any stream or other body of water for any purpose, including navigation and drainage [16 U.S.C. 662(a)]. Consistent with this consultation requirement, NMFS may provide recommendations and comments to Federal action agencies for the purposes of conserving fish and wildlife resources. The FWCA allows the opportunity to offer recommendations for the conservation of species and habitats beyond those currently managed under the ESA and the Magnuson-Stevens Fishery Conservation and Management Act.

NMFS has no additional recommendations under the FWCA.

Please contact Ms. Leslie Wolff at (707) 825-5172, or via email at Leslie.Wolff@noaa.gov, if you have any questions regarding these consultations.

Sincerely,

for 
Rodney R. McInnis
Regional Administrator

Cc: Copy to file ARN 151422SWR2012AR00032

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