NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

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Consultation Conducted By:	Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce
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ENDANGERED SPECIES ACT SECTION 7 BIOLOGICAL OPINION

Action Agency: Environmental Protection Agency

Activity Considered: Reissuance of the Pesticides General Permit for Discharge of Pesticide Pollutants into Waters of the United States

Consultation Conducted By: Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service

Approved: Donna S Wieting

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TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) requires Federal agencies to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. When a Federal agency's action "may affect" a protected species, that agency is required to consult formally with NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), together, the Services, depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR §402.14(a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS or the USFWS concurs with that conclusion (50 CFR §402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide a biological opinion (opinion) stating how the Federal agencies' actions will affect ESA-listed species and their designated critical habitat under their jurisdiction. If the analyses concludes that the action will jeopardize an ESA-listed species or adversely modify designated critical habitat, section 7(b)(3) of the ESA directs the consulting agency to provide reasonable and prudent alternatives that the action agency can implement to avoid jeopardy or adverse modification or indicate whether there are no reasonable and prudent alternatives. If an incidental take is expected, section 7(b)(4) of the ESA requires the consulting agency to provide an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

This document represents NMFS' opinion on the U.S. Environmental Protection Agency's (EPA's) reissuance of its Pesticides General Permit (PGP) authorizing discharges of biological pesticides and residues from chemical pesticides (together, pesticide pollutants) to waters of the U.S. and the implications of these discharges for threatened and endangered species and their designated critical habitat under NMFS' jurisdiction. The EPA uses general permits issued under section 402, the National Discharge Elimination System (NPDES) of the Clean Water Act (33 U.S.C. 1342 et seq.; CWA), to authorize routine discharges by multiple dischargers. Coverage for discharges under a general permit is granted to applicants after they submit a notice of intent to discharge (NOI[1]). Once the NOI is submitted and any review period specified under the PGP has closed, the applicant is authorized to discharge under the terms of the general permit. Under the PGP, however, some dischargers are automatically covered without submitting an NOI. The PGP authorizes discharges only of pesticide pollutants from pesticides that EPA has registered for use under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA), 7 U.S.C. 136-136y.

The opinion and incidental take statement were prepared by NMFS' Endangered Species Act Interagency Cooperation Division in accordance with section 7(b) of the ESA and implementing regulations at 50 CFR §402. This document represents NMFS' opinion on the effects of these actions on endangered and threatened species and designated critical habitat that has been designated for those species. A complete record of this consultation is on file at NMFS' Office of Protected Resources in Silver Spring, Maryland.

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[1] There are many types of NOIs, throughout this document NOI refers to the notice of intent to discharge into waters of the U.S. in the action area.

1.1 Background

On October 14, 2011, NMFS' Office of Protected Resources issued a biological opinion on EPA's first CWA PGP authorizing discharges of FIFRA-approved pesticides to waters of the U.S.. NMFS concluded that EPA's issuance of the PGP was likely to jeopardize listed species and likely to adversely modify designated critical habitat. The EPA issued its final NPDES PGP on October 31, 2011. The PGP is valid until October 31, 2016.

1.2 Consultation History

The current PGP expires on October 31, 2016. Below we summarize meetings and communications on the ESA section 7 consultation process on a proposed new PGP. Pre-consultation discussions began in 2015. Formal consultation was initiated on May 25, 2016.[2]

On June 4, 2015, EPA Office of Water[3] met with the Services to provide an update on the status of the 2016 PGP, share information collected under the 2011 PGP, and share a draft schedule for the new permit issuance.

On June 16, 2015, EPA shared data extracted from the PGP annual reports and Best Management Practices worked out for PGP discharges in the state of Idaho.

On July 29, 2015, EPA met via conference call with NMFS to coordinate development of EPA's biological evaluation (BE).

On August 3, 2015, EPA and NMFS met via conference call to discuss the analysis framework for the BE.

On August 7, 2015 NMFS shared a draft analysis framework for the BE.

On August 18, 2015, EPA and NMFS met via conference call to discuss the draft analysis framework.

On October 1, 2015, NMFS submitted comments on the PGP NOI form to EPA

On January 6, 2016, EPA met with NMFS via conference call to discuss the creation of a webmap of locations where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur.

On February 26, 2016, EPA transmitted its request to initiate formal consultation for EPA's reissuance of the PGP. EPA's BE, submitted with the request, contained information gathered under the requirements of the 2011 PGP.

On April 21, 2016, NMFS transmitted a letter identifying additional information needed before formal consultation could begin.

On April 22, 2016, NMFS transmitted a draft description of the action and *Action Area* for review by EPA.

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[2] In 2013, The National Academy of Sciences issued *Assessing Risks to Endangered and Threatened Species from Pesticides* (National Research Council, 2013;http://www.nap.edu/catalog.php?record_id=18344). In response to the report's recommendations EPA, NMFS, and the US Fish and Wildlife Service have been working closely and have developed interim approaches for ESA consultations on EPA's FIFRA decisions. Because the agencies have not reached final decisions, neither EPA's BE nor this opinion rely on the interim approaches.

[3] Both EPA's Office of Water and Office of Pesticide Programs participated in this consultation. We will refer simply to "EPA," unless there is a reason to identify which office participated.

On May 25, 2016, EPA supplied NMFS with the additional information needed to initiate formal consultation.

On August 9, 2016, NMFS transmitted draft reasonable and prudent alternatives (RPAs) and a draft incidental take statement (ITS) to EPA for review.

On September 15, 2016, EPA provided comments on the draft RPAs and ITS.

On October 13, 2016, NMFS provided EPA revised draft RPAs and ITS.

2 THE ASSESSMENT FRAMEWORK

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

"*Jeopardize the continued existence of* means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species." 50 CFR 402.02.

"Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features. " 50 CFR 402.02. An ESA Section 7 assessment involves the following steps:

Description of the Proposed Action (Section 3), *Interrelated and Interdependent Actions* (Section 4), and *Action Area* (Section 5)*:* We describe the proposed action and those aspects (or stressors) of the proposed action that may have direct or indirect effects on the physical, chemical, and biotic environment, we identify any interrelated and interdependent actions, and describe the action area with the spatial extent of those stressors.

Status of Species and Designated Critical Habitat (Section 6).We identify the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time and evaluate the status of those species and habitat. In this Section, we also identify those *Species and Designated Critical Habitat Not Considered Further in the Opinion* (Section 6.1), because these resources will either not be affected or are not likely to be adversely affected.

Environmental Baseline (Section 7). We describe the environmental baseline in the action area including: past and present impacts of Federal, state, or private actions and other human activities in the action area; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, impacts of state or private actions that are contemporaneous with the consultation in process.

Effects of the Action: Risk Assessment (Section 8.1) and *Programmatic Analysis* (Section 8.2): To determine the effects of the action, we conduct two separate analyses. First, in the Risk Assessment, we evaluate the potential adverse effects of discharges under the PGP on ESA-listed species and designated critical habitat under NMFS' jurisdiction, without consideration of the protective measures of the PGP. To do this, we begin with problem formulation that identifies and integrates the stressors of the action with the species status (Section 6) and the

Environmental Baseline (Section 7) and formulate risk hypotheses. The risk hypotheses identify assessment endpoints of concern for listed species and designated critical habitat. To evaluate the risk hypotheses, we consider the exposure by individual members of listed species (exposure analysis) and essential features of designated critical habitat, and what expected responses might be (response analysis). If the assessment endpoints of the individuals or the essential features indicate adverse effects, we evaluate whether those responses will affect populations or subpopulations of species or the designated critical habitat (risk characterization.). Second, since we conclude that population level effects to species and adverse effects to essential features of designated critical habitat are likely to occur as a result of the pesticide discharges, we conduct a Programmatic Analysis. In this analysis, we evaluate whether the process and the protective measures in the PGP are enough to allow EPA to insure that its program is not likely to jeopardize listed species or destroy or adversely modify designated critical habitat. To do so, we consider seven questions focused on EPA's knowledge and ability to respond.

Integration and Synthesis (Section 9): In this section we integrate the analyses in the opinion to summarize the consequences to ESA-listed species and designated critical habitat under NMFS' jurisdiction.

Cumulative Effects (Section 10): Cumulative effects are the effects to listed species and designated critical habitat of future state or private activities that are reasonably certain to occur within the action area. 50 CFR 402.02. Effects from future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation..

Conclusion (Section 11); With full consideration of the status of the species and the designated critical habitat, we consider the effects of the action within the action area on populations or subpopulations and on essential habitat features when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

Reduce appreciably the likelihood of survival and recovery of each ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of that species; or

Appreciably diminish the value of designated critical habitat for the conservation of a ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify designated critical habitat.

If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, then we must identify reasonable and prudent alternative(s) (RPAs) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives. See 50 C.F.R. § 402.14.

In addition, we include an incidental take statement (ITS) that specifies the impact of the take, reasonable and prudent measures (RPMs) to minimize the impact of the take, and terms and conditions to implement the RPMs. ESA Section 7(b)(4); 50 CFR 402.14(i). We also provide discretionary conservation recommendations that may be implemented by EPA. 50 CFR 402.14(j). Finally, we identify the circumstances in which reinitiation of consultation is required. 50 CFR 402.16.

To comply with our obligation to use the best scientific and commercial data available, we collected information identified through searches of ISI Web of Science, Medline, scientific publisher databases (e.g., Elsevier), government databases (e.g., EPA's National Service Center for Environmental Publications), and literature cited sections of peer reviewed articles, species listing documentation, and reports published by government and private entities. This opinion is based on our review and analysis of various information sources, including:

EPA' s Biological Evaluation (BE) for the PGP;

the PGP and its fact sheet;

toxicity data provided by EPA;

annual reports and NOI submitted under the 2011 PGP;

NPDES program compliance and enforcement data;

Section 7 consultations on pesticide re-registrations;

status reviews, recovery plans, and listing notices for ESA-listed species and designated critical habitat;

reports on the status and trends of water quality; and

peer reviewed research.

These resources were used to identify information relevant to the potential stressors and responses of ESA-listed species and designated critical habitat under NMFS' jurisdiction that may be affected by the proposed action to draw conclusions on risks the action may pose to the continued existence of these species and the value of designated critical habitat for the conservation of ESA-listed species.

3 DESCRIPTION OF THE PROPOSED ACTION

The EPA proposes to re-issue the PGP to authorize point source discharges of pesticide pollutants directly to waters of the U.S. by pesticide Operators. An *Operator* is any entity who performs the application of a pesticide or who has day-to-day control of the application (i.e., *Applicators*) or any entity with control over the decision to perform pesticide applications including the ability to modify those decisions (i.e., *Decision-makers*). All Applicators and Decision-makers are Operators, and Operators can be either or both an Applicator and a Decision-maker. When an Operator is both Applicator and Decision-maker, the Operator must comply with all requirements for both. Some Decision-Makers must submit NOIs prior to discharge, as described in Appendix A of the PGP and Table 1, with discharge authorized within 30 days after filing the NOI. Any proposed discharge to waters of the U.S. containing *NMFS' Listed Resources of Concern* requires a NOI. The PGP contains an exception for response to a Declared Pest Emergency, but still requires the filing of a NOI within 30 days of beginning a discharge. If the PGP does not require a NOI, then the discharge is authorized without notice to EPA.

The PGP defines *pesticides* as (1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, (2) any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant, and (3) any nitrogen stabilizer. *Pesticide pollutants* are defined as all biological pesticides[4] and those chemical pesticides that leave a residue. A *pesticide residue* is that portion of a pesticide application that is discharged from a point source to waters of the U.S. and no longer provides its pesticidal purpose. Pesticide residues also include any degradates of the pesticide. The EPA, in its BE for the PGP assumed that "all chemical pesticides will leave a residue once the product has performed its intended purpose."

The PGP authorization to discharge pesticide pollutants into waters of the U.S. is available to eligible Operators in those States and Territories where the EPA is the permitting authority: American Samoa, District of Columbia, Guam, Idaho, Johnston Atoll, Massachusetts, Midway Island, New Hampshire, New Mexico, Northern Mariana Islands, Puerto Rico, and Wake Island. The proposed general permit will also authorize discharges of pesticide pollutants into waters of the U.S. resulting from pesticide applications on Federal lands located in Colorado, Delaware, Vermont, and Washington, as well as Indian lands nationwide. The statutory authority for the PGP is the NPDES of the Clean Water Act (33 U.S.C. 1342 et seq.; CWA), which is administered by EPA's Office of Water. The purpose of the proposed general permit is to satisfy the goals and policies of the CWA (33 U.S.C. 1251).

Although the PGP would authorize discharges of pesticide pollutants into waters of the U.S. under the CWA, these pesticides and their use patterns have been evaluated, registered, and regulated under the FIFRA as amended by the Food Quality Protection Act of 1996, which is administered by the EPA's Office of Pesticide Programs.

The EPA is requiring that discharges of pesticide pollutants to waters of the U.S. resulting from the four use patterns be subject to the terms of the PGP under the CWA. This provides EPA with the authority to enforce CWA requirements that may not have been addressed and may be in addition to requirements under FIFRA. Operators must comply with all other applicable federal and state laws and regulations that pertain to the application of pesticides. For example, the PGP does not negate the requirements under the FIFRA and its implementing regulations to use registered pesticides consistent with the product's labeling. Violation of certain FIFRA requirements, such as exceeding label rates, would also be a violation of the PGP and therefore a violation of the CWA.

This proposed permit does not affect the existing CWA exemptions for irrigation agriculture return flows or agricultural stormwater runoff. These discharges are excluded from the definition of a point source under Section 502 (14) of the CWA. Agricultural stormwater runoff and irrigation agriculture return flows do not require NPDES permits. Therefore, runoff from irrigation agriculture return flows and agricultural stormwater are not considered in this opinion.

3.1 Authorized Discharges

The proposed PGP authorizes point-source discharges of pesticide pollutants into aquatic habitats from the application of pesticides directly to or at waters edge for waters of the U.S. as a result of the following four use patterns:

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[4] EPA Office of Water is relying on existing regulatory definitions in 40 CFR 174.3, 158.2000(a)(1), and 158.2100(b) developed under FIFRA to define the term "biological pesticides" to include microbial pesticides [40 CFR 158.2100(b)], biochemical pesticides [40 CFR 158.2000(a)(1)], and plant-incorporated protectants. [40 CFR 174.3]

Mosquito and Other Flying Insect Pest Control: to control public health/nuisance and other flying insect pests that develop or are present during a portion of their life cycle in or above standing or flowing water. Public health/nuisance and other flying insect pests in this use category include mosquitoes and black flies.

Weed and Algae Pest Control: to control weeds, algae, and pathogens that are pests in water and at water's edge, including ditches and/or canals.

Animal Pest Control: to control animal pests in water and at water's edge. Animal pests in this use category include lampreys, other fish, insects, mollusks, and pathogens.

Forest Canopy Pest Control: application of a pesticide to a forest canopy to control the population of a pest species (e.g., insect or pathogen) where, to target the pests effectively, a portion of the pesticide unavoidably will be applied over and deposited to water.

3.2 Limitations on Coverage

The PGP restricts coverage for discharges to waters impaired by pesticides, Tier 3 waters, discharges covered or previously covered under another NPDES permit, and discharges to waters used by species and designated critical habitat protected under the ESA.

3.2.1 Discharges to Pesticide-impaired Waters

Discharges from a pesticide application to waters of the U.S. are not eligible for coverage under the PGP if the water is identified by EPA as impaired by either the specific active ingredient in that pesticide or its degradate, as listed at www.epa.gov/OWOW/tmdl/. Impaired waters are those that have been identified as not meeting applicable state or tribal water quality standards pursuant to section 303(d) of the CWA. These include waters with EPA-approved or EPA-established total maximum daily loads (TMDLs) and waters for which EPA has not yet approved or established a TMDL. If there is evidence that shows the water is no longer impaired, Operators may submit this information to EPA and request coverage under the PGP.

3.2.2 Discharges to Tier 3 Waters

In most cases the PGP does not cover discharges to waters designated by a state or tribe as Tier 3 (Outstanding National Resource Waters) for antidegradation purposes under Title 40 of the Code of Federal Regulations (CFR) 131.12(a)(3). Discharges to Tier 3 waters may be covered if the purpose of the pesticide application is to restore or maintain water quality or to protect public health or the environment and the application will not degrade water quality or will only degrade water quality on a short-term or temporary basis. In such cases a NOI is required and must specifically identify the Tier 3 water by the name, as listed, at www.epa.gov/npdes/pesticides.

3.2.3 Discharges Currently or Previously Covered by another Permit

Discharges are not eligible for coverage under the PGP if the discharge is already covered by another NPDES permit, or the discharge was included in a permit that in the past five years has been or is in the process of being denied, terminated, or revoked by EPA (this does not apply to the routine permit reissuance every five years).

3.2.4 Discharges to Waters with *NMFS' Listed Resources of Concern*[5]

The proposed 2016 PGP includes the same procedures, including a requirement to submit a NOI at least 30 days prior to discharge, as the 2011 PGP to assist in protecting *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP. The current definition found in Appendix A of the draft PGP is:

> *Federally-listed endangered and threatened species and federally-listed critical habitat for which NMFS' 2011 Endangered Species Act Section 7 Consultation Opinion on the United States Environmental Protection Agency's Proposed PGP concluded the draft 2011 PGP, absent any additional mitigating measures, would either jeopardize the continued existence of such species or destroy or adversely modify such critical habitat. The opinion included a Reasonable and Prudent Alternative, implemented through the PGP, to avoid likely jeopardy to ESA-listed species or adverse modification of critical habitat. Additional information, including maps noting where these resources overlap with PGP areas of coverage is available at www.epa.gov/npdes/pesticides.*

NMFS notes that this definition does not protect species or designated critical habitat listed after issuance of the 2011 permit and does not protect species anticipated to be listed and potentially affected by 2016 PGP-authorized discharges over the course of the five-year permit term.[6]

The draft PGP submitted for public comment in January of 2016 explains that EPA is currently conducting consultation with the Services under the ESA and that the results of consultation with the Services may result in additional or altered conditions to the final 2016 PGP.

The draft permit states in part 1.6 that Operators must comply with all conditions and/or requirements that address discharges from activities also covered under this PGP resulting from:

ESA section 7 consultation that Operators have completed with USFWS and/or NMFS, and/or

ESA section 10 permits issued to Operators by USFWS and/or NMFS.

As proposed, NOIs filed by Decision-makers will contain a section that directs the decision maker to self-certify whether pesticide application activities will overlap with the distribution of endangered or threatened species or designated critical habitat under NMFS' jurisdiction, and if so: 1) if their pesticide applications have undergone ESA section 7 consultations or if the Operator has received an ESA section 10(a)(1)(b) permit and; 2) a list of those endangered or threatened species, or designated critical habitat whose distributions overlap with treatment areas. A Decision-maker required to submit a NOI, either because the proposed discharge is to waters of the U.S. containing *NMFS' Listed Resources of Concern* or for one of the other discharges requiring a NOI, self-certifies their eligibility to discharge under the PGP under one of six eligibility criteria (A-F). These criteria are:

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[5] The draft PGP definition of "NMFS Listed Resources of Concern" is out of date in that it is limited to ESA-listed species and designated critical habitat at the time of issuance of the 2011 PGP and occurring in waters where EPA has permitting authority. For purposes of this opinion, we use the term "ESA-listed species and designated critical habitat under NMFS' jurisdiction" to include also the species listed and designated critical habitat designated since 2011.

[6] NMFS requested and included in a RPA to this opinion that EPA revise its definition of "NMFS listed Resources of Concern" to include species listed or designated critical habitat designated since the 2011 PGP was issued in an e-mail dated April 18, 2016.

Criterion A. Pesticide application activities will not result in a point source discharge to one or more waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP.

Criterion B. Pesticide application activities for which permit coverage is being requested will discharge to one or more receiving waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP, but consultation with NMFS under section 7 of the ESA has been concluded for pesticide application activities covered under the PGP. Consultations can be either formal or informal, and would have occurred only as a result of a separate federal action. The consultation addressed the effects of pesticide discharges and discharge-related activities on federally-listed threatened or endangered species and federally-designated critical habitat, and must have resulted in either:

i. A opinion from NMFS finding no jeopardy to federally-listed species and no destruction/adverse modification of federally-designated critical habitat; or

ii. Written concurrence from NMFS with a finding that the pesticide discharges and discharge-related activities are not likely to adversely affect federally-listed species or federally-designated critical habitat.

Criterion C. Pesticide application activities for which permit coverage is being requested will discharge to one or more waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP, but all "take" of these resources associated with such pesticide application activities has been authorized through NMFS' issuance of a permit under section 10 of the ESA, and such authorization addresses the effects of the pesticide discharges and discharge-related activities on federally-listed species and federally-designated critical habitat. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. See Section 3 of the Endangered Species Act, 16 U.S.C. § 1532(19).

Criterion D. Pesticide application activities were, or will be, discharged to one or more waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP, but only in response to a Declared Pest Emergency Situation. Decision-makers must provide EPA with their rationale supporting the determination whether the discharge is likely to adversely affect *NMFS' Listed Resources of Concern*, including the description of appropriate measures to be undertaken to avoid or eliminate the likelihood of adverse effects.

Criterion E. Pesticide application activities for which permit coverage is being requested in the NOI will discharge to one or more waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP. Eligible discharges include those where the Decision-maker includes in the NOI written correspondence from NMFS that pesticide application activities performed consistent with appropriate measures will avoid or eliminate the likelihood of adverse effects to *NMFS' Listed Resources of Concern*. Eligibility under this criterion is contingent upon the Decision-maker following the measures described in correspondence from NMFS designed to avoid or eliminate the likelihood of adverse effects.

Criterion F. Pesticide application activities for which permit coverage is being requested in the NOI will discharge to one or more waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP. Eligible discharges include those from pesticide application activities that are demonstrated by the Decision-maker as not likely to adversely affect *NMFS' Listed Resources of Concern* or that the pest poses a greater threat to the *NMFS' Listed Resources of Concern* than does the discharge of the pesticide. Decision-makers must provide EPA with their documentation demonstrating the basis for their finding.

3.2.5 Review of Notices of Intent to Discharge

For discharges to those areas with *NMFS' Listed Resources of Concern*, as defined in Appendix A, NMFS will provide EPA with a determination as to whether it believes the eligibility criterion of "not likely to adversely affect ESA-listed species or designated critical habitat" has been met, could be met with conditions that NMFS identifies, or has not been met. EPA expects to rely on NMFS' determination in deciding whether to withhold authorization. If NMFS does not provide EPA with this information within 30 days of EPA posting on the Internet receipt of a complete and accurate NOI, the discharges will be authorized 30 days after EPA posted on the Internet receipt of a complete NOI.

NOI for discharges in response to a Declared Pest Emergency Situation are to be submitted no later than 30 days after beginning discharge. For Declared Pest Emergency Situation in waters of the U.S. containing *NMFS' Listed Resources of Concern*, NMFS will have 30 days after submission of an NOI to provide EPA with a determination as to whether it believes the eligibility criteria of "not likely to adversely affect ESA-listed species or designated critical habitat" has been met, could be met with conditions that NMFS identifies, or has not been met. EPA expects to rely on NMFS' determination in deciding whether to disallow continued permit coverage or if additional conditions are necessary. If NMFS does not provide EPA with a recommendation within 30 days of EPA posting on the Internet receipt of a complete and accurate NOI, authorization for these discharges will continue. If EPA identifies additional permit conditions or prohibitions, or includes additional permit conditions or prohibitions recommended by NMFS, as necessary to qualify discharges for particular Operators as eligible for coverage beyond 60 days under the PGP for the Declared Pest Emergency Situation, those conditions remain in effect for the life of the PGP.

EPA may authorize certain discharges in less than 30 days, but no fewer than 10 days, for any discharges authorized under Criterion B, C, or E for which NMFS has already evaluated the effects of these discharges. In sum, PGP coverage is available only for discharges that are not likely to adversely affect ESA-listed species, except as provided for in a separate ESA section 7 consultation (Criterion B), covered under a permit issued under section 10 of the ESA (Criterion C), or in the event of a declared pest emergency (Criterion D). The PGP does not specify how EPA will evaluate NOIs for accuracy or if the listed resource distribution and application area overlap determinations contained therein are correct.

3.3 Obtaining Authorization

Decision-makers that are required to submit an NOI to discharge pesticide pollutants under PGP that do not discharge to waters where *NMFS' Listed Resources of Concern* occur would be authorized no earlier than 10 days after EPA posts a receipt of a complete and accurate NOI. NOI for discharges in response to a Declared Pest Emergency Situation are to be submitted no later than 30 days after beginning discharge. NOIs are required from the following types of Decision-makers (see Table 1):

Decision-makers exceeding the annual treatment area threshold in Table 1

Decision-makers specifically in the business of pest control;

Decision-makers discharging to Tier 3 waters; and

Decision-makers discharging to waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP.

NOIs are also required to be submitted by public, quasi-public, and private entities with land resource stewardship responsibilities or having as an integral responsibility for controlling pests regardless of the size of the area treated. The specific entities required to submit NOIs, regardless of whether an annual treatment area threshold is exceeded, are:

Any Agency for which pest management for land resource stewardship is an integral part of the organization's operation (e.g., state departments of natural resources and federal agencies such as the U.S. Forest Service)

Mosquito control districts (or similar pest control districts, such as vector control districts)

Irrigation control districts (or other similar public or private entities supplying irrigation waters)

Weed control districts (or other similar special purpose districts created with a responsibility of pest control)

Table 1. Decision-makers required to submit NOIs under the 2016 PGP.

PGP Part/ Pesticide Use	Which Decision-makers Must Submit NOIs?	For Which Pesticide Application Activities?
All four use patterns identified in Part 1.1.1	Any Decision-maker with an eligible discharge to a Tier 3 water (Outstanding National Resource Water) consistent with Part 1.1.2.2	Activities resulting in a discharge to a Tier 3 water
All four use patterns identified in Part 1.1.1	Any Decision-maker with an eligible discharge to waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP	Activities resulting in a discharge to waters of the U.S. containing *NMFS' Listed Resources of Concern*, as defined in Appendix A of the PGP
1.1.1(a) - Mosquito and Other Flying Insect Pest Control	Any Agency for which pest management for land resource stewardship is an integral part of the organization's operations.	All mosquito and other flying insect pest control activities resulting in a discharge to waters of the U.S.
	Mosquito control districts, or similar pest control districts	All mosquito and other flying insect pest control activities resulting in a discharge to waters of the U.S.
	Local governments or other entities that exceed the annual treatment area threshold identified here	Adulticide treatment if more than 6,400 acres during a calendar year
1.1.1(b) - Weed and Algae Pest Control	Any Agency for which pest management for land resource stewardship is an integral part of the organization's operations.	All weed and algae pest control activities resulting in a discharge to waters of the U.S.
	Irrigation and weed control districts, or similar pest control districts	All weed and algae pest control activities resulting in a discharge to waters of the U.S.
	Local governments or other entities that exceed the annual treatment area threshold identified here	Treatment during a calendar year if more than either: 20 linear miles OR 80 acres of water (i.e., surface area)
1.1.1(c) - Animal Pest Control	Any Agency for which pest management for land resource stewardship is an integral part of the organization's operations.	All animal pest control activities resulting in a discharge to waters of the U.S.
	Local governments or other entities that exceed the annual treatment area threshold identified here	Treatment during a calendar year if more than either: 20 linear miles OR 80 acres of water (i.e., surface area)
1.1.1.(d) - Forest Canopy Pest Control	Any Agency for which pest management for land resource stewardship is an integral part of the organization's operations.	All forest canopy pest control activities resulting in a discharge to waters of the U.S.
	Local governments or other entities that exceed the annual treatment area threshold identified here	Treatment if more than 6,400 acres during a calendar year

The annual treatment area for the uses Mosquitoes and Other Flying Insect Pest Control and Forest Canopy Pest control is additive over the calendar year. That is to say, each pesticide application activity is counted as a separate area treated. For example, applying pesticides three times a year to the same 3,000 acre site should be counted as 9,000 acres of treatment area for purposes of determining if such an application exceeds an annual treatment area threshold.

The annual treatment area for Weed and Algae Control and Animal Pest Control is not additive over the calendar year. The treatment area is either the linear extent or the surface area of waters of the U.S. (or at water's edge) treated. For these uses each treatment area is counted only once, regardless of the number of pesticide application activities performed on that area in a given year. Also, treatment of linear features (e.g., a canal or ditch) is measured as the length of the feature regardless of whether treating at water's edge/bank on one side or both sides of that feature.

Certain Operators are automatically covered under the PGP and are not required to submit an NOI. These include Operators who are for-hire applicators, but are not Decision-makers, as defined in Appendix A of the PGP and Decision-makers who apply pesticides to relatively small areas below the defined annual thresholds listed in Table 1. If a Decision-maker who was previously not required to submit an NOI discovers that they will exceed a treatment threshold, that Decision-maker must submit an NOI at least 10 days prior to exceeding the threshold in order to be authorized by the PGP. The 2016 PGP also provides automatic authorization of eligible discharges that result from the application of a pesticide as part of *pesticide research and development*, as defined in Appendix A of the PGP. EPA emphasizes in its BE that even if an NOI is not required, Operators that are covered automatically under the PGP are still subject to all applicable requirements contained within the PGP. This is not explicitly stated in the PGP itself.

3.4 Continuation of the PGP

If the 2016 PGP is not reissued or replaced before its expiration date, it will be administratively continued in accordance with 40 CFR 122.6 and remain in force and effect. If an Operator was authorized to discharge under the PGP before the expiration date, any discharges authorized under the PGP will automatically remain covered by the PGP until:

A Decision-maker is authorized for coverage under a reissued permit or a replacement of the PGP, following the timely and appropriate submittal of a complete NOI requesting authorization to discharge under the new permit and in compliance with the requirements of the NOI;

A Decision-maker submits a Notice of Termination and that notice is processed and posted on the Internet;

An NPDES individual permit for a discharge resulting from application of a pesticide that would otherwise be covered under the PGP is issued or denied;

EPA issues a formal permit decision not to reissue this general permit, at which time EPA will identify a reasonable period for covered dischargers to seek coverage under an alternative NPDES general permit or an NPDES individual permit. Coverage under the PGP will cease when coverage under another permit is granted/authorized; or

EPA has informed the Operator that its discharge is no longer covered under the PGP.

3.5 Alternative Permits

EPA may require, or an Operator may request, that authorization to discharge be applied for and obtained under either an NPDES individual permit or an alternative NPDES general permit. If coverage under an alternative permit is required by EPA, the applicant will be notified in writing with a brief statement of the reasons for the decision, information on what permit to apply for, and, if the Operator is authorized under the PGP, the notice will include a deadline to apply for an alternative permit and will include a statement that on the effective date of the NPDES individual permit, coverage under this general permit will terminate. Operators wanting coverage under an NPDES individual permit must submit an individual permit application with reasons supporting the request to EPA. EPA may issue an NPDES individual permit or authorize the discharges under an alternative NPDES general permit. Authorization to discharge under the PGP is terminated on the effective date of the NPDES individual permit or alternative NPDES general permit.

3.6 Severability

Invalidation of a portion of the PGP will not render the whole permit invalid. EPA's intent is that the PGP will remain in effect to the extent possible; if any part of the PGP is invalidated, the remaining parts of the PGP will remain in effect unless EPA issues a written statement otherwise.

3.7 Technology-Based Effluent Limitations

For the purpose of the PGP, "Operator" is defined to mean any entity associated with the application of pesticides which results in a discharge to waters of the U.S. that meets either of the following two criteria: (1) any entity who performs the application of a pesticide or who has day-to-day control of the application (i.e., they are authorized to direct workers to carry out those activities); or (2) any entity with control over the decision to perform pesticide applications including the ability to modify those decisions. Operators identified in (1) above are referred to in this permit as Applicators while Operators identified in (2) are referred to in this permit as Decision-makers. As defined, more than one Operator may be responsible for complying with this permit for any single discharge from the application of pesticides.

Both Applicators and Decision-makers are required to comply with manufacturer specifications, industry standards and recommended industry practices related to the application of pesticides, relevant legal requirements and other provisions that a prudent Operator would implement to reduce and/or eliminate pesticide discharges to waters of the U.S. Both must use only the amount of pesticide and frequency of pesticide application necessary to control the target pest, using equipment and application procedures appropriate for this task.

Responsibilities of applicators include:

To the extent not determined by the Decision-maker, using only the amount of pesticide and frequency of pesticide application necessary to control the target pest, using equipment and application procedures appropriate for this task.

Maintain pesticide application equipment in proper operating condition, including requirement to calibrate, clean, and repair such equipment and prevent leaks, spills, or other unintended discharges.

Assess weather conditions (e.g. temperature, precipitation, and wind speed) in the treatment area to ensure application is consistent with all applicable federal requirements.

All Decision-makers required to submit an NOI must employ Pest Management Measures to minimize the discharge of pesticide pollutants to waters of the U.S. from the application of pesticides. Prior to their first pesticide application under the PGP and prior to the first pesticide application for each calendar year thereafter, Decision-makers must conduct a problem identification to evaluate the extent and source of the pest problem and to determine the conditions under which pest control will be necessary (i.e., the action threshold[7]). Once the pest problem has been framed, the Decision-maker must consider pest management options: whether to take no action, take action to prevent the need for control, to apply mechanical, physical or cultural methods (as appropriate), to use biological control agents, or to apply pesticides. To determine when the action threshold(s) is met the Decision-maker must assess the pest management area by conducting surveillance of the target pest/life stage in an area that is representative of the pest problem, evaluating existing surveillance data and environmental conditions, or evaluating data from adjacent areas. The Decision-maker must reduce impact on the environment and on non-target organisms by applying the pesticide only when the action threshold(s) has been met.

The Decision-maker must use larvicides as a preferred pesticide for mosquito or flying insect pest control when the larval action threshold(s) has been met. In situations or locations where it is not practical or feasible to achieve effective control through the use of larvicides, the Decision-maker may use adulticides for mosquito or flying insect pest control when the adult action threshold(s) has been met. For pesticide control of forest canopy pests, the Decision-maker must also evaluate the use of pesticides against the most susceptible developmental stage of the pest.

3.8 Water Quality Based Effluent Limits

All Operators must control discharges as necessary to meet applicable state and tribal water quality standards. If at any time the Operator becomes aware that the PGP discharge causes or contributes to a failure to meet such standards, the Operator must take corrective actions.

3.9 Monitoring

During any pesticide application or post-application surveillance of discharges authorized under the PGP, Applicators or all Operators must, when considerations for safety and feasibility allow, visually assess the area to and around where pesticides are applied for possible and observable adverse incidents, as defined in Appendix A, caused by application of pesticides, including the unanticipated death or distress of non-target organisms and disruption of wildlife habitat, recreational or municipal water use.

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[7] Action Threshold: the point at which pest populations or environmental conditions necessitate that pest control action be taken based on economic, human health, aesthetic, or other effects. An action threshold may be based on current and/or past environmental factors that are or have been demonstrated to be conducive to pest emergence and/or growth, as well as past and/or current pest presence. Action thresholds are those conditions that indicate both the need for control actions and the proper timing of such actions.

3.10 Pesticide Discharge Management Plan

A Pesticide Discharge Management Plan (PDMP) documents how a Decision-maker will implement the Technology Based and Water Quality based effluent limitations (including Pest Management Measures), response procedures, and information supporting eligibility considerations under other federal laws. Certain Decision-makers required to submit an NOI are not required to develop a PDMP. These include Decision-makers who are:

working for private enterprises meeting the Small Business Administration size standard (13 CFR 121.201);

working for a local government serving a population of 10,000 or less;

responding to a Declared Pest Emergency Situation; or

submitting an NOI for the sole purpose of obtaining authorization for discharges to waters of the U.S. containing *NMFS' Listed Resources of Concern*.

All other Decision-makers that are required to submit an NOI must develop a PDMP prior to filing their NOI. The PDMP includes the name, contact information, and specific responsibilities for all PDMP team members, one of which should be trained in procedures for stopping, containing, and cleaning up leaks, spills, and other releases to waters of the U.S. Operators who may cause, detect, or respond to a spill or leak must be trained in response procedures and have necessary spill response equipment available. Contact information for state/federal permitting agency, nearest emergency medical facility, and nearest hazardous chemical responder must be in locations that are readily accessible and available.

The PDMP will include the Pest Management Measures (i.e., problem identification and evaluation of pest management options) to be implemented under the PGP. The problem identification describes:

the management area, target pest or pests, pest source or sources, and data used to identify the problem;

the development and planned implementation of action thresholds;

the geographic boundaries of the area to which the plan applies;

the location of the waters of the U.S. affected;

any Tier 3 (Outstanding National Resource Waters), and

any water(s) identified as impaired by a substance which either is an active ingredient or a degradate of such an active ingredient of a pesticide that may be applied under the PGP.

The evaluation of pest management options within the PDMP takes into consideration impacts to water quality and to non-target organisms, feasibility, cost effectiveness, and any relevant previous Pest Management Measures.

The PDMP will also describe spill and adverse incident response procedures that must include procedures for expeditiously stopping, containing, and cleaning up leaks, spills, and other releases to waters of the U.S., procedures for responding to any adverse incident resulting from pesticide applications, and procedures for notifying appropriate personnel within the Decision-maker's agency/organization, emergency response agencies, and regulatory agencies.

Decision-makers will modify their PDMP whenever necessary to address any of the triggering conditions for corrective action in Part 6.1 of the PGP, or when a change in pest control activities significantly changes the type or quantity of pollutants discharged. Changes to the PDMP must be made before the next pesticide application that results in a discharge, if practicable, or if not, no later than 90 days after any change in pesticide application activities.

Decision-makers must retain a copy of the current PDMP, along with all supporting maps and documents, including supporting documentation for their determination with regard to endangered and threatened species and designated critical habitat protection, at the address provided in the NOI. The PDMP and all supporting documents must be readily available, upon request, and copies of any of these documents provided, upon request, to EPA, any state, tribal, or local agency governing discharges or pesticide applications within their respective jurisdictions, and representatives of the Services. Any Confidential Business Information, as defined in 40 CFR Part 2, may be withheld from the public provided that a claim of confidentiality is properly asserted and documented in accordance with 40 CFR Part 2; however, Confidential Business Information must be submitted to EPA, if requested, and may not be withheld from staff within EPA, USFWS, and NMFS cleared for Confidential Business Information review.

3.11 Corrective Action

Pest Management Measures must be reviewed and revised before or, if not practicable, as soon as possible after the next pesticide application if:

An unauthorized release or discharge associated with the application of pesticides (e.g., spill, leak, or discharge not authorized by this or another NPDES permit) occurs.

Any Operator observes or is otherwise made aware of evidence that a person or non-target organism has likely been exposed to a pesticide residue, and has suffered a toxic or adverse effect (i.e., adverse incident).

Operators become aware, or EPA concludes, that Pest Management Measures are not adequate/sufficient for the discharge to meet applicable water quality standards.

Any monitoring activities indicate failure to meet applicable technology-based effluent limitations.

An inspection or evaluation of activities by an EPA official, or local, state, or tribal entity, reveals that modifications to the Pest Management Measures are necessary to meet the effluent limitations in the PGP.

Unauthorized releases and adverse incidents require specific notification and documentation by the Operator. Other events triggering corrective action require documentation within 30 days of discovery. Documentation must include the date of discovery, how the problem was identified, the condition triggering the need for corrective action, any water quality monitoring data used in identifying that condition, a summary of the corrective action taken or planned, including initiation date and anticipated completion date, measures taken to prevent recurrence of the problem, and whether the modifications to the PDMP were required.

3.12 Unauthorized Release or Discharges

An Operator must notify the National Response Center immediately upon becoming aware of a leak, spill, or other release into waters of the U.S. containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302 occurs over any 24-hour period. State or local requirements may necessitate also reporting spills or leaks to local emergency response, public health, or drinking water supply agencies. If the leak results in an adverse incident, adverse incident reporting is required (see section 3.13 below). If an adverse incident did not result from the unauthorized discharge, within 30 days of becoming aware of the release the Operator must document and retain information on the corrective action taken or planned, expected initiation and completion of corrective actions, measures to prevent recurrence, and whether modifications to the PDMP are required.

3.13 Adverse Incidents

The phrase “toxic or adverse effect” includes effects on non-target plants, fish, or wildlife that are unusual or unexpected as a result of exposure to a pesticide residue, and may include observation of dead, immobile, or nonresponsive non-target aquatic organisms, abnormal or erratic movement by non-target aquatic organisms, or stunting, wilting, or desiccation of non-target submerged or emergent aquatic plants. An Operator must immediately notify the appropriate EPA Incident Reporting Contact of any adverse incident within 24 hours of becoming aware of the incident. If the adverse incident has affected ESA-listed species or designated critical habitat, the Operator must also notify NMFS in the case of incidents involving ESA-listed anadromous or marine species or designated critical habitat, or USFWS in the case of incidents involving ESA-listed terrestrial or freshwater species or designated critical habitat.

Adverse incident reporting under the PGP are in addition to (i.e., do not replace) reporting requirements under FIFRA section 6(a)(2) and its implementing regulations at 40 CFR Part 159. Under the PGP, notification must include contact and permit identification, a description of the activity and parties contributing to the adverse incident, a description of how the incident was detected, and the response measures taken or planned. When the incident involved ESA-listed species, the Operator must also identify the species affected. The Operator is required provide a written report to the appropriate EPA Regional office within 30 days of the initial notification. The report must include the information provided by the Operator when EPA was initially notified along with:

Date and time the Operator contacted EPA notifying the Agency of the adverse incident, who the Operator spoke with at EPA, and any instructions received from EPA;

Location of incident, including the names of any waters affected and appearance of those waters (sheen, color, clarity, etc.);

A description of the circumstances of the adverse incident including species affected, estimated number of individual and approximate size of dead or distressed organisms;

Magnitude and scope of the affected area;

Pesticide application rate; intended use site (e.g., on the bank, above waters, or directly to water); method of application; and the name of pesticide product and EPA registration number;

Description of the habitat and the circumstances under which the adverse incident occurred (including any available ambient water data for pesticides applied);

If laboratory tests were performed, an indication of which test(s) were performed, and when; additionally, a summary of the test results must be provided within 5 days after they become available, if not available at the time of submission of the 30-day report; and

Description of actions to be taken to prevent recurrence of adverse incidents.

Where multiple Operators are authorized for a discharge that results in an adverse incident, notification and reporting by any one of the Operators constitutes compliance for all of the Operators, provided a copy of the required written report is also provided to all of the other authorized Operators within 30 days of the reportable adverse incident.

Incidents that require revision of Pesticide Management Measures may be a violation of the PGP. Corrective action does not absolve liability for any violation and failure to make changes to the Pesticide Management Measures in a timely fashion constitutes an additional permit violation. EPA will consider the appropriateness and promptness of corrective action in determining enforcement responses to permit violations and may impose additional requirements and schedules of compliance, including requirements to submit additional information concerning the condition(s) triggering corrective action or schedules and requirements more stringent than specified in the PGP.

Adverse incident reporting is not required when the Operator is aware of facts indicating the adverse incident was not related to toxic effects or exposure from the pesticide application, has been notified by EPA that the reporting requirement has been waived for this incident or category of incidents (such notification must be retained), receives information of an adverse incident that is clearly erroneous, or the incident occurs to pests that are similar in kind to potential target pests identified on the FIFRA label.

3.14 Record Keeping and Annual Reporting

All Operators must retain any records required under the PGP for at least 3 years after the Operator's coverage expires or is terminated. Required records must be documented as soon as possible but no later than 14 days following completion of each pesticide application. Operators must make available to EPA, including an authorized representative of EPA, all records kept under the PGP, upon request, and provide copies of such records, upon request.

3.14.1 Records Required of All Operators

Adverse Incident Reports

If any incidents were identified but determined not to be reportable, the rationale for making that determination must also be retained as a record.

Corrective action documentation

Spill, leak, or other unpermitted discharge documentation

Documentation for each treatment area to which pesticides are discharged, including:

A description of treatment area, its location and size and identification of any waters of the U.S. to which pesticide(s) are discharged;

The pesticide use pattern(s);

Target pest(s);

The name and EPA registration number of each pesticide product applied to each treatment area;

Quantity of each pesticide product applied to each treatment area;

Pesticide application date(s);

Equipment calibration documentation (by Applicators and Decision-makers that are also Applicators); and

Whether or not visual monitoring was conducted during pesticide application and/or post-application.

If visual monitoring was not conducted, records must indicate why monitoring did not occur.

If monitoring did occur, records must describe any possible or observable adverse incidents caused by application of pesticides.

3.14.2 Records Required of All Decision-makers

Any Decision-maker required to submit an NOI must retain:

A copy of the NOI;

A copy of any correspondence with EPA specific to coverage under the PGP;

A copy of the EPA acknowledgment letter with the assigned permit tracking number;

Records containing the names and contact information of companies hired to apply pesticides;

An explanation for the need to control target pests; and

A description of the pest management measures implemented prior to the first pesticide application.

3.14.3 Records Required of Decision-makers for a Large Entity

Decision-makers that submitted an NOI for a large entity[8] must also retain:

Copies of annual reports submitted to EPA;

A copy of the PDMP documenting:

the action threshold(s) derived for pest management measures;

the method(s) and/or data used to determine when an action threshold(s) has been met; and

any modifications made to the PDMP during the term of the 2016 PGP.

3.15 Annual Reporting Requirements

Decision-makers who submit an NOI for any large entity and those submitting an NOI for small entities[9] making discharges to waters of the U.S. Containing *NMFS' Listed Resources of Concern* are required to submit an annual report to EPA for each year of coverage under the

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[8] Large Entity: Any public entity that serves a population greater than 10,000 or private enterprise that exceeds the Small Business Administration size standard identified at 13 CFR 121.201

[9] Small Entity: Any public entity that serves a population less than 10,000 or private enterprise that meets the Small Business Administration size standard identified at 13 CFR 121.201

PGP. If a Decision-maker's obligation to submit an annual report changes at some point during a calendar year (i.e., ceases due to permit termination or, for large entities, is triggered by exceeding an annual treatment area threshold), the Decision-maker must submit an annual report for that portion of the year during which the entity was covered under the PGP and required to provide annual reporting. Once a Decision-maker meets the obligation to submit an annual report, the Decision-maker must submit the annual report each calendar year thereafter for the duration of coverage under this general permit, whether or not the Decision-maker has discharges from the application of pesticides in any subsequent calendar year.

The annual report must contain the following information:

Name and contact information for the Decision-maker and any other contact person;

NPDES permit tracking number(s);

For each area treated in that year:

Description of treatment area, including location and size (acres or linear feet) of treatment area and identification of any waters of the U.S., either by name or by location, to which pesticide(s) are discharged;

Pesticide use pattern(s) (i.e., mosquito and other flying insects, weed and algae, animal pest, or forest canopy) and target pest(s);

Company name(s) and contact information for pesticide applicator(s), if different from the Decision-maker;

Total amount of each pesticide product applied for the reporting year by the EPA registration number(s) and by application method (e.g., aerially by fixed-wing or rotary aircraft, broadcast spray, etc.);

If the Annual Report is from a large entity, the report must indicate whether this pest control activity was addressed in the PDMP prior to pesticide application;

If the Annual Report is from a small entity, the report must indicate the dates of pesticide application;

If applicable, any adverse incidents as a result of these treatment(s), as described in Part 6.4.1; and

If applicable, description of any corrective action(s), including spill responses, resulting from pesticide application activities and the rationale for such action(s).

3.16 Standard Permit Conditions

The PGP includes an appendix explaining permit holders duty to comply with permit provisions that outlined the administrative penalties, civil penalties, and criminal penalties for negligent violations, intentional violations or endangerment, and the making of false statements. This appendix also includes the following permit holder requirements:

Reapply for coverage if discharge activities are to continue after the PGP has expired.

Take all reasonable steps to minimize or prevent any discharge in violation of the PGP, which has a reasonable likelihood of adversely affecting human health or the environment.

Properly operate and maintain all facilities and systems of treatment and controls to achieve compliance with the conditions of the PGP.

Provide EPA or an authorized representative any information or access for inspection that EPA may request to determine whether cause exists for modifying, revoking and reissuing, terminating coverage, or to determine compliance with the PGP.

Retain records of all reports required by the PGP, and records of all data used to complete the NOI for the PGP, for a period of at least 3 years from the date the PGP expires or the date the Operator's authorization is terminated. That period may be extended by request of EPA at any time.

Comply with all signatory and reporting requirements of the PGP.

4 INTERRELATED AND INTERDEPENDENT ACTIONS

NMFS must consider interrelated and interdependent actions of the proposed action. Interdependent actions are actions having no independent utility apart from the proposed action [50 CFR §402-02]. They are typically a consequence of the proposed action. For example, if our consultation were evaluating the effects of building a road, an interdependent action would be the planned construction of homes and other structures that would not be accessible without the presence of that road. Interrelated actions are actions that are part of a larger action and depend on the larger action for their justification [50 CFR §402-02]. They are actions that are typically associated with the proposed action. In the case of the PGP, no chemical pesticide residue can be discharged without a discharge of a chemical pesticide. NMFS therefore includes discharges of all pesticides, whether or not included in the PGP definition of pesticide pollutants, as interrelated actions and assesses the effects from these charges as part of the effects of the action. In this opinion, we will use the term "pesticide" or "pesticides" to refer to all pesticides, and use the term "pesticide pollutant" only when referring specifically to the terms of the PGP.

5 ACTION AREA

The action area for this consultation consists of all waters of the U.S. in states, territories, and possessions receiving discharges authorized by EPA under the PGP. Because NMFS only has jurisdiction over marine, estuarine, and anadromous endangered and threatened species and designated critical habitat for those species, this consultation addresses the potential effects of PGP-authorized discharges to waters of the U.S. occurring in coastal areas and inland waters used by ESA-listed marine, estuarine, and anadromous species under NMFS' jurisdiction where EPA has permitting authority. This includes the entire states of Massachusetts, New Hampshire, and Idaho, the District of Columbia, Puerto Rico, the Pacific territories, federally operated facilities in Washington and Delaware, and Indian country lands[10] nationwide. At this time, waters of the U.S. are defined as (40 CFR 122.2):

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[10] The term "Indian country" means: (a) all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent,

- All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide and all interstate waters, including interstate "wetlands."
- All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:
  - Which are or could be used by interstate or foreign travelers for recreational or other purposes;
  - From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
  - Which are used or could be used for industrial purposes by industries in interstate commerce.
- All impoundments of waters otherwise defined as waters of the U.S. under this definition.
- Tributaries of those waters described above.
- The territorial sea.
- "Wetlands" adjacent to waters (other than waters that are themselves wetlands).
- Waters of the U.S. extend to the outer reach of the three mile territorial sea, defined in section 502(8) of the Clean Water Act as the belt of the seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of three miles.

Although degradates and metabolites of some of the pesticide considered in this opinion might be transported more than three miles from our coastline at some concentration, the data we would need to follow a pesticide as it is transported from a particular application site to reservoirs in coastal waters and the open ocean are not available to us. Similarly, the data we would need to trace pesticides found in the tissues of marine and coastal animals back to particular terrestrial applications are not available. Without some data or other information, we can only acknowledge the probability of this kind of transport in our opinion; we do not extend the *Action Area* more than three miles from the coast of the coastal states, territories, and possessions included in the proposed PGP.

While EPA has permitting authority on Federal and Indian lands in certain states, some of these areas were excluded from designated critical habitat designations for reasons of national defense or in support of U.S.-tribal relationships. Effects within these areas are included in the *Action Area* for this opinion with respect to jeopardy determinations (i.e., effects to the species), but

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and, including rights-of-way running through the reservation; (b) all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state; and(c) all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same (18 USC 1151).

cannot be considered in adverse modification determinations for designated critical habitat. However, the effects of discharges originating from excluded areas on *adjacent* designated critical habitat are considered in adverse modification determinations. For example, EPA has NPDES permitting authority for Indian country lands in California. Designated critical habitat for the southern Distinct Population Segment (DPS) of Pacific eulachon occurs on the Klamath River in California (76 FR 65323, October 20, 2011). The portion of the Klamath River which flows through the Yurok Reservation is excluded from the designated critical habitat. Accordingly, jeopardy determinations would consider effects of PGP discharges to the species over the extent of the Klamath River while adverse modification determinations would only consider effects to designated critical habitat elements essential to the conservation of the species on that portion of the Klamath River designated as critical habitat (i.e., not within the Yurok Reservation).

The action area for this opinion encompasses 3,935 sub-watersheds within 363 thousand square kilometers (approximately 140 thousand square miles) dispersed over 18 states and territories. Among these, 161 sub-watersheds discharge directly to bays or the ocean where ESA-listed species and designated critical habitat under NMFS' jurisdiction may occur.

The distribution of sub-watersheds subject to PGP discharges are illustrated in Figure 1 and Figure 2 for the East and West Coasts, respectively. Waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction may occur in Puerto Rico are shown in Figure 3. The entire extent of waters in Puerto Rico and the Pacific Territories are subject to PGP-authorized discharges. According to the National Atlas, Indian Country Lands in Alaska include only the Annette Islands off South East Alaska

Table 2. Extent of the action area EPA has permitting authority for the PGP and where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur.

	All Watersheds			**Coastal Watersheds**		
State or Territory	**# Sub-watersheds**	**Acres**	**km^2**	**# Sub-watersheds**	**Acres**	**km^2**
East Coast						
Connecticut Indian Country Lands	2	35,363	143	1	17,182	70
Rhode Island Indian Country Lands	3	68,090	276	1	18,017	73
District of Columbia	6	161,124	652			
Delaware Federally Operated Facilities	9	185,536	751	5	119,489	484
Massachusetts	226	5,205,997	21,079	26	544,455	2,204
Maine Indian Country Lands	13	329,342	1,333	2	87,435	354
New Hampshire	334	7,390,815	29,910	9	241,779	978
Caribbean						
Puerto Rico	219	2,206,073	8,928	52	433,246	1,753
West Coast						
Alaska Indian Country Lands	7	317,423	1,285	6	307,605	1,245
California Indian Country Lands	201	6,349,845	25,697	11	478,323	1,936
Idaho	2,573	56,696,234	229,446	5	89,294	361
Oregon Indian Country Lands	77	1,695,526	6,862	1	6,816	28
Washington Indian Country Lands and Federally Operated Facilities	246	8,162,553	33,033	27	576,597	2,331
Pacific Territories						
American Samoa	4	317,694	1,286	2	48,393	196
Guam	10	364,856	1,477	9	134,470	544
Northern Marianas	5	152,049	615	4	29,451	119

.

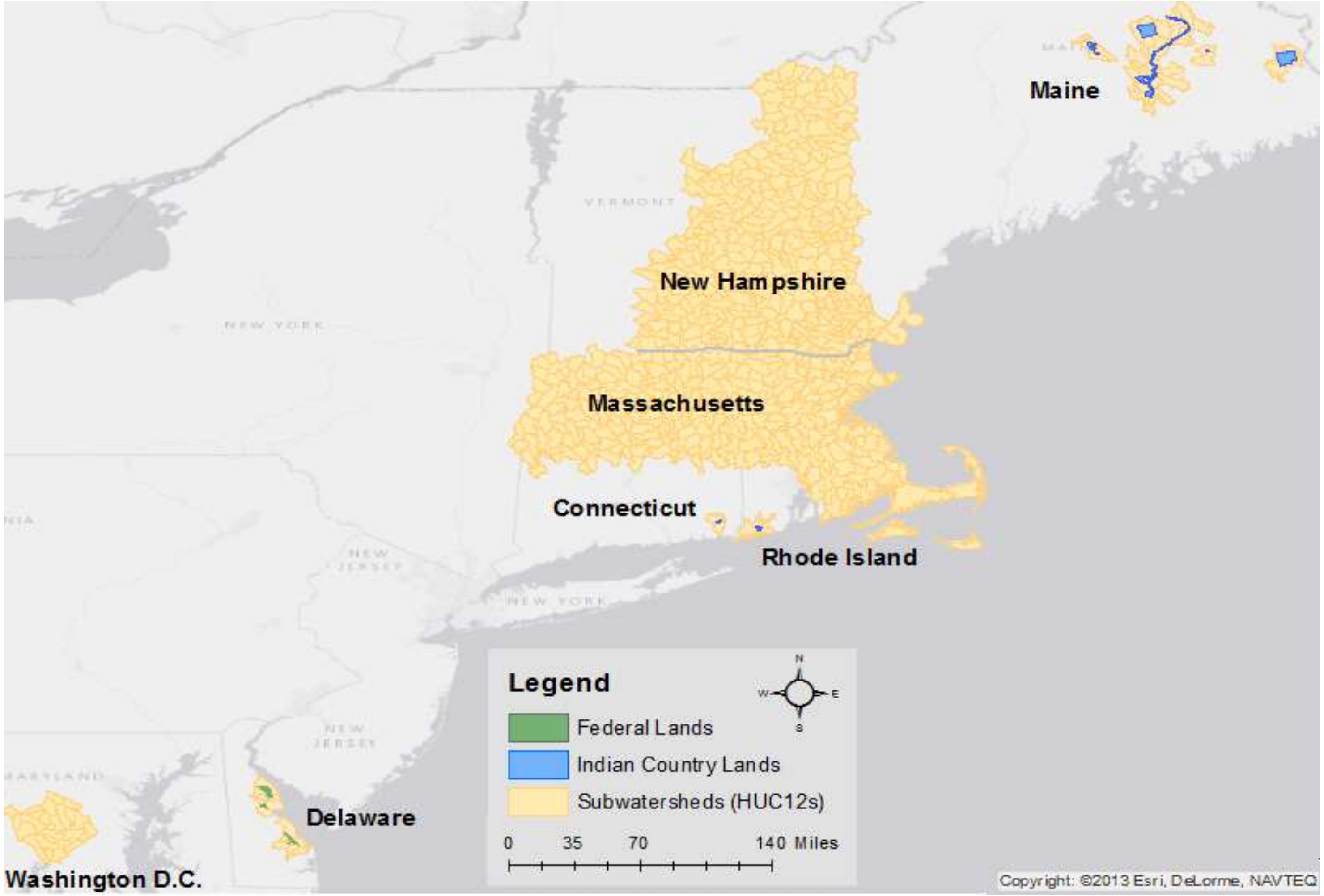

Figure 1. Map of east coast lands and sub-watersheds subject to PGP-authorized discharges in the states of Massachusetts and New Hampshire, the District of Columbia, Federal Facilities in Delaware, and Indian Country Lands in Maine, Connecticut and Rhode Island.

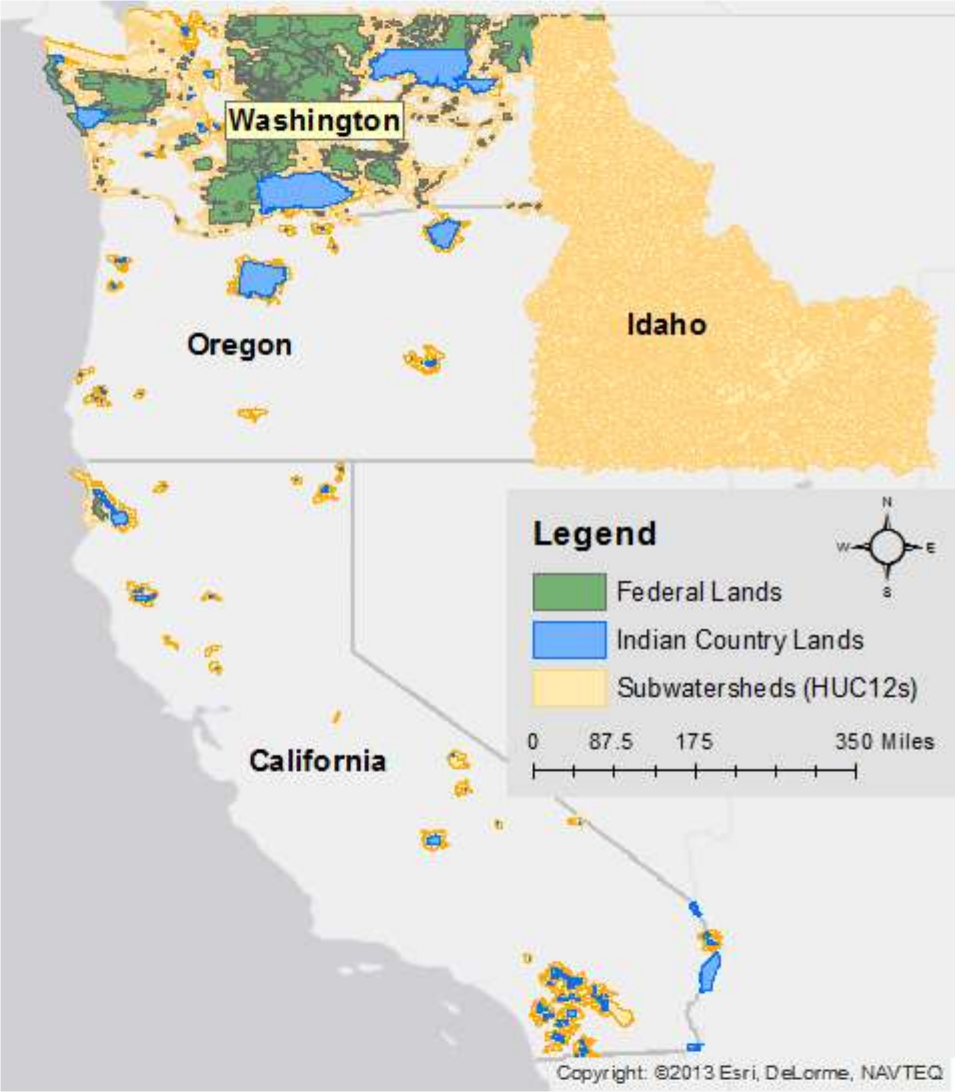

Figure 2. Map of West Coast lands and sub-watersheds subject to PGP-authorized discharges within the State of Idaho and Indian Country Lands in California, Oregon, or Washington, or Located on Federal lands in Washington.

Figure 3. Map of coastal waters of Puerto Rico subject to PGP-authorized discharges where ESA-listed species under NMFS' jurisdiction may occur.

6 STATUS OF THE SPECIES AND DESIGNATED CRITICAL HABITAT

As described in Section 2, during the consultation we identify those endangered or threatened species or designated critical habitat that may be affected by the proposed action. In order for a proposed action to be determined to not likely adversely affect species or designated critical habitat, all of the effects of that action must be expected to be discountable, insignificant, or completely beneficial. Discountable effects are those that are extremely unlikely to occur. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or designated critical habitat.

6.1 Species and Critical Habitat Not Likely to be Adversely Affected

For this opinion, we determined that exposures to pesticide discharges authorized under EPA's PGP would be extremely unlikely for those species that do not frequent coastal waters where EPA has permitting authority (i.e., effects would be discountable). Therefore, EPA's PGP is not likely to adversely affect the following species:

blue whale (*Balaenoptera musculus*, endangered)

false killer whale (*Pseudorca crassidens*, endangered)

fin whale (*Balaenoptera physalus*, endangered)

sei whale (*Balaenoptera borealis*, endangered)

sperm whale (*Physeter macrocephalus*, endangered)

- Humpback Whale (*Megaptera novaeangliae*, endangered)
- North Atlantic Right Whale (*Eubalaena glacialis*) and designated critical habitat (endangered)
- Scalloped Hammerhead (*Sphyrna lewini*) Eastern Pacific DPS (endangered)
- Scalloped Hammerhead (*Sphyrna lewini*) Central and Southwest Atlantic DPS (endangered)

The EPA is the permitting authority on Indian Country lands within range of Gulf sturgeon (threatened) and smalltooth sawfish (endangered), but these lands are inland. While these species may be exposed to PGP-authorized discharges, such exposures are expected to be insignificant given the dissipation and degradation that would occur before reaching the waters they occupy. EPA does not have permitting authority in waters where white and black abalone (both endangered) occur or where the Carolina DPS and south Atlantic DPS of Atlantic sturgeon (both endangered) occur. For these species, exposures to pesticide discharges authorized under the PGP are extremely unlikely (i.e., effects would be discountable), therefore EPA's PGP is not likely to adversely affect these species.

6.2 Species and Designated Critical Habitat Considered in this Opinion

The ESA-listed species and designated critical habitats which occur within the action area that fall under NMFS' jurisdiction and may be exposed to the pesticide discharges and experience direct or indirect effects of those exposures are identified in Table 3 and Table 4.

Table 3. NMFS endangered and threatened species and designated critical habitat considered in this opinion.

Species	ESA Status	Designated Critical Habitat	Recovery Plan
Marine Mammals – Cetaceans			
Southern Resident Killer Whale *(Orcinus orca)*	E – 70 FR 69903	71 FR 69054	73 FR 4176
Salmonids			
salmon, Chinook (*Oncorhynchus tshawytscha*)			
- California coastal	T – 64 FR 50393	70 FR 52488	– –
- Central Valley spring-run	T – 64 FR 50393	70 FR 52488	79 FR 42504
- Lower Columbia River	T – 64 FR 14308	70 FR 52630	78 FR 41911
- Upper Columbia River spring-run	E – 64 FR 14308	70 FR 52630	72 FR 57303
- Puget Sound	T – 64 FR 14308	70 FR 52630	72 FR 2493
- Sacramento River winter-run	E – 59 FR 440	58 FR 33212	79 FR 42504
- Snake River fall-run	T – 59 FR 42529	58 FR 68543	– –
- Snake River spring/summer-run	T – 59 FR 42529	64 FR 57399	– –
- Upper Willamette River	T – 64 FR 14308	70 FR 52630	76 FR 52317b
salmon, chum (*Oncorhynchus keta*)			
- Columbia River	T – 64 FR 14507	70 FR 52630	78 FR 41911
- Hood Canal summer-run	T – 64 FR 14507	70 FR 52630	72 FR 29121
salmon, coho (*Oncorhynchus kisutch*)			
- Central California coast	E – 61 FR 56138	65 FR 7764	– –
- Oregon coast	T – 63 FR 42587	73 FR 7816	78 FR 41911
- Southern Oregon & Northern California coasts	T – 62 FR 24588	64 FR 24049	– –
- Lower Columbia River	T – 70 FR 37160	81 FR 9251	78 FR 41911
salmon, sockeye (*Oncorhynchus nerka*)			
- Ozette Lake	T – 64 FR 14528	70 FR 52630	74 FR 24706
- Snake River	E – 56 FR 58619	58 FR 68543	– –
trout, steelhead (*Oncorhynchus mykiss*)			
- California Central Valley	T – 71 FR 834	70 FR 52488	79 FR 42504
- Central California coast	T – 71 FR 834	70 FR 52488	– –
- South-Central California coast	T – 71 FR 834	70 FR 52488	– –
- Southern California	E – 71 FR 834	70 FR 52488	– –
- Northern California	T – 71 FR 834	70 FR 52488	– –
- Lower Columbia River	T – 71 FR 834	70 FR 52630	74 FR 50165
- Middle Columbia River	T – 71 FR 834	70 FR 52630	– –
- Upper Columbia River	T – 74 FR 42605	70 FR 52630	72 FR 57303
- Upper Willamette River	T – 71 FR 834	70 FR 52630	76 FR 52317b
- Snake River Basin	T – 71 FR 834	70 FR 52630	– –
- Puget Sound	T – 72 FR 26722	81 FR 9251	– –
Atlantic Salmon (*Salmo salar*)	E – 74 FR 29344	74 FR 29300	70 R 75473

Species	ESA Status	Designated Critical Habitat	Recovery Plan
- Gulf of Maine DPS			
Non-Salmonid Anadromous Species			
Eulachon (*Thaleichthys pacificus*)	T – 75 FR 13012	76 FR 65323	– –
Shortnose sturgeon (*Acipenser brevirostrum*)	E – 32 FR 4001	– –	63 FR 69613
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)			
- Gulf of Maine DPS	T – 77 FR 5880	81 FR 35701 (Proposed)	– –
- New York Bight DPS	E - 77 FR 5880		
- Chesapeake Bay DPS			
Green sturgeon, (*Acipenser medirostris*)	T – 71 FR 17757	74 FR 52300	– –
- Southern DPS			
Marine Fish			
Bocaccio *(Sebastes paucispinis)*	E – 75 FR 22276	79 FR 68041	– –
Yellow Eye Rockfish (*Sebastes ruberrimus*)	T – 75 FR 22276	79 FR 68041	– –
Nassau Grouper	T – 79 FR 51929		
Sea Turtles			
Green Turtle *(Chelonia mydas) – North Atlantic DPS*	E – 43 FR 32800	63 FR 46693	63 FR 28359
Hawksbill Turtle (*Eretmochelys imbricata*)	E – 35 FR 8491	63 FR 46693	57 FR 38818
Kemp's Ridley Turtle *(Lepidochelys kempii)*	E – 35 FR 18319	– –	75 FR 2496
Olive Ridley Turtle (*Lepidochelys olivacea*)			
Pacific Coast of Mexico breeding populations	E – 43 FR 32800	– –	63 FR 28359
all other populations	T – 43 FR 32800		
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710	63 FR 28359
Loggerhead Turtle (*Caretta carettaCaretta caretta*)			
- Northwest Atlantic and North Pacific DPS	E – 76 FR 58868	79 FR 39856	63 FR 28359
Corals			
Elkhorn Coral (*Acropora palmata*)	T – 71 FR 26852	73 FR 72210	80 FR 12146
Staghorn Coral (*Acropora cervicornis*)			

Species	ESA Status	Designated Critical Habitat	Recovery Plan
Coral Species - *Mycetophyllia ferox* - The *Orbicella:* *O.faveolata* O. franksi *O. annularis* - Pillar *(Dendrogyra cylindrus)* - *The Acropora* *A. globiceps* *A. jacquelineae* *A. lokani* *A. pharaonis* *A. retusa* *A. rudis* *A. speciosa* *A. tenella* - *Anacropora spinosa* - *Euphyllia paradivisa* - *Isopora crateriformis* - *Montipora australiensis* - *Pavona diffluens* - *Porites napopora* - *Seriatopora aculeata*	T – 79 FR 54122	– –	– –

Table 4. Physical and biological features of designated critical habitat that are essential to the conservation of the species. Water quality and biological features which may be affected by toxicants are in boldface.

Species DPS or Evolutionarily Significant Unit (ESU)	**Physical or Biological Features Essential for the Conservation of the Species**
Invertebrates	
Elkhorn Coral & Staghorn Coral	Substrate of suitable quality and availability to support successful larval settlement and recruitment, and reattachment and recruitment of fragments
Reptiles	
Green Turtle Florida & Mexico Pacific coast breeding colonies; all other areas	Activities requiring special management considerations include: • Vessel traffic • Coastal construction • Point and non-point source pollution • Fishing activities • Dredge and fill activities • Habitat restoration
Hawksbill Turtle	
Leatherback Turtle	• Activities identified as modifying CH include: recreational boating ○ swimming, ○ sandmining (see 77 FR 32909 for the 6/4/2012 determination on Sierra Club's petition to revise the CH) • **Prey species, primarily Scyphomedusae (*Chrysaora*, *Aurelia*, *Phacellophora*, and *Cyanea*) of sufficient condition, distribution, diversity, and abundance to support individual as well as population growth, reproduction, and development** • Migratory pathway conditions to allow for safe and timely passage and access to/from/within high use foraging areas
Marine Mammals	
Killer Whale - Southern Resident	• **Water quality to support growth and development**; • **Prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth**; and • Passage conditions to allow for migration, resting, and foraging.
Marine and anadromous fish other than Pacific salmonids	
Green Sturgeon - Southern	**Freshwater areas:** • **Abundant prey items for larval, juvenile, subadult, and adult life stages.** • Substrate type or size (i.e., structural features of substrates) • A flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) necessary for normal behavior, growth, and survival of all life stages. • **Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.** • A migratory pathway necessary for the safe and timely passage of Southern DPS fish within riverine habitats and between riverine and estuarine habitats (e.g., an unobstructed river or dammed river that still allows for safe and timely passage). • Deep (≥5 m) holding pools for both upstream and downstream holding of adult or subadult fish, with adequate water quality and flow to maintain the physiological needs of the holding adult or subadult fish. • **Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages**. **Estuarine areas:** • **Abundant prey items within estuarine habitats and substrates for juvenile,**

Species **DPS or Evolutionarily Significant Unit (ESU)**	**Physical or Biological Features Essential for the Conservation of the Species**
	subadult, and adult life stages. • Within bays and estuaries adjacent to the Sacramento River (i.e., the Sacramento-San Joaquin Delta and the Suisun, San Pablo, and San Francisco bays), sufficient flow into the bay and estuary to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds. • **Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.** • A migratory pathway necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between estuarine and riverine or marine habitats. • A diversity of water depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages. • **Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages. This includes sediments free of elevated levels of contaminants** **Coastal Marine Areas:** • A migratory pathway necessary for the safe and timely passage of Southern DPS fish within marine and between estuarine and marine habitats. • Coastal marine waters with adequate dissolved oxygen levels and **acceptably low levels of contaminants (e.g., pesticides, PAHs, heavy metals that may disrupt the normal behavior, growth, and viability of subadult and adult green sturgeon).** • **Abundant prey items for subadults and adults, which may include benthic invertebrates and fish.**
Atlantic sturgeon - Gulf of Maine - New York Bight - Chesapeake Bay	• Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 parts per thousand range) for settlement of fertilized eggs, refuge, growth, and development of early life stages • Aquatic habitat with a gradual downstream salinity gradient of 0.5 to 30 parts per thousand and soft substrate (e.g., sand, mud) downstream of spawning sites for juvenile foraging and physiological development • Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: (1) Unimpeded movement of adults to and from spawning sites; (2) seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary; and (3) staging, resting, or holding of subadults or spawning condition adults. Water depths in main river channels must also be deep enough (e.g., ≥1.2 m) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river • Water, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support: (1) Spawning; (2) annual and interannual adult, subadult, larval, and juvenile survival; and (3) larval, juvenile, and subadult growth, development, and recruitment (e.g., 13 °C to 26 °C for spawning habitat and no more than 30° C for juvenile rearing habitat, and 6 mg/L dissolved oxygen for juvenile rearing habitat)
Eulachon - Southern	• Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles. • A flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of freshwater discharge over time) that supports spawning, and survival of all life stages. • **Water quality suitable for spawning and viability of all eulachon life stages. Sublethal concentrations of contaminants affect the survival of aquatic species**

Species DPS or Evolutionarily Significant Unit (ESU)	**Physical or Biological Features Essential for the Conservation of the Species**
	by increasing stress, predisposing organisms to disease, delaying development, and disrupting physiological processes, including reproduction. • Suitable water temperatures, within natural ranges, in eulachon spawning reaches. • Spawning substrates for eulachon egg deposition and development. • Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. • Safe and unobstructed migratory pathways for eulachon adults to pass from the ocean through estuarine areas to riverine habitats in order to spawn, and for larval eulachon to access rearing habitats within the estuaries and juvenile and adults to access habitats in the ocean. • A flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of freshwater discharge over time) that supports spawning migration and outmigration of larval eulachon from spawning sites. • **Water quality suitable for survival and migration of spawning adults and larval eulachon.** • Water temperature suitable for survival and migration. • **Prey resources to support larval eulachon survival.** • **Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival.** • **Prey items, in a concentration that supports foraging leading to adequate growth and reproductive development for juveniles and adults in the marine environment.** • **Water quality suitable for adequate growth and reproductive development.**
Puget Sound / Georgia Basin Rockfish species Yelloweye Boccacio	**Adults** • **Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities,** • **water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities**, and • the type and amount of structure and rugosity that supports feeding opportunities and predator avoidance. **Juvenile boccacio** • **Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and** • **water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities**.
Pacific Salmonids	
Chum Salmon - Columbia River - Hood Canal summer run Sockeye - Lake Ozette Chinook Salmon - Puget Sound - Lower Columbia River - Upper Willamette River Steelhead - Upper Columbia River - Snake River	• Freshwater spawning sites with **water quantity and quality conditions and substrate supporting spawning, incubation and larval development**; • Freshwater rearing sites with: ◦ Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; ◦ **Water quality and forage supporting juvenile development**; ◦ Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, **aquatic vegetation**, large rocks and boulders, side channels, and undercut banks. ◦ Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic **vegetation**, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

Species **DPS or Evolutionarily Significant Unit (ESU)**	**Physical or Biological Features Essential for the Conservation of the Species**
- Middle Columbia River - Upper Willamette River - Lower Columbia River - Puget Sound Coho Salmon - Lower Columbia River	• Estuarine areas free of obstruction and excessive predation with: ◦ **Water quality**, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh & saltwater; ◦ Natural cover such as **submerged and overhanging large wood, aquatic vegetation**, large rocks and boulders, side channels; ◦ **Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.** • Nearshore marine areas free of obstruction and excessive predation with: ◦ **Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation**; and ◦ Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. • **Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation**.
Coho Salmon - Central California Coast - Southern Oregon/Northern California Coast	Within the range of both ESUs, the species' life cycle can be separated into 5 essential habitat types: • juvenile summer and winter rearing areas; • juvenile migration corridors; • areas for growth and development to adulthood; • adult migration corridors; and • spawning areas. Essential features of coho designated critical habitat include adequate: Substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, **food, riparian vegetation,** space, safe passage
Steelhead - Puget Sound Coho Salmon - Lower Columbia River	• Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development. • Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; **water quality and forage supporting juvenile development**; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, **aquatic vegetation,** large rocks and boulders, side channels, and undercut banks. • Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, **aquatic vegetation,** large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival. • Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, **aquatic vegetation,** large rocks and boulders, and side channels; and **juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.** • Nearshore marine areas free of obstruction with **water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation**; and natural cover such as submerged and overhanging large wood, **aquatic vegetation**, large rocks and boulders, and side channels. • Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.
Coho Salmon - Oregon Coast	• Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development. • Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; **water quality and forage supporting juvenile development;** and natural cover such as

Species **DPS or Evolutionarily Significant Unit (ESU)**	**Physical or Biological Features Essential for the Conservation of the Species**
	shade, submerged and overhanging large wood, log jams and beaver dams, **aquatic vegetation,** large rocks and boulders, side channels, and undercut banks. • Freshwater migration corridors free of obstruction with **water quantity and quality conditions** and natural cover such as submerged and overhanging large wood, **aquatic vegetation**, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival. • Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, **aquatic vegetation**, large rocks and boulders, and side channels; and **juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation**. • Nearshore marine areas free of obstruction with **water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation**; and natural cover such as submerged and overhanging large wood, **aquatic vegetation**, large rocks and boulders, and side channels. • Offshore marine areas with **water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation**.
Chinook Salmon - Snake River fall-run - Snake River spring/summer run	juvenile rearing areas include adequate: spawning gravel, **water quality**, water quantity , water temperature, cover/shelter, **food**, **riparian vegetation,** space **juvenile and adult migration corridors are the same as for Snake River sockeye salmon
Sockeye Salmon - Snake River	spawning and juvenile rearing areas: spawning gravel, **water quality,** water quantity, water temperature, **food, riparian vegetation**, access, juvenile migration corridors:substrate, **water quality**, water quantity, water temperature, water velocity, cover/shelter, **food, riparian vegetation**, space, safe passage conditions **adult migration corridor has the same essential features, excluding “food”**

The following sections describe the status of species that occur in the action area and the threats to those species and where applicable, their designated critical habitat. A comprehensive description of these species, their life history, population dynamics and threats including climate change is available in Appendix A of this opinion.

6.3 Southern Resident Killer Whale

Status. We used information available in the final rule, the 2012 Status Review (NMFS 2013) (NMFS 2012) and the 2011 Stock Assessment Report (NMFS 2014) to summarize the status of this species. The Southern Resident killer whale DPS was listed as endangered in 2005 in response to the population decline from 1996 to 2001, small population size, and reproductive limitations (i.e., few reproductive males and delayed calving). This species occurs in the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait during the spring, summer and fall. During the winter, they move to coastal waters primarily off Oregon, Washington, California, and British Columbia.

The most recent abundance estimate for the Southern Resident DPS is 87 whales in 2012. This represents an average increase of 0.4 percent annually since 1982 when there were 78 whales. Population abundance has fluctuated during this time with a maximum of approximately 100 whales in 1995 (NMFS 2013). As compared to stable or growing populations, the DPS reflects a smaller percentage of juveniles and lower fecundity (NMFS 2014) and has demonstrated weak growth in recent decades.

Threats. Current threats to its survival and recovery include: contaminants, vessel traffic, and reduction in prey availability. Chinook salmon populations have declined due to degradation of habitat, hydrology issues, harvest, and hatchery introgression; such reductions may require an increase in foraging effort. In addition, these prey contain environmental pollutants (e.g., flame retardants; PCBs and DDT). These contaminants become concentrated at higher trophic levels and may lead to immune suppression or reproductive impairment (70 FR 69903).

The inland waters of Washington and British Columbia support a large whale watch industry, commercial shipping, and recreational boating; these activities generate underwater noise, which may mask whales' communication or interrupt foraging. The factors that originally endangered the species persist throughout its habitat: contaminants, vessel traffic, and reduced prey. The DPS's resilience to future perturbation is reduced as a result of its small population size (N = 86); however, it has demonstrated the ability to recover from smaller population sizes in the past and has shown an increasing trend over the last several years. NMFS is currently conducting a status review prompted by a petition to delist the DPS based on new information, which indicates that there may be more paternal gene flow among populations than originally detected (Pilot et al. 2010).

Designated critical habitat. The designated critical habitat consists of approximately 6,630 km^2 in three areas: the Summer Core Area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca. It provides the following physical and biological features: water quality to support growth and development; prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and inter-area passage conditions to allow for migration, resting, and foraging.

6.4 Pacific Salmonids

6.4.1 The 2016 Five-Year Status Reviews

The Pacific salmonid species have similar life histories, habitat needs, and threats. In May 2016, NOAA Fisheries' West Coast Region completed a five-year status review of all 28 West Coast salmon and steelhead species listed under the ESA (Table 5). Some species, such Oregon Coast coho salmon, mid-Columbia steelhead and Hood Canal chum, rebounded from the lows of past decades. Highly endangered Snake River sockeye have benefitted from a captive broodstock program while Snake River steelhead populations are steady. The California drought and unusually high ocean and stream temperatures over the 5-year period hit many populations hard. In the case of Sacramento River winter-run Chinook salmon, for example, drought conditions and high stream temperatures reduced the 2015 survival of juvenile fish in the first stretch of river to just three percent.

Table 5. Summary of current ESA listing status, recent trends and summary of conclusions for the most recent five-year review for Pacific salmonids (Northwest Fisheries Science Center 2015, Williams et al. 2016).

Species	ESU/DPS	Five-Year Review Risk Trend	ESA Listing Status
Chinook	Upper Columbia spring	Stable	Endangered
	Snake River spring/summer	Stable	Threatened
	Snake River fall	Improving	Threatened
	Upper Willamette spring	Declining	Threatened
	Lower Columbia	Stable/Improving	Threatened
	Puget Sound	Stable/Declining	Threatened
	California Coastal	Mixed	Threatened
	Central Valley Spring	Decreased risk of extinction	Threatened
	Sacramento River winter	Increased risk of extinction	Endangered
Coho	Lower Columbia	Stable/Improving	Threatened
	Oregon Coast	Improving	Threatened
	Southern Oregon/Northern California	Mixed	Threatened
	Central California Coast	Mixed	Endangered
Sockeye	Snake River	Improving	Endangered
	Lake Ozette	Stable	Threatened
Chum	Hood Canal summer	Improving	Threatened
	Columbia River	Stable	Threatened
Steelhead	Upper Columbia	Improving	Threatened
	Snake River	Stable/Improving	Threatened
	Middle Columbia	Stable/Improving	Threatened
	Upper Willamette	Declining	Threatened
	Lower Columbia	Stable	Threatened
	Puget Sound	Stable	Threatened
	Northern California	Mixed	Threatened
	Central California Coast	Uncertain	Threatened
	South Central California	Declining	Threatened
	Southern California	Uncertain	Endangered

Threats. During all freshwater life stages, salmonids require cool water that is free of contaminants. Water free of contaminants supports survival, growth, and maturation of salmon and the abundance of their prey. In addition to affecting survival, growth, and fecundity, contaminants can disrupt normal behavior necessary for successful migration, spawning, and juvenile rearing. Sufficient forage is necessary for juveniles to maintain growth that reduces freshwater predation mortality, increases overwintering success, initiates smoltification, and increases ocean survival. Natural riparian cover such as submerged and overhanging large wood and aquatic vegetation provides shelter from predators, shades freshwater to prevent increase in water temperature, provides nutrients from leaf litter, supports production of insect prey, and creates important side channels. Riparian vegetation stabilizes bank soils and captures fine sediment in runoff, which maintains functional channel bottom substrate for development of eggs and alevins.

The process of smoltification enables salmon to adapt to the ocean environment. Environmental factors such as exposure to chemicals including heavy metals and elevated water temperatures can affect the smoltification process, not only at the interface between fresh water and saltwater, but higher in the watershed as the process of transformation begins long before fish enter saltwater (Wedemeyer et al. 1980).

The three major threats to Atlantic salmon identified in the listing rule also threaten Pacific salmonids: dams, regulatory mechanisms related to dams, and low marine survival. In addition, a number of secondary threats were identified, including threats to habitat quality and accessibility, commercial and recreational fisheries, disease and predation, inadequacy of regulatory mechanisms related to water withdrawal and water quality, aquaculture, artificial propagation, climate change, competition, and depleted fish communities.

The action area for this consultation overlaps with designated critical habitat for all Pacific salmonids. NMFS has identified features of designated critical habitat that are essential to the conservation of the species. Many of these features specific to each life stage (e.g., migration, spawning, rearing, and estuary, see Table 5). The following sections describe the designated critical habitat for Pacific salmonids.

6.4.2 Chinook Salmon Designated Critical Habitat (Nine ESUs)

Designated critical habitat for the Puget Sound, Lower Columbia River, and Upper Willamette River ESUs for Chinook salmon identify features essential to the conservation of the species and sites necessary to support one or more Chinook salmon life stage(s). These features essential to the conservation of the species are detailed in Table 5 and include biological elements that are vulnerable to the stressors of the action. These include water quality conditions that support spawning and incubation, larval and juvenile development, and physiological transitions between fresh and saltwater. The features essential to the conservation of the species also include aquatic invertebrate and fish prey species and water quality to support juvenile and adult development, growth, and maturation, and natural cover of riparian and nearshore vegetation and aquatic vegetation. Designated critical habitat for the Snake River fall-run and Snake River spring/summer run Chinook salmon generically designates water quality, food, and riparian vegetation Features essential to the conservation of the species.

6.4.3 Chum Salmon Designated Critical Habitat (Two ESUs).

Areas designated as critical habitat are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. features essential to the conservation of the species for both chum salmon ESUs include freshwater spawning, rearing, and migration areas; estuarine and nearshore marine areas free of obstructions; and offshore marine areas with good water quality. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity.

6.4.4 Coho Salmon Designated Critical Habitat (Four ESUs)

The essential features of designated critical habitat for the Central California Coast and Southern Oregon/Northern California Coast coho salmon ESUs that are vulnerable to the stressors of the action are generically identified as water quality, food, and riparian vegetation. The essential features of designated critical habitat for the Lower Columbia River and Oregon Coast ESUs are more detailed. They include water quality conditions supporting spawning, incubation and larval development, water quality and forage supporting juvenile development; and natural cover of riparian and aquatic vegetation, water quality conditions supporting juvenile and adult physiological transitions between fresh- and saltwater, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation (Table 5).

6.4.5 Sockeye Salmon Designated Critical Habitat (Two ESUs)

The essential features of designated critical habitat for Lake Ozette sockeye ESU that are potentially affected by the stressors of the action include water quality conditions and forage species supporting spawning, incubation, development, growth, maturation, physiological transitions between fresh and saltwater, and natural cover of riparian and nearshore vegetation and aquatic vegetation. The essential features of designated critical habitat for Snake River sockeye potentially affected by the stressors of the action are identified generically as water quality, food, and riparian vegetation (Table 5).

6.4.6 Steelhead Trout Designated Critical Habitat (Eleven ESUs)

Designated critical habitat. The essential features of designated critical habitat for all steelhead DPSs that are potentially affected by the stressors of the action include water quality conditions and/or forage species supporting spawning, incubation, development, growth, maturation, physiological transitions between fresh and saltwater, and natural cover of riparian and nearshore vegetation and aquatic vegetation (Table 5).

6.5 Atlantic Salmon, Gulf of Maine DPS

Status. The Gulf of Maine DPS of Atlantic salmon was first listed as endangered in response to population decline caused by many factors, including overexploitation, degradation of water quality, and damming of rivers, all of which remain persistent threats. The species' listing currently include all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. The USFWS has jurisdiction over this species in freshwater, so the NMFS' jurisdiction is limited to potential PGP-authorized discharges from the coastal lands belonging to the Passamoquoddy Tribe at Pleasant Point. The most recent status review for Atlantic salmon was published in 2006 (Fay et al. 2006). This review stated that fewer than 1,500 adults have returned to spawn each year since 1998. The Population Viability Analysis estimates of the probability of extinction for the Gulf of Mexico DPS of Atlantic Salmon ranges from 19 percent to 75 percent within the next 100 years, even with the continuation of current levels of hatchery supplementation. The abundance was estimated at 1,014 individuals in 2007, the most recent year for which abundance records are available.

In 2015, NMFS announced a new program to focus and redouble its efforts to protect some of the species that are currently among the most at risk of extinction in the near future with the goal of reversing their declining trend so that the species will become a candidate for recovery in the future. Atlantic salmon is one of the eight species identified for this initiative (NMFS 2015c). These species were identified as among the most at-risk of extinction based on three criteria (1) endangered listing, (2) declining populations, and (3) are considered a recovery priority #1. A priority #1 species is one whose extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction, whose limiting factors and threats are well understood and the needed management actions are known and have a high probability of success, and is a species that is in conflict with construction or other developmental projects or other forms of economic activity (55 FR 24296, June 15, 1990).

Designated critical habitat. The designated critical habitat includes all anadromous Atlantic salmon streams whose freshwater range occurs in watersheds from the Androscoggin River northward along the Maine coast northeastward to the Dennys River, and wherever these fish occur in the estuarine and marine environment. The features essential to the conservation of the species identified within freshwater and estuarine habitats of the occupied range of the Gulf of Maine DPS include sites for spawning and incubation, juvenile rearing, and migration. Designated critical habitat and features essential to the conservation of the species were not designated within marine environments because of the limited of the physical and biological features that the species uses during the marine phase of its life.

6.6 Southern Pacific Eulachon

Status. Eulachon are small smelt native to eastern North Pacific waters from the Bering Sea to Monterey Bay, California, or from 61º N to 31º N (Hart and McHugh 1944, Eschmeyer et al. 1983, Minckley et al. 1986, Hay and McCarter 2000). Eulachon that spawn in rivers south of the Nass River of British Columbia to the Mad River of California comprise the southern population of Pacific eulachon. This species status is classified as "at moderate risk of extinction throughout all of its range" (Gustafson 2010) based upon timing of runs and genetic distinctions (Hart and McHugh 1944, McLean et al. 1999, Hay and McCarter 2000, McLean and Taylor 2001, Beacham et al. 2005). Based on a number of data sources, the 2016 Status Review Update for eulachon reports that the spawning population has increased between 2011 and 2015 and that of the size of some sub-populations is larger than originally estimated in 2010 (Gustafson et al. 2016). The status update does not recommend a change in status because it is too early to tell whether recent improvements in the southern DPS of eulachon will persist. Recent poor ocean conditions taken with given variability inherent in wild populations suggest that population declines may again become widespread in the upcoming return years.

Threats. The Biological Review Team 2010 assessment of the status of the southern DPS of eulachon ranked climate change impacts on ocean conditions as the most serious threat to the persistence of eulachon in all four subareas of the DPS: Klamath River, Columbia River, Fraser River, and British Columbia coastal rivers south of the Nass River. Climate change impacts on freshwater habitat and eulachon bycatch in offshore shrimp fisheries were also ranked in the top four threats in all subareas of the DPS. Dams and water diversions in the Klamath and Columbia rivers and predation in the Fraser and British Columbia coastal rivers filled out the last of the top four threats (Gustafson 2010).

Designated critical habitat. The designated critical habitat for the southern population of Pacific eulachon includes freshwater creeks and rivers and their associated estuaries, comprising approximately 539 km (335 mi) of habitat. The physical or biological features potentially affected by the stressors of the action include water quality conditions supporting spawning and incubation, larval and adult mobility, and abundant prey items supporting larval feeding after the yolk sac is depleted, and nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. Eulachon prey on a wide variety of species including crustaceans such as copepods and euphausiids (Hay and McCarter 2000, WDFW and ODFW 2001), unidentified malacostracans (Sturdevant et al. 1999), cumaceans (Smith and Saalfeld 1955) mysids, barnacle larvae, and worm larvae (WDFW and ODFW 2001).

6.7 Shortnose Sturgeon

Status. We used information available in the Shortnose Sturgeon Recovery Plan (NMFS 1998), the 2010 NMFS Biological Assessment (SNS BA 2010), and the listing document (32 FR 4001) to summarize the status of the species. Shortnose sturgeon were listed as endangered throughout its range on March 11, 1967 pursuant to the Endangered Species Preservation Act of 1966. Shortnose sturgeon remained on the list as endangered with enactment of the ESA in 1973. Shortnose sturgeon occur along the Atlantic Coast of North America, from the Saint John River in Canada to the Saint Johns River in Florida. The Shortnose Sturgeon Recovery Plan describes 19 shortnose sturgeon populations that are managed separately in the wild. Two additional geographically separated populations occur behind dams in the Connecticut River (above the Holyoke Dam) and in Lake Marion on the Santee-Cooper River system in South Carolina (above the Wilson and Pinopolis Dams). While shortnose sturgeon spawning has been documented in several rivers across its range (including but not limited to: Kennebec River, ME, Connecticut River, Hudson River, Delaware River, Pee Dee River, SC, Savannah, Ogeechee, and Altamaha rivers, GA), status for many other rivers remain unknown.

Threats. The viability of sturgeon populations is highly sensitive to juvenile mortality resulting in lower numbers of sub-adults recruiting into the adult breeding population. The 1998 recovery plan for shortnose sturgeon (NMFS 1998) identify Habitat degradation or loss (resulting, for example, from dams, bridge construction, channel dredging, and pollutant discharges), and mortality (for example, from impingement on cooling water intake screens, dredging, and incidental capture in other fisheries) as principal threats to the species' survival. Introductions and transfers of indigenous and nonindigenous sturgeon, intentional or accidental, may threaten wild shortnose sturgeon populations by imposing genetic threats, increasing competition for food or habitat, or spreading diseases. Sturgeon species are susceptible to viruses enzootic to the west coast and fish introductions could further spread these diseases. Shortnose sturgeon populations are at risk from incidental bycatch, loss of habitat, dams, dredging and pollution. These threats are likely to continue into the future. We conclude that the shortnose sturgeon’s resilience to further perturbation is low.

Designated critical habitat. No critical habitat has been designated for shortnose sturgeon.

6.8 Atlantic Sturgeon (Five DPSs)

Status. The range of Atlantic sturgeon includes the St. John River in Canada, to St. Johns River in Florida. EPA has NPDES permitting authority throughout New Hampshire, Massachusetts, the District of Columbia, Federally operated facilities in Delaware and Tribal lands in Connecticut, Rhode Island, New York, North Carolina, and Florida. Five DPSs of Atlantic sturgeon were designated and listed under the ESA on February 6, 2012 (Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic). The Gulf of Maine, New York Bight, and Chesapeake Bay DPSs are those potentially affected by the 2016 PGP.

Threats. Of the stressors evaluated in the 2007 status review (ASSRT 2007), bycatch mortality, water quality, lack of adequate state and/or Federal regulatory mechanisms, and dredging activities were most often identified as the most significant threats to the viability of Atlantic sturgeon populations. Additionally, some populations were affected by unique stressors, such as habitat impediments (e.g., Cape Fear and Santee-Cooper rivers) and apparent ship strikes (e.g., Delaware and James rivers).

Designated critical habitat. The proposed designated critical habitat for Atlantic sturgeon includes tidally-affected accessible waters of coastal estuaries where the species occurs (81 FR 35701, 81 FR 36077). The essential features of the proposed designated critical habitat for the Atlantic sturgeon DPSs within these rivers do not include plant or animal life that may be affected by the stressors of the action. From north to south, the rivers and waterways that make up the spatial extent of designated critical habitat are detailed in Table 6.

Table 6. River systems in the action area that are included in proposed designated critical habitat for Atlantic sturgeon.

DPS	River/Waterway		
Gulf of Maine	Penobscot Piscataqua	Kennebec Merrimack	Androscoggin
New York Bight	Connecticut Housatonic Delaware	Housatonic	Hudson
Chesapeake Bay	Susquehanna York James	Potomac Mattaponi	Rappahannock Pamunkey

6.9 Green Sturgeon

Status. We used information available in the 2002 Status Review and Status Review Updates (GSSR 2002, 2005, 2015), and the proposed and final listing rules (70 FR 17836; 71 FR 17757) to summarize the status of the species. The Southern DPS of green sturgeon is listed as threatened (71 FR 17757; April 7, 2006). On June 2, 2010, NMFS issued a 4(d) Rule for the Southern DPS, applying certain take prohibitions (75 FR 30714). The most recent 5-year status review was published in August of 2015. Green sturgeon occur in coastal Pacific waters from San Francisco Bay to Canada. The Southern DPS of green sturgeon includes populations south of (and exclusive of) the Eel River, coastal and Central Valley populations, and the spawning population in the Sacramento River, CA (Adams et al. 2007).

The 2015 status update indicates that DPS structure of the North American green sturgeon has not changed and that many of the principle factors considered when listing Southern DPS green sturgeon as threatened are relatively unchanged. Loss of spawning habitat and bycatch in the white sturgeon commercial fishery are two major causes for the species decline. Spawning in the Feather River is encouraging and the decommissioning of Red Bluff Diversion Dam and breach of Shanghai Bench makes spawning conditions more favorable. The prohibition of retention in commercial and recreational fisheries has eliminated a known threat and likely had a very positive effect on the overall population, although recruitment indices are not presently available.

Threats. The 2015 status review (NMFS 2015b) for the southern DPS of green sturgeon indicates that many of the principle factors considered when listing Southern DPS green sturgeon as threatened are relatively unchanged. Current threats to the Southern DPS include entrainment by water projects, contaminants, incidental bycatch and poaching. Given the small population size, the species' life history traits (e.g., slow to reach sexual maturity), and that the threats to the population are likely to continue into the future, the Southern DPS is not resilient to further perturbations. The spawning area for the species is still small, as the species still encounters impassible barriers in the Sacramento, Feather and other rivers that limit their spawning range. Entrainment threat includes stranding in flood diversions during high water events.

Designated critical habitat. Designated critical habitat for the Southern DPS of green sturgeon was designated includes coastal U.S. marine waters within 60 fathoms deep from Monterey Bay, CA to Cape Flattery, Washington, including the Strait of Juan de Fuca, and numerous coastal rivers and estuaries: see the Final Rule for a complete description (74 FR 52300). Essential features identified in this designation that may be affects by the stressors of the action include acceptably low levels of contaminants (e.g., pesticides, PAHs, heavy metals that may disrupt the normal behavior, growth, and viability of subadult and adult green sturgeon) and abundant prey items (benthic invertebrates and fish) for subadults and adults.

6.10 Bocaccio Puget Sound/Georgia Basin DPS

The bocaccio that occur in the Georgia Basin are listed as an endangered "species," which, in this case, refers to a distinct segment of a vertebrate population (75 FR 22276). The listing includes bocaccio throughout Puget Sound, which encompasses all waters south of a line connecting Point Wilson on the Olympic Peninsula and Partridge on Whidbey Island; West Point on Whidbey Island, Deception Island, and Rosario Head on Fidalgo Island; and the southern end of Swinomish Channel between Fidalgo Island and McGlinn Island (U.S. Geological Survey 1979), and the Strait of Georgia, which encompasses the waters inland of Vancouver Island, the Gulf Islands, and the mainland coast of British Columbia.

Status. Bocaccio have always been rare in recreational fisheries that occur in North Puget Sound and the Strait of Georgia; however, there have been no confirmed reports of bocaccio in Georgia Basin for several years. Although their abundance cannot be estimated directly, NMFS' BRT estimated that the populations of bocaccio and yelloweye rockfish are small in size, probably numbering fewer than 10,000 individuals in Georgia Basin and fewer than 1,000 total individuals in Puget Sound (74 FR 18532) (Drake et al. 2010). Georgia Basin bocaccio are most common at depths between 50 and 250 meters (160 and 820 feet).

Threats. The 2016 draft recovery plan for rockfish indicates that historical overfishing is recognized as the primary cause of the decline of rockfishes in Puget Sound (Palsson et al. 2008, Drake et al. 2010, Williams et al. 2010), there is some uncertainty about the relative impact of some fisheries today, and of the additional remaining threats, which include degraded water quality and habitat, contaminants, derelict fishing gear, and other threats (Palsson et al. 2008, Drake et al. 2010, WDFW 2013).

Designated critical habitat. NMFS proposed critical habitat designation includes approximately 1,185 mi^2 of marine habitat for bocaccio in Puget Sound, Washington. Physical or biological features essential to adult bocaccio include the benthic habitats or sites deeper than 30m (98ft) that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat are essential to conservation because these features support growth, survival, reproduction, and feeding opportunities by providing the structure for rockfish to avoid predation, seek food and persist for decades. Several attributes of these sites determine the quality of the habitat and are useful in considering the conservation value of the associated feature, and whether the feature may require special management considerations or protection. These attributes are also relevant in the evaluation of the effects of a proposed action in a section 7 consultation if the specific area containing the site is designated as critical habitat. These attributes include: (1) Quantity, quality and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities, (2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities, and (3) the type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

6.11 Yelloweye and Canary Rockfish (Puget Sound/Georgia Basin DPS)

Status. July of 2016 NMFS petitioned to delist the canary rockfish based on newly obtained genetic information that demonstrates that the Puget Sound/Georgia Basin canary rockfish population does not meet the DPS criteria and therefore does not qualify for listing under the ESA. Georgia Basin yelloweye rockfish occur through Puget Sound, which encompasses all waters south of a line connecting Point Wilson on the Olympic Peninsula and Partridge on Whidbey Island; West Point on Whidbey Island, Deception Island, and Rosario Head on Fidalgo Island; and the southern end of Swinomish Channel between Fidalgo Island and McGlinn Island (U.S. Geological Survey 1979), and the Strait of Georgia, which encompasses the waters inland of Vancouver Island, the Gulf Islands, and the mainland coast of British Columbia.

The frequency of yelloweye rockfish in collections from Puget Sound appears to have been highly variable; frequencies were less than 1 percent in the 1960s and 1980s and about 3 percent in the 1970s and 1990s. In North Puget Sound, however, the frequency of yelloweye rockfish has been estimated to have declined from a high of greater than 3 percent in the 1970s to about 0.65 percent in more recent samples. This decline combined with their low intrinsic growth potential, threats from bycatch in commercial and recreational fisheries, loss of nearshore rearing habitat, chemical contamination, and the proportion of coastal areas with low dissolved oxygen levels led to this species' listing as threatened under the ESA.

Although their abundance cannot be estimated directly, NMFS' Biological Review Team estimated that the populations of bocaccio, yelloweye rockfish and canary rockfish are small in size, probably numbering fewer than 10,000 individuals in Georgia Basin and fewer than 1,000 total individuals in Puget Sound (74 FR 18532) (Drake et al. 2010).

Designated critical habitat. Physical or biological features essential to the conservation of both adult and juvenile yelloweye rockfish are the same as for adult bocaccio and adult canary rockfish.

6.12 Nassau Grouper

Status. The Nassau grouper (*Epinephelus striatus*) is primarily a shallow-water, insular fish species found from inshore to about 330 feet (100m) depth. The species is distributed throughout the islands of the western Atlantic including Bermuda, the Bahamas, southern Florida and along the coasts of central and northern South America. It is not known from the Gulf of Mexico except at Campeche Bank off the coast of the Yucatan Peninsula, at Tortugas, and off Key West. Adults are generally found near coral reefs and rocky bottoms while juveniles are found in shallower waters in and around coral clumps covered with macroalgae (Laurencia spp.) and over seagrass beds. Their diet is mostly fishes and crabs, with diet varying by age/size. Juveniles feed mostly on crustaceans, while adults (>30 cm; 11.8 in) forage mainly on fish. The Nassau grouper usually forages alone and is not a specialized forager.

Under the authority of the Magnuson-Stevens Fisheries Act, NMFS classified the Nassau grouper as "overfished" in its October 1998 "Report to Congress on the status of Fisheries and Identification of overfished Stocks."

Designated critical habitat. Designated critical habitat has not been designated for this species.

6.13 Sea Turtles

Sea turtles share the common threats described below.

Bycatch: Fishing is the primary anthropogenic threat to sea turtles in the ocean. Fishing gear entanglement potentially drowns or seriously injures sea turtles. Fishing dredges can crush and entrap turtles, causing death and serious injury. Infection of entanglement wounds can compromise health. The development and operation of marinas and docks in inshore waters can negatively impact nearshore habitats. Turtles swimming or feeding at or just beneath the surface of the water are particularly vulnerable to boat and vessel strikes, which can result in serious propeller injuries and death.

Marine Debris: Ingestion or entanglement in marine debris is a cause of morbidity and mortality for sea turtles in the pelagic (open ocean) environment (Stamper et al. 2009). Consumption of non-nutritive debris also reduces the amount of nutritive food ingested, which then may decrease somatic growth and reproduction (McCauley and Bjorndal 1999). Marine debris is especially problematic for turtles that spend all or significant portions of their life cycle in the pelagic environment (e.g., leatherbacks, juvenile loggerheads, and juvenile green turtles).

Habitat Disturbance: Sea turtle nesting and marine environments are facing increasing impacts through structural modifications, sand nourishment, and sand extraction to support widespread development and tourism (Lutcavage et al. 1997, Bouchard et al. 1998, Hamann et al. 2006, Maison 2006, Hernandez et al. 2007, Santidrián Tomillo et al. 2007, Patino-Martinez 2013). These factors decrease the amount of nesting area available to nesting females, and may evoke a change in the natural behaviors of adults and hatchlings through direct loss of and indirect (e.g., altered temperatures, erosion) mechanisms (Ackerman 1997, Witherington et al. 2003, 2007). Lights from developments alter nesting adult behavior and are often fatal to emerging hatchlings as they are drawn to light sources and away from the sea (Witherington and Bjorndal 1991, Witherington 1992, Cowan et al. 2002, Deem et al. 2007, Bourgeois et al. 2009).

Beach nourishment also affects the incubation environment and nest success. Although the placement of sand on beaches may provide a greater quantity of nesting habitat, the quality of that habitat may be less suitable than pre-existing natural beaches. Constructed beaches tend to differ from natural beaches in several important ways. They are typically wider, flatter, more compact, and the sediments are more moist than those on natural beaches (Nelson et al. 1987) (Ackerman 1997, Ernest and Martin 1999). Nesting success typically declines for the first year or two following construction, even when more nesting area is available for turtles ((Trindell et al. 1998) (Ernest and Martin 1999, Herren 1999). Likely causes of reduced nesting success on constructed beaches include increased sand compaction, escarpment formation, and changes in beach profile (Nelson et al. 1987, Grain et al. 1995, Lutcavage et al. 1997, Steinitz et al. 1998, Ernest and Martin 1999, Rumbold et al. 2001). Compaction can inhibit nest construction or increase the amount of time it takes for turtles to construct nests, while escarpments often cause female turtles to return to the ocean without nesting or to deposit their nests seaward of the escarpment where they are more susceptible to frequent and prolonged tidal inundation. In short, sub-optimal nesting habitat may cause decreased nesting success, place an increased energy burden on nesting females, result in abnormal nest construction, and reduce the survivorship of eggs and hatchlings. In addition, sand used to nourish beaches may have a different composition than the original beach; thus introducing lighter or darker sand, consequently affecting the relative nest temperatures (Ackerman 1997, Milton et al. 1997).

In addition to effects on sea turtle nesting habitat, anthropogenic disturbances also threaten coastal foraging habitats, particularly areas rich in seagrass and marine algae. Coastal habitats are degraded by pollutants from coastal runoff, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, increased under water noise and boat traffic, as well as structural degradation from excessive boat anchoring and dredging (Francour et al. 1999, Lee Long et al. 2000, Waycott et al. 2005).

Pollutants: Conant et al. (2009) included a review of the impacts of marine pollutants on sea turtles: marine debris, oil spills, and bioaccumulative chemicals. Sea turtles at all life stages appear to be highly sensitive to oil spills, perhaps due to certain aspects of their biology and behavior, including a lack of avoidance behavior, indiscriminate feeding in convergence zones, and large pre-dive inhalations (Milton and Lutz 2003). Milton et al. (2003) state that the oil effects on turtles include increased egg mortality and developmental defects, direct mortality due to oiling in hatchlings, juveniles and adults, and impacts to the skin, blood, salt glands, and digestive and immune systems. Vargo et al. (1986) reported that sea turtles would be at substantial risk if they encountered an oil spill or large amounts of tar in the environment. In a review of available information on debris ingestion, Balazs (1985) reported that tar balls were the second most prevalent type of debris ingested by sea turtles. Physiological experiments showed that sea turtles exposed to petroleum products may suffer inflammatory dermatitis, ventilator disturbance, salt gland dysfunction or failure, red blood cell disturbances, immune response, and digestive disorders (Vargo et al. 1986, Lutcavage et al. 1995).

Natural Threats: A number of threats are common to all sea turtles.[11] Predation is a primary natural threat. While cold stunning is not a major concern for leatherback sea turtles, which can tolerate low water temperatures, it is considered a major natural threat to other sea turtle species. Disease is also a factor in sea turtle survival. Fibropapillomatosis (FP) tumors are a major threat to green turtles in some areas of the world and is particularly associated with degraded coastal habitat. Scientists have also documented FP in populations of loggerhead, olive ridley, and flatback turtles, but reports in green turtles are more common. Large tumors can interfere with feeding and essential behaviors, and tumors on the eyes can cause permanent blindness. FP was first described in green turtles in the Florida Keys in the 1930s. Since then it has been recorded in many green turtle populations around the world. The effects of FP at the population level are not well understood. The sand-borne fungal pathogens *Fusarium falciforme* and *F. keratoplasticum* capable of killing greater than 90 percent of sea turtle embryos they infect, threatening nesting productivity under some conditions. These pathogens can survive on decaying organic matter and embryo mortality rates attributed to fusarium were associated with clay/silt nesting areas compared to sandy areas (Sarmiento-Ramırez et al. 2014).

Climate Change and Sea Turtle Nesting Habitat. While all species are affected by the influence of climate change on habitat distribution and quality, the Conant et al. 2009 review describes unique impact of climate change on sea turtle nesting habitat. Rising sea level is one of the most certain consequences of climate change (Titus and Narayanan 1995), and will result in increased erosion rates along nesting beaches. This could particularly affect areas with low-lying

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[11] See http://www.nmfs.noaa.gov/pr/species/turtles/threats.htm, updated June 16, 2014

beaches where sand depth is a limiting factor, as the sea will inundate nesting sites and decrease available nesting habitat (Fish et al. 2005, Baker et al. 2006). The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Baker et al. 2006). On some undeveloped beaches, shoreline migration will have limited effects on the suitability of nesting habitat. The Bruun rule specifies that during a sea level rise, a typical beach profile will maintain its configuration but will be translated landward and upward (Rosati et al. 2013). However, along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels will cause severe effects on nesting females and their eggs. Erosion control structures can result in the permanent loss of dry nesting beach or deter nesting females from reaching suitable nesting sites (Council 1990). Nesting females may deposit eggs seaward of the erosion control structures potentially subjecting them to repeated tidal inundation. Non-native vegetation often out competes native species, is usually less stabilizing, and can lead to increased erosion and degradation of suitable nesting habitat. Exotic vegetation may also form impenetrable root mats that can prevent proper nest cavity excavation, invade and desiccate eggs, or trap hatchlings.

6.13.1 Leatherback Sea Turtle

Status. The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. It ranges from tropical to subpolar latitudes, worldwide.

The global population of adult females has declined over 70 percent in less than one generation, from an estimated 115,000 adult females in 1980 to 34,500 adult females in 1995 (Pritchard 1982, Spotila et al. 1996). There may be as many as 34,000 – 94,000 adult leather backs in the North Atlantic, alone (TEWG 2007), but dramatic reductions (> 80 percent) have occurred in several populations in the Pacific, which was once considered the stronghold of the species (Sarti Martinez 2000). The 2013 five year review (NMFS and USFWS 2013b) reports that the East Pacific and Malaysia leatherback populations have collapsed, yet Atlantic populations generally appear to be stable or increasing. Many explanations have been provided to explain the disparate population trends, including fecundity and foraging differences seen in the Pacific, Atlantic, and Indian Oceans. Since the last 5-year review, studies indicate that high reproductive output and consistent and high quality foraging areas in the Atlantic Ocean have contributed to the stable or recovering populations; whereas prey abundance and distribution may be more patchy in the Pacific Ocean, making it difficult for leatherbacks to meet their energetic demands and lowering their reproductive output. Both natural and anthropogenic threats to nesting and marine habitats continue to affect leatherback populations, including the 2004 tsunami in the Indian Ocean, 2010 oil spill in the U.S. Gulf of Mexico, logging practices, development, and tourism impacts on nesting beaches in several countries.

In 2015, NMFS announced a new program to focus and redouble its efforts to protect some of the species that are currently among the most at risk of extinction in the near future with the goal of reversing their declining trend so that the species will become a candidate for recovery in the future. The leatherback sea turtle is one of the eight species identified for this initiative (NMFS 2015c). These species were identified as among the most at-risk of extinction based on three criteria (1) endangered listing, (2) declining populations, and (3) are considered a recovery priority #1. A priority #1 species is one whose extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction, whose limiting factors and threats are well understood and the needed management actions are known and have a high probability of success, and is a species that is in conflict with construction or other developmental projects or other forms of economic activity (55 FR 24296, June 15, 1990).

Designated critical habitat. On March 23, 1979, leatherback designated critical habitat was identified adjacent to Sandy Point, St. Croix, U.S. Virgin Islands from the 183 m isobath to mean high tide level between 17° 42’12” N and 65°50’00” W (44 FR 17710). This habitat is essential for nesting, which has been increasingly threatened since 1979, when tourism increased significantly, bringing nesting habitat and people into close and frequent proximity; however, studies do not support significant designated critical habitat deterioration. On January 20, 2012, NMFS issued a final rule to designate additional designated critical habitat for the leatherback sea turtle (50 CFR 226). This designation includes approximately 43,798 km2 stretching along the California coast from Point Arena to Point Arguello east of the 3000 m depth contour; and 64,760 km^2 stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 m depth contour. The designated areas comprise approximately 108558 km2 of marine habitat and include waters from the ocean surface down to a maximum depth of 80 m. They were designated specifically because of the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

6.13.2 Hawksbill Sea Turtle

Status. The hawksbill sea turtle has a sharp, curved, beak-like mouth. It has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical oceans. The hawksbill turtle was once abundant in tropical and subtropical regions throughout the world. Over the last century, this species has declined in most areas and stands at only a fraction of its historical abundance. According to the 2013 status review (NMFS and USFWS 2013a), nesting populations in the eastern Pacific, and the Nicaragua nesting population in the western Caribbean appears to have improved. However, the trends and distribution of the species throughout the globe largely is unchanged. Although greatly depleted from historical levels, nesting populations in the Atlantic in general are doing better than in the Indian and Pacific Oceans. In the Atlantic, more population increases have been recorded in the insular Caribbean than along the western Caribbean mainland or the eastern Atlantic. In general, hawksbills are doing better in the Indian Ocean (especially the southwestern and northwestern Indian Ocean) than in the Pacific Ocean. The situation for hawksbills in the Pacific Ocean is particularly dire, despite the fact that it still has more nesting hawksbills than in either the Atlantic or Indian Oceans.

Designated critical habitat. On September 2, 1998, NMFS established designated critical habitat for hawksbill sea turtles around Mona and Monito Islands, Puerto Rico (63 FR 46693). Aspects of these areas that are important for hawksbill sea turtle survival and recovery include important natal development habitat, refuge from predation, shelter between foraging periods, and food for hawksbill sea turtle prey.

6.13.3 Kemp’s Ridley Sea Turtle

Status. The Kemp’s ridley is the smallest of all sea turtle species and considered to be the most endangered sea turtle, internationally (Groombridge 1982, TEWG 2000). The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973. According to the 2015 status review (NMFS and USFWS 2013a), population growth rate (as measured by numbers of nests) stopped abruptly after 2009. Given the recent lower nest numbers, the population is not projected to grow at former rates. An unprecedented mortality in subadult and adult females post-2009 nesting season may have altered the 2009 age structure and momentum of the population, which had a carryover impact on annual nest numbers in 2011-2014. The results indicate the population is not recovering and cannot meet recovery goals unless survival rates improve. The Deep Water Horizon oil spill that occurred at the onset of the 2010 nesting season and exposed Kemp's ridleys to oil in nearshore and offshore habitats may have been a factor in fewer females nesting in subsequent years, however this is still under evaluation. The long-term impacts from the Deep Water Horizon oil spill and response to the spill (e.g., dispersants) to sea turtles are not yet known. Given the Gulf of Mexico is an area of high-density offshore oil exploration and extraction, future oil spills are highly probable and Kemp's ridleys and their habitat may be exposed and injured. Commercial and recreational fisheries continue to pose a substantial threat to the Kemp's ridley despite measures to reduce bycatch. Kemp's ridleys have the highest rate of interaction with fisheries operating in the Gulf of Mexico and Atlantic Ocean than any other species of turtle.

Designated critical habitat. Designated critical habitat has not been designated for this species.

6.13.4 Olive Ridley Sea Turtle

Status. The olive ridley sea turtle is a small, mainly pelagic, sea turtle with a circumtropical distribution. The species was listed under the ESA on July 28, 1978 (43 FR 32800). The species was separated into two listing designations: endangered for breeding populations on the Pacific coast of Mexico, and threatened wherever found except where listed as endangered (i.e., in all other areas throughout its range). The status review (NMFS and USFWS 2014), indicates that, based on the current number of olive ridleys nesting in Mexico, three populations appear to be stable (Mismaloya, Tlacoyunque, and Moro Ayuta), two increasing (Ixtapilla, La Escobilla) and one decreasing (Chacahua). Elsewhere in the eastern Pacific, the large arribada nesting populations have declined since the 1970s. Nesting at some arribada beaches continues to decline (e.g., Nancite in Costa Rica) and is stable or increasing at others (e.g., Ostional in Costa Rica). There are too few data available from solitary nesting beaches to confirm the declining trend that has been described for numerous countries throughout the region including El Salvador, Guatemala, Costa Rica, and Panama. Recent at-sea estimates of density and abundance of the olive ridley in the Pacific show a yearly estimate of 1.39 million (Confidence Interval: 1.15 to 1.62 million), which is consistent with the increases seen on nesting beaches as a result of protection programs that began in the 1990s.

Western Atlantic arribada nesting populations are currently very small. The Suriname olive ridley population is currently small and has declined by more than 90 percent since the late 1960s. However, nesting is reported to be increasing in French Guiana. The other nesting population in Brazil, for which no long term data are available, is small, but increasing. In the eastern Atlantic, long-term data are not available and thus the abundance and trends of this population cannot be assessed at this time. In the northern Indian Ocean, arribada nesting populations are still large, but trend data are ambiguous and major threats continue. Declines of solitary nesting olive ridleys have been reported in Bangladesh, Myanmar, Malaysia, Pakistan, and southwest India.

Designated critical habitat. Designated critical habitat has not been designated for this species.

6.13.5 Loggerhead Sea Turtle

Status. Based on the 2009 status review (Conant et al. 2009), for three of five DPSs with sufficient data (Northwest Atlantic Ocean, South Pacific Ocean, and North Pacific Ocean), analyses indicate a high likelihood of quasi-extinction. Similarly, threat matrix analysis indicated that all other DPSs have the potential for a severe decline in the future.

Northwest Atlantic Ocean loggerhead sea turtle DPS designated critical habitat. The final designated critical habitat for the Northwest Atlantic Ocean loggerhead DPS within the Atlantic Ocean and the Gulf of Mexico includes 36 occupied marine areas within the range of the Northwest Atlantic Ocean DPS (79 FR 39855). These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors.

6.13.6 Green Sea Turtle

Status. The green sea turtle was separated into two listing designations: endangered for breeding populations in Florida and the Pacific coast of Mexico, and threatened in all other areas throughout its range. On August 1, 2012, NMFS found that a petition to identify the Hawaiian population of green turtle as a DPS, and to delist the DPS, may be warranted (77 FR 45571). In April 2016, we removed the range-wide and breeding population listings of the green sea turtle, and in their place, listed eight DPSs as threatened and 3 DPSs as endangered (81 FR 20057). Among these, only the North Atlantic DPS occurs in waters where EPA has permitting authority.

Once abundant in tropical and subtropical waters, globally, green sea turtles exist at a fraction of their historical abundance, as a result of over-exploitation. The North Atlantic DPS is characterized by geographically widespread nesting with eight sites having high levels of abundance (i.e., <1,000 nesters). Nesting is reported in 16 countries and/or U.S. Territories at 73 sites. This region is data rich and has some of the longest running studies on nesting and foraging turtles anywhere in the world. All major nesting populations demonstrate long-term increases in abundance. The prevalence of FP has reached epidemic proportions in some parts of the North Atlantic DPS. The extent to which this will affect the long-term outlook for green turtles in the North Atlantic DPS is unknown and remains a concern, although nesting trends across the DPS continue to increase despite the high incidence of the disease. There are still concerns about future risks, including habitat degradation (particularly coastal development), bycatch in fishing gear, continued turtle and egg harvesting, and climate change.

Designated critical habitat. On September 2, 1998, NMFS designated critical habitat for green sea turtles (63 FR 46694), which include coastal waters surrounding Culebra Island, Puerto Rico. Seagrass beds surrounding Culebra provide important foraging resources for juvenile, subadult, and adult green sea turtles. Additionally, coral reefs surrounding the island provide resting shelter and protection from predators. This area provides important developmental habitat for the species.

6.14 Corals

Status. There are currently 22 coral species listed as threatened under the ESA, 16 of which occur in the action area (Table 7). Information from the proposed listings (77 FR 73219 and 79 FR 53852) and status reports (ABRT 2005) were used to summarize the status of these species.

Table 7: Threatened coral species occurring in the PGP action area.

Threatened Corals	Currently Known in These U.S. Geographic Areas			
Caribbean Waters: Puerto Rico				
Acropora cervicornis (Staghorn)*and designated critical habitat*	X			
Acropora palmata (Elkhorn) *and designated critical habitat*	X			
Mycetophyllia ferox	X			
Dendrogyra cylindrus	X			
Orbicella annularis	X			
Orbicella faveolata	X			
Orbicella franksi	X			
Pacific Waters				
	Guam	**Northern Mariana Islands**	**Pacific Remote Island Areas**	**American Samoa**
Acropora globiceps	X	X	X	X
Acropora jacquelineae				X
Acropora retusa	X		X	X
Acropora rudis				X
Acropora speciosa			X	X
Euphyllia paradivisa				X
Isopora crateriformis				X
Pavona diffluens	X	X		X
Seriatopora aculeata	X			

Threats. Massive mortality events from disease conditions of corals and the keystone grazing urchin *Diadema antillarum* have precipitated widespread and dramatic changes in reef community structure. Large-scale coral bleaching reduces population viability. In addition, continuing coral mortality from periodic acute events such as hurricanes, disease outbreaks, and bleaching events from ocean warming have added to the poor state of coral populations and yielded a remnant coral community with increased dominance by weedy brooding species, decreased overall coral cover, and increased macroalgal cover. Additionally, iron enrichment may predispose the basin to algal growth. Further, coral growth rates in many areas have been declining over decades. Such reductions prevent successful recruitment as a result of reduced density. Finally, climate change is likely to result in the endangerment of many species as a result of temperature increases (and resultant bleaching), sea level rises, and ocean acidification (van Dam et al. 2012a, Gittings et al. 2013).

Designated critical habitat. On November 26, 2008, NMFS designated critical habitat for elkhorn and staghorn coral. They designated marine habitat in four specific areas: Florida (1,329 square miles), Puerto Rico (1,383 square miles), St. John/St. Thomas (121 square miles), and St. Croix (126 square miles). These areas support the following physical or biological features that are essential to the conservation of the species: substrate of suitable quality and availability to support successful larval settlement and recruitment and reattachment and recruitment of fragments.

7 ENVIRONMENTAL BASELINE

The *Environmental Baseline* is defined as: "past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" (50 CFR 402.02). The key purpose of the environmental baseline is to describe the natural and anthropogenic factors influencing the status and condition of ESA-listed species and designated critical habitat in the action area. Since this is a programmatic consultation on what is primarily a continuing action with a large geographic scope, this environmental baseline focuses more generally on the status and trends of the aquatic ecosystems in the U.S. and the consequences of that status for listed resources. The action considered in this opinion is the Clean Water Act PGP authorization of discharge of pesticide pollutants to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur, and the interrelated actions of discharges of pesticides that are not included in the definition of pesticide pollutants. For this reason the discussion of the baseline conditions for this opinion focuses on water quality and pesticides. A more comprehensive discussion of the baseline condition of these species is provided in Appendix B, which includes consideration of impacts to the environmental baseline of factors such as climate change, by-catch, vessel-strikes, etc.

Activities that negatively impact water quality also threaten aquatic species. The deterioration of water quality is a contributing factor that has led to the endangerment of some aquatic species under NMFS' jurisdiction. Declines in populations of ESA-listed species leave them vulnerable to a multitude of threats. Due to the cumulative effects of reduced abundance, low or highly variable growth capacity, and the loss of essential habitat, these species are less resilient to additional disturbances. In larger populations, stressors that affect only a limited number of individuals could once be tolerated by the species without resulting in population level impacts; in smaller populations, the same stressors are more likely to reduce the likelihood of survival. It is with this understanding of the *Environmental Baseline* that we consider the effects of the proposed action, including the likely effect that the PGP will have on endangered and threatened species and their designated critical habitat. There may be direct and indirect effects of activities associated with the proposed PGP in streams, wetlands, rivers, lakes, estuaries, irrigation canals, and drainage systems into, over, and in close proximity to which pesticides are applied. Areas adjacent to or downstream from these jurisdictional areas may be indirectly affected by activities authorized under the PGP. As noted in Section 4, we also analyze effects from the interrelated discharges of pesticides that do not fall into the category of pesticide pollutants. Based on the *Action Area*, as defined in Section 5 above, we identified the following regions and states for inclusion in the *Environmental Baseline* section of this opinion: Pacific Coast (Washington, Idaho, Oregon, and California); New England (Maine, New Hampshire, Vermont, and Massachusetts); Mid-Atlantic (District of Columbia, Delaware, and Virginia); U.S. Caribbean (Puerto Rico) and U.S. Pacific Islands (excluding Hawaii). These regions/states cover the vast majority of the proposed action area. At the regional level, our baseline assessment focused on the natural and anthropogenic threats affecting the ESA-listed species (and their habitats) within the action area for each particular region: Pacific Coast – all listed ESUs and DPSs of Pacific salmon and steelhead, eulachon, Southern DPS green sturgeon, and Southern Resident killer whale; New England – Atlantic salmon, Atlantic sturgeon (5 listed DPSs); Mid-Atlantic - Atlantic sturgeon (5 listed DPSs); Caribbean – Nassau grouper, elkhorn coral, staghorn coral, lobed star coral, boulder star coral, mountainous star coral, pillar coral, and rough cactus coral; Pacific Islands – all listed Pacific Islands coral species.

While there are some Tribal lands and federal facilities in regions or states not mentioned above, in general these areas are either very small, far removed from ESA-listed species or habitat, or not affected by the proposed action. For example, any discharges of pesticide on Tribal lands in Florida would have to be transported through Everglades or Big Cypress National Parks, where they would be degraded by exposure to sunlight, microbial action and chemical processes. While all areas of overlap between ESA-listed species (and their designated critical habitat) and the PGP coverage area are evaluated in this opinion, the environmental baseline will focus specifically on the aquatic ecosystems in the regions/states (listed above) where the anticipated effects of the proposed action are considered more likely to adversely affect ESA-listed species.

The action area for this consultation covers a very large number of individual watersheds and an even larger number of specific water bodies (e.g., lakes, rivers, streams, estuaries). It is, therefore, not practicable to describe the environmental baseline and assess risk for each particular area where the PGP may authorize discharges and activities. Accordingly, this opinion approaches the environmental baseline more generally by describing the activities, conditions and stressors which adversely affect ESA-listed species and designated critical habitat. These include natural threats (e.g., parasites and disease, predation and competition, wildland fires), water quality, hydromodification projects, land use changes, dredging, mining, artificial propagation, non-native species, fisheries, vessel traffic, and climate changes. For each of these threats we start with a general overview of the problem, followed by a more focused analysis at the regional and state level for the species listed above, as appropriate and where such data are available.

Our summary of the environmental baseline complements the information provided in the Status of Listed Resources section of this opinion, and provides the background necessary to evaluate and interpret information presented in the Effects of the Proposed Action and Cumulative Effects sections to follow. We then evaluate the consequences of EPA's proposed action in combination with the status of the species, environmental baseline and the cumulative effects to determine whether EPA can insure that the likelihood of jeopardy or adverse modification of designated critical habitat will be avoided.

The quality of the biophysical components within aquatic ecosystems is affected by human activities conducted within and around coastal waters, estuarine and riparian zones, as well as those conducted more remotely in the upland portion of the watershed. Industrial activities can result in discharge of pollutants, changes in water temperature and levels of dissolved oxygen, and the addition of nutrients. In addition, forestry and agricultural practices can result in erosion, run-off of fertilizers, herbicides, insecticides or other chemicals, nutrient enrichment and alteration of water flow. Chemicals such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later consumed by benthic feeders, such as macroinvertebrates, and then work their way higher into the food web (e.g., to sturgeon and sea turtles). Some of these compounds may affect physiological processes and impede a fish's ability to withstand stress, while simultaneously increasing the stress of the surrounding environment by reducing dissolved oxygen, altering pH, and altering other physical properties of the water body. Coastal and riparian areas are also heavily impaired by development and urbanization resulting in storm water discharges, non-point source pollution and erosion.

Climate change will extend growing seasons and spatial extent of arable land in temperate and northern biomes. This would be accompanied by changes land use and pesticide application patterns to control pests (Kattwinkel et al. 2011). However modeling results indicate that predictions of mean trends in pesticide fate and transport is complicated by case specific and location specific conditions (Gagnon et al. 2016). Hellmann et al. (2008) described the consequences for climate change on the effectiveness of management strategies for invasive species. Such species are expected become more vigorous in areas where they had previously been limited by cold or ice cover. Increased vigor would make making mechanical control less effective and pesticide use likely. Some plant species may become more tolerant of herbicides due to elevated CO2. Pesticide fate and transport, toxicities, degradation rates, and the effectiveness of biocontrol agents are expected to change with changing temperature and water regimes, driven largely by effects on rates in organism metabolism and abiotic reactions (Bloomfield et al. 2006, Schiedek et al. 2007, Noyes et al. 2009).

7.1.1 Water Quality

This section describes the current status and recent health trends of aquatic ecosystems within the *Action Area*. EPA sampling results (USEPA 2015) are summarized by region for the following biological, chemical, and physical indicators: 1) Biological – benthic macroinvertebrates; 2) Chemical – phosphorous, nitrogen, ecological fish tissue contaminants, sediment contaminants, sediment toxicity, and pesticides; and 3) Physical – dissolved oxygen, salinity, water clarity, pH, and Chlorophyll a. Cumulatively, these biological, chemical, and physical measures provide an overall picture of the ecological condition of aquatic ecosystems. Different thresholds, based on published references and the best professional judgment of regional experts, are used to evaluate each region as “good,” “fair,” or “poor” for each water quality indicator. EPA rates overall water quality from results of the five key indicators using the following guidelines: “poor” – two or more component indicators are rated poor; “fair” - one indicator is rated poor, or two or more are rated fair; “good” - no indicators are rated poor, and a maximum of one is rated fair.

Benthic macroinvertebrates (e.g., worms, mollusks, and crustaceans) inhabiting the bottom substrates of aquatic ecosystems are an important food source for a wide variety of fish, mammals, and birds. Benthic communities serve as reliable biological indicators of environmental quality because they are sensitive to chemical contamination, dissolved oxygen stresses, salinity fluctuations, and sediment disturbances. A good benthic index rating means that benthic habitats contain a wide variety of species, including low proportions of pollution-tolerant species and high proportions of pollution-sensitive species. A poor benthic index rating indicates that benthic communities are less diverse than expected and are populated by more pollution-tolerant species and fewer pollution-sensitive species than expected.

Chemical and physical components are measured as indicators of key stressors that have the potential to degrade biological integrity. Some of these are naturally occurring and others result only from human activities, but most come from both sources. EPA evaluates overall water quality based on the following primary indicators: surface nutrient enrichment—dissolved inorganic nitrogen and dissolved inorganic phosphorus concentrations; algae biomass—surface chlorophyll a concentration; and potential adverse effects of eutrophication—water clarity and bottom dissolved oxygen levels (USEPA 2015). Contaminants, including some pesticides, PCBs and mercury, also contribute to ecological degradation. Many contaminants adsorb onto suspended particles and accumulate in areas where sediments are deposited and may adversely affect sediment-dwelling organisms. As other organisms eat contaminated sediment-dwellers the contaminants can accumulate in organisms and potentially become concentrated throughout the food web.

Northeast Region (Maine to Virginia)

A wide variety of coastal environments are found in the Northeast region including rocky coasts, drowned river valleys, estuaries, salt marshes, and city harbors. The Northeast is the most populous coastal region in the U.S. In 2010, the region was home to 54.2 million people, representing about a third of the nation's total coastal population (USEPA 2015). The population in this area has increased by ten million residents (~ 23 percent) since 1970. The coast from Cape Cod to the Chesapeake Bay consists of larger watersheds that are drained by major riverine systems that empty into relatively shallow and poorly flushed estuaries. These estuaries are more susceptible to the pressures of a highly populated and industrialized coastal region.

A total of 238 sites were sampled to assess approximately 10,700 square miles of Northeast coastal waters. Figure 4 shows a summary of findings from the EPA's National Coastal Condition Assessment Report for the Northeast Region (USEPA 2015). Biological quality is rated as good in 62 percent of the Northeast coast region based on the benthic index. Poor biological conditions occur in 27 percent of the coastal area. About 11 percent of the region reported missing results, due primarily to difficulties in collecting benthic samples along the rocky coast north of Cape Cod. Based on the water quality index, 44 percent of the Northeast coast is in good condition, 49 percent is rated fair, and 6 percent is rated poor.

Based on the sediment quality index, 60 percent of the Northeast coastal area sampled is in good condition, 20 percent is in fair condition, and 9 percent is in poor condition (11 percent were reported "missing"). Compared to ecological risk-based thresholds for fish tissue contamination, less than 1 percent of the Northeast coast is rated as good, 27 percent is rated fair, and 33 percent is rated poor. Researchers were unable to evaluate fish tissue for 39 percent of the region, including almost the entire Acadian Province, because target species were not caught for analysis. The contaminants that most often exceed the thresholds for a "poor" rating in the assessed areas of the Northeast coast are selenium, mercury, arsenic, and, in a small proportion of the area, total PCBs.

New Hampshire conducted site specific water quality assessments on 42 percent of rivers, 81 percent of aquatic estuarine waters, and 85 percent of ocean waters within the state. Results reported in the New Hampshire 2012 Surface Water Quality Report indicate that approximately 0.8 percent of freshwater rivers and stream mileage is fully supportive of aquatic life, 26.0 percent is not supportive, and 73.2 percent could not be assessed due to insufficient information (NHDES 2012). In estuarine waters, approximately 0.8 percent of the square mileage is fully supportive of aquatic life, 91.9 percent is not supportive and 7.2 percent could not be assessed due to insufficient information. Twenty-six percent of estuarine waters fully met the water quality standards, 54 percent were impaired, and 19 percent could not be assessed due to insufficient information. In ocean waters, approximately 94.1 percent of the square mileage is fully supportive of aquatic life, 0.0 percent is not supportive and 5.9 percent could not be assessed due to insufficient information (NHDES 2012). Fifty-six percent of ocean waters fully met the water quality standards, 29 percent were impaired, and 15 percent could not be assessed due to insufficient information.

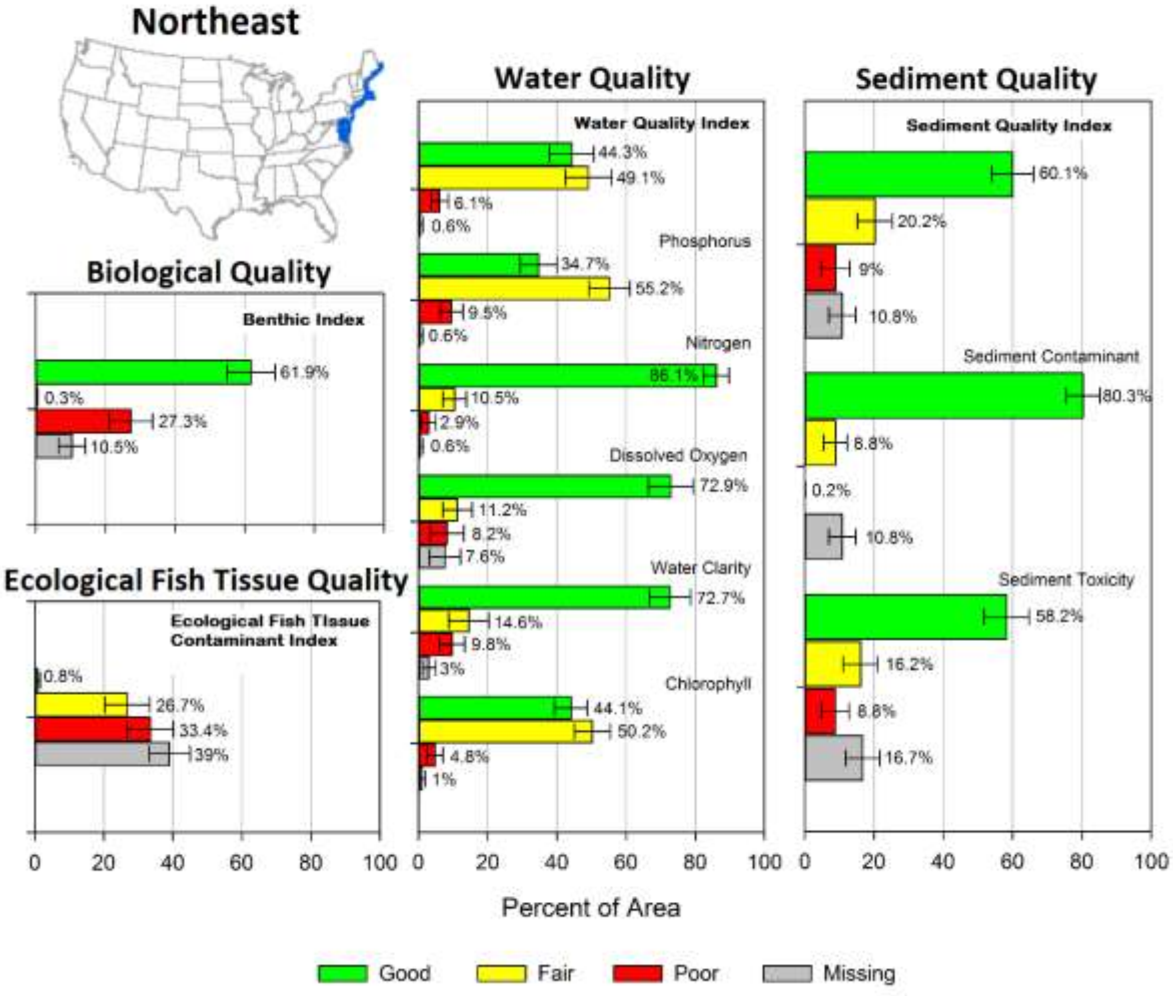

Figure 4. National Coastal Condition Assessment 2010 Report findings for the Northeast Region. Bars show the percentage of coastal area within a condition class for a given indicator (n = 238 sites sampled). Error bars represent 95 percent confidence levels (USEPA 2015).

All of New Hampshire waters are impaired by mercury contamination in fish tissue, with the source being atmospheric deposition. All of New Hampshire's bays and estuaries are impaired by dioxins and PCBs. The top five reasons for impairment in New Hampshire rivers for 2012 were: mercury (16,962 acres), pH (3,821 acres), E coli (1,306 acres), dissolved oxygen (688 acres), and aluminum (563 acres) (NHDES 2012). The top five reasons for impairment in New Hampshire estuaries for 2012 were: mercury (18 acres), dioxin (18 acres), PCBs (18 acres), estuarine bioassessments (15 acres), and nitrogen (14 acres). The top five reasons for impairment in New Hampshire ocean waters for 2012 were: PCBs (81 acres), mercury (81 acres), dioxin (81 acres), Enterococcus (0.5 acres), and fecal coliform (0.5 acres). Besides atmospheric deposition, sources of impairment in New Hampshire include forced drainage pumping, waterfowl, domestic wastes, combined sewer overflows, animal feeding operations, municipal sources, and other unknown sources (NHDES 2012).

Violation rates among EPA- permitted pollutant sources are relatively low in New Hampshire. A total of 386 (1.7 percent) of 23,192 permitted facilities are in violation of their permits, and only 58 (0.25 percent) of these violations are classified as a significant noncompliance. Of the 254

NPDES permits in New Hampshire, 28 currently have effluent violations and five of these are classified as significant noncompliance.

In 2012, Massachusetts assessed the condition of 2,816 miles (28 percent) of the state's rivers and streams and found 63 percent to be impaired[12]. Four out of the top five impairment causes for rivers and streams in Massachusetts are attributed to pathogens and nutrients. The probable sources for these impaired waters include unknown sources, municipal discharges and unspecified urban stormwater. The distribution of impairment causes and probable sources suggest that eutrophication is a factor in Massachusetts rivers and stream impairments. PCBs in fish tissue from legacy sediment contamination is identified as a contributing factor in 14 percent of assessed river or stream miles. Both invasive species and atmospheric mercury deposition are major contributors to impairments of lakes, reservoirs and ponds. Nearly the entire spatial area of Massachusetts' bays and estuaries were assessed (98 percent of 248 square miles), with 87 percent found to be impaired. Fecal coliform contamination from municipal discharges impair the entire extent of assessed bays and estuaries. PCBs in fish tissue are also a significant factor, occurring in 36 percent of assessed waters. The impairment classification "other cause" is identified in 27 percent of estuaries and bays. This reporting category is used for dissolved gases, floating debris and foam, leachate, stormwater pollutants, and many other uncommon causes lumped together. Among sources for pollutants, stormwater was a major factor for Massachusetts estuaries and bays as three of the top five identified sources of impairments are discharges from municipal separate storm sewer systems (53 percent of impaired area), wet weather discharges (27 percent) and unspecified urban stormwater (25 percent). Among the 29,788 discharge-permitted facilities located in Massachusetts, 956 (3 percent) are in violation, with 115 (0.39 percent) of these violations classified as a significant noncompliance. NPDES permits are held by 833 of these facilities. Effluent violations are identified at 77 of these facilities, with 33 violations classified as in significant noncompliance.

In 2014, the District of Columbia (D.C.) assessed the condition of 98.5 percent of its 39 miles of rivers and streams and 99 percent of its 6 square miles of bays and estuaries[13]. All waters assessed were found to be impaired by PCBs. By impairment group, pesticides accounted for the most causes for impairment for 303(d) listed waters assessed in D.C. The following pesticides were identified as causes for impairment in D.C. rivers/streams and bays/estuaries: heptachlor epoxide (21.9 miles), dieldrin (21.9 miles), chlordane (21.1 miles), DDT (19.4 miles), DDD (16.2 miles), and DDE (16.2 miles). Out of 2,729 facilities with pollutant-source permits in D.C., 48 permits (1.8 percent) are in violation, with three classified as significant noncompliance. Among the twenty-eight NPDES permits in D.C., two had effluent violations (7 percent), but none of the effluent violations were classified as a significant noncompliance.

The remaining East coast portion of the *Action Area* is very small. It includes Tribal and federal lands within 24 subwatersheds distributed among Maine, Vermont, Connecticut, and Delaware. Although 13 of these are in Maine, few river and stream aquatic impairments are reported in this state (8 out of 250 total assessed water bodies are impaired). Impairment causes in Maine are identified as low dissolved oxygen and dioxins. Microbial pollution of rivers and streams are indicated as major impairment causes in Vermont, Connecticut and Delaware, accounting for nearly 60 percent of the impaired river and stream miles among these states (EPA Water Quality

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[12] MA 2014 Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=MA

[13] DC 2014 Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=DC

Assessment and TMDL Information, https://iaspub.epa.gov/waters10/attains_index.home). Mercury, arsenic pollution and "unknown" are also among the top impairment causes for rivers and streams in these states. None of the 35 federally operated permitted facilities in Delaware and Vermont or the six facilities on Tribal land in Connecticut have permit violations (NMFS 2015a). The 9 facilities located in Maine include 5 with violations, 4 of which are classified as a significant noncompliance. There are no NPDES permits for sub-watersheds of Maine or Vermont within the *Action Area*. The single NPDES permitted facility in the Delaware portion of the *Action Area* is currently in compliance with its permit.

West Coast Region

The West Coast region contains 410 estuaries, bays, and sub-estuaries that cover a total area of 2,200 square miles (USEPA 2015). More than 60 percent of this area consists of three large estuarine systems—the San Francisco Estuary, Columbia River Estuary, and Puget Sound (including the Strait of Juan de Fuca). Sub-estuary systems associated with these large systems make up another 27 percent of the West Coast. The remaining West Coast water bodies, combined, compose only 12 percent of the total coastal area of the region.

The majority of the population in the West Coast states of California, Oregon, and Washington lives in coastal counties. In 2010, approximately 40 million people lived in these coastal counties, representing 19 percent of the U.S. population residing in coastal watershed counties and 63 percent of the total population of West Coast states (U.S. Census Bureau, http://www.census.gov/2010census/). Between 1970 and 2010, the population in the coastal watershed counties of the West Coast region almost doubled, growing from 22 million to 39 million people.

A total of 134 sites were sampled to characterize the condition of West Coast waters. Figure 5 shows a summary of findings from the EPA's National Coastal Condition Assessment Report for the west Coast Region (USEPA 2015).

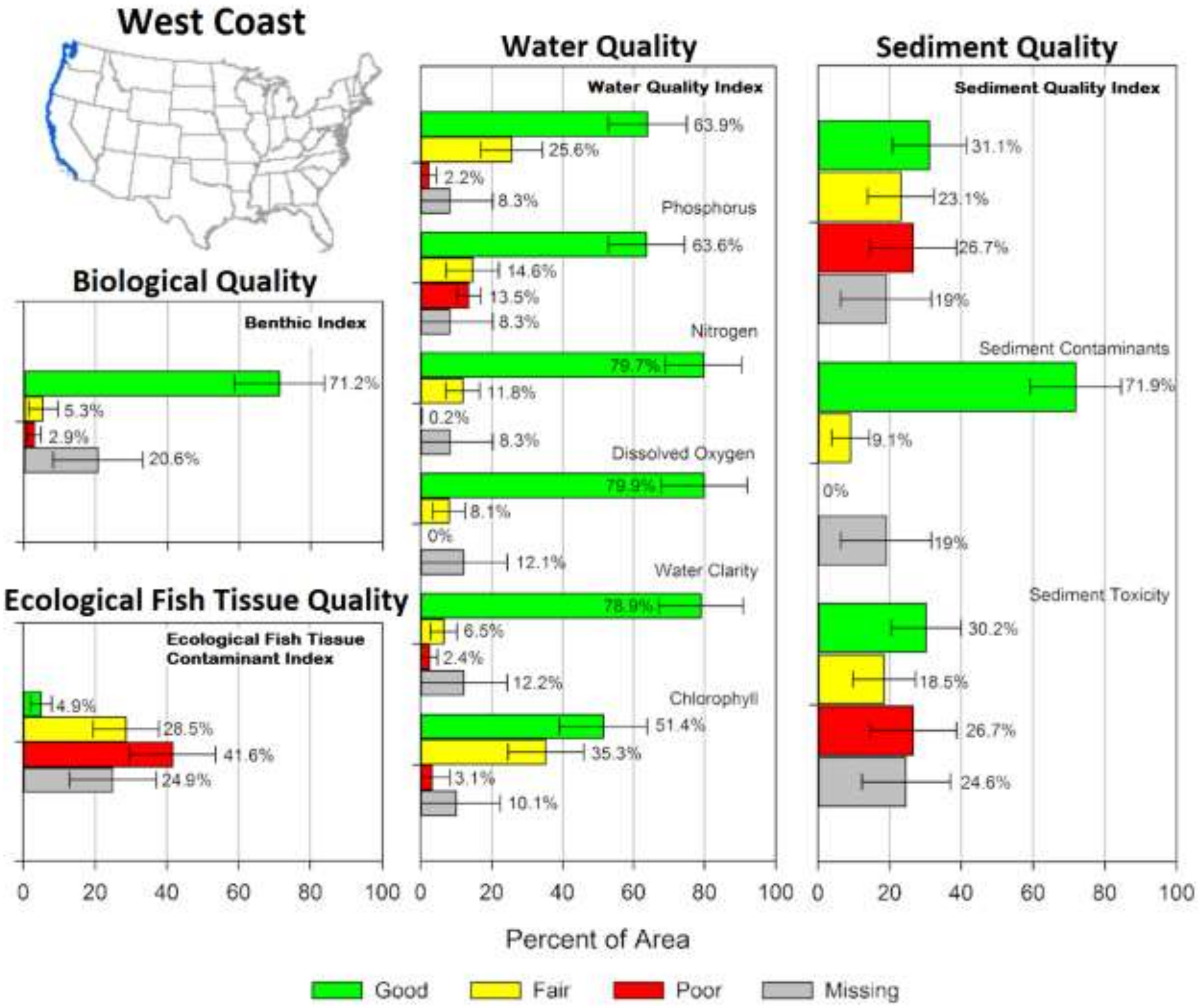

Figure 5. National Coastal Condition Assessment 2010 Report findings for the West Coast Region. Bars show the percentage of coastal area within a condition class for a given indicator (n = 238 sites sampled). Error bars represent 95 percent confidence levels (USEPA 2015).

Biological quality is rated good in 71 percent of West Coast waters, based on the benthic index. Fair biological quality occurs in 5 percent of these waters, and poor biological quality occurs in 3 percent (data are missing for an additional 21 percent of waters due to difficulty obtaining samples). Based on the water quality index, 64 percent of waters in the West Coast region are in good condition, 26 percent are rated fair, and 2 percent are rated poor (USEPA 2015).

Based on the sediment quality index, 31 percent of West Coast waters sampled are in good condition, 23 percent in fair condition, and 27 percent in poor condition (data missing for 19 percent of waters sampled) (USEPA 2015). Based on the ecological fish tissue contaminant index, 42 percent of West Coast waters are in poor condition, 29 percent in fair condition, and 5 percent in good condition (data missing for 25 percent of waters sampled). The contaminants that most often exceed the thresholds for “poor” condition are selenium, mercury, arsenic, and, in a very small proportion of the area, hexachlorobenzene (USEPA 2015).

Subwatersheds associated with Washington State federal lands where PGP eligible activities may occur (e.g., Department of Defense, Bureau of Land Management, Bureau of Reclamation) or Tribal lands, are distributed throughout the state and along the coast line. Information from the 2008 state water quality assessment report for the entire state was used to infer conditions within the *Action Area*. For the 2008 reporting year, the state of Washington assessed 1,997 miles of rivers and streams, 434,530 acres of lakes, reservoirs, and ponds, and 376 square miles of ocean and near coastal waters (Washington 2008 Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=WA). Among assessed waters, 80 percent of rivers and streams, 68 percent of lakes, reservoirs, and ponds, and 53 percent of ocean and near coastal waters were impaired. Temperature (39 percent of assessed waters) and fecal coliform (32 percent of assessed waters) are prominent causes of impairments. These are followed by low dissolved oxygen (19 percent), pH (9 percent), and instream flow impairments (2 percent). Ocean and near coastal impairment causes include fecal coliform in 17 percent of assessed waters, followed by low dissolved oxygen in 12 percent of these waters. The remaining contributors are invasive exotic species, sediment toxicity, and PCBs.

Among the 485 facilities located within Washington's Tribal lands, 67 are in violation of their permits, with 7 of these violations classified as a significant noncompliance (NMFS 2015a). There are 349 NPDES permits within the *Action Area*, but only two of these facilities have effluent violations. There are no violations reported for the 11 EPA permitted facilities within the watersheds associated with federally operated facilities in Washington. Three of these permits are NPDES permits.

The area covered by subwatersheds within Tribal lands in Oregon where EPA has permitting authority account for only 1.5 percent of the *Action Area*. Direct examination of these areas using EPA's geospatial databases from 2006 indicate that 80 percent of the 376 km of rivers and streams assessed are impaired by elevated iron (NMFS 2015a). While the source of the iron is not identified, iron contamination can result from acid mine drainage. Eleven out of the 13 assessed lakes, reservoirs, and ponds in subwatersheds associated with these lands are impaired, with causes listed as temperature and fecal coliform bacteria. This amounts to impairment of 93 percent of the assessed area.

EPA also has permitting authority for Tribal lands in California. The subwatersheds associated with these lands account for about 6 percent of the total *Action Area*, but are dispersed widely and make up a very small fraction of the watersheds within the state. As such, we did not make generalizations about water quality in these areas based on the 2010 statewide water quality assessment report. Rather, information for the relevant watersheds was extracted from EPA Geospatial databases and analyzed separately. Seventy nine percent of the assessed rivers and streams within these Tribal land subwatersheds are impaired by nutrients, aluminum, arsenic, temperature, and chlordane (NMFS 2015a). Stressor sources are attributed to unknown sources, municipal point discharges, agriculture, natural background, and loss of riparian habitat. High impairment rates (93 percent) are also found for assessed lakes, reservoirs and ponds within the *Action Area* in California (NMFS 2015a). The predominant impairment for these waters is arsenic, affecting 45 percent of assessed waters, while mercury is a factor in about 9 percent of assessed waters. Arsenic is also the identified cause of impairment in 97 percent of assessed bays and estuaries (NMFS 2015a). Among the 204 facilities located in the California *Action Area*, a total of 25 facilities are in violation of their NPDES, Clean Air Act, or Resource Conservation and Recovery Act permit, with 2 of these violations classified as a significant noncompliance. The single NPDES permit listed among these permits is in compliance (NMFS 2015a).

Puerto Rico

Since the ESA-listed species and designated critical habitat under NMFS' jurisdiction in Puerto Rico are strictly marine and do not occur in freshwaters or wetlands, this discussion will focus on water quality conditions reported for coastal shoreline and saltwater habitats. In 2014, Puerto Rico assessed the condition of 390 out of 550 miles of coastal shoreline (70.9 percent) and all 8.7 square miles of the surrounding bays and estuaries. The findings indicate that 77 percent of the coastline and 100 percent of the assessed estuaries and bays are impaired (Puerto Rico Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_index.control?p_area=PR#total_assessed_waters). TMDLs are needed in 100 percent of coastal areas sampled but none have been completed. TMDLs are needed in 58.6 percent of bay/estuary areas sampled but are completed for less than 2 percent of assessed areas. Pathogens (e.g., fecal coliform, total coliform, Enterococcus) and pathogen sources dominate the impairment profiles for all three types of assessed waters These include onsite waste water systems, agriculture, concentrated animal feed operations, major municipal point sources, and urban runoff. Coastline impairment causes include pH, turbidity and Enterococcus bacteria. Many of these impairments are attributed to sewage and urban-related stormwater runoff. Rates of noncompliance among EPA-permitted pollution sources are fairly high. Among the 10,077 facilities located in Puerto Rico, 59 percent were in violation of at least one permit in 2012, and nearly all were classified as significant noncompliance. There are 522 facilities with NPDES permits and 84 (16 percent) of these were classified as in significant violation of permit effluent limits as of 2012.

Pacific Islands

EPA has NPDES permitting authority in the Pacific islands of Guam, the Northern Marianas, and American Samoa. Because the ESA-listed species and designated critical habitat under NMFS' jurisdiction in these areas are strictly marine and do not occur in freshwaters or wetlands, this discussion will focus on water quality conditions reported for coastal shoreline and saltwater habitats.

The population of American Samoa was 55,519 in 2010. Factors such as population density, inadequate land-use permitting, and increased production of solid waste and sewage, have impaired water quality in streams and coastal waters of this U.S. territory. The total surface area of American Samoa is very small, only 76.1 sq. miles, which is divided into 41 watersheds with an average size of 1.8 sq. miles. Water quality monitoring, along with coral and fish benthic monitoring, covers 34 of the 41 watersheds, which includes areas populated by more than 95 percent of the total population of American Samoa. For the goal to protect and enhance ecosystems (aquatic life), of the 45.1 shoreline miles (out of 149.5 total) assessed in 2012-2013, 15.5 miles were found to be fully supporting, 12.8 miles were found to be partially supporting, and 16.8 miles were found to be not supporting (Tuitele et al. 2014). For the goal to Protect and Enhance Public Health, all 7.9 shoreline miles assessed in 2012-2013 for fish consumption were found to be not supporting. Eighty four percent of American Samoa's coastline was assessed in 2010 and 60 percent of the assessed waters were found to be impaired. Enterococcus is identified as causing impairments along 50 percent of the coastline evaluated, while 26 percent of assessed coastline had nonpoint source pollutants contributing to impairments. Of the 5.7 km^2 of reef flats assessed in 2010, 76 percent were fully supporting and 24 percent were not supporting the goal of Protect and Enhance Ecosystems (Tuitele et al. 2014). The major stressors identified were PCBs, metals (mercury), pathogen indicators, and other undetermined stressors (Tuitele et al. 2014). The major sources of impairment included sanitary sewer overflows and animal feed operations, each implicated for 50 percent of the waters assessed. Multiple nonpoint sources were identified as a stressor source for 26 percent of assessed waters, while contaminated sediments contributed to impairments in 6 percent of assessed waters. Among the 204 facilities with pollutant permits, a total of 21 (10.3 percent) facilities were in violation, with 17 of these violations classified as a significant noncompliance. Of the six facilities with NDPES permits, two have violated effluent limits, one of which is considered to be in significant noncompliance.

Guam assessed 3 percent of its 915 acres of bays/estuaries and 14 percent of its 117 miles of coastline in 2010 (Guam 2010 Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=GU). Impairments are identified in 42 percent of assessed bays and estuaries and the entire extent of assessed coastline. PCBs levels in fish tissue was the cause of impairment in 33 percent of assessed bays and estuaries, followed by antimony, dieldrin, tetrachloroethylene, and trichloroethylene, each listed as causing impairments to 6 percent of assessed waters. Enterococcus bacteria is the cause of impairment in nearly all of Guam's coastal shoreline waters (96 percent), while PCB contamination is a minor contributor to impairment of the coastal shoreline (4 percent). Sources of impairment causes have not been identified for Guam. Among the 403 NPDES, Clean Air Act, or Resource Conservation and Recovery Act EPA-permitted facilities located in Guam, a total of 23 (5.7 percent) facilities are in violation, with 13 of these violations classified as a significant noncompliance. NPDES permits are held by 19 facilities, six of which have effluent violations classified as significant noncompliance.

In the Northern Marianas, 36 percent of the 235.5 miles of assessed shoreline were found to be impaired in 2014 (N. Mariana Islands Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=CN). Phosphate is listed as a cause for all impaired areas. Other causes identified among the impaired stretches of shoreline include microbiological contamination from Enterococcus bacteria (22 percent), dissolved oxygen saturation levels (16 percent), and mercury in fish tissue (1 percent). The presence of Enterococci bacteria was implicated for the impairment of 32.2 miles of Saipan's, 17.8 miles of Rota's, and 24.3 miles of Tinian's shoreline for recreational uses. In addition 15 percent of the assessed waters had impaired biological assemblages. Sources of impairments included sediments (15 percent), unknown sources (13 percent), on-site septic treatment systems (12 percent), urban runoff (12 percent), and livestock operations (7 percent). We did not find any NPDES permitted facilities in the Northern Marianas.

7.1.2 Baseline Pesticide Detections in Aquatic Environments

Pesticide detections for the *Environmental Baseline* are addressed as reported in the U.S. Geological Survey (USGS) National Water-Quality Assessment Program's (NAWQA) national assessment (Gilliom 2006). This approach was chosen because the NAWQA reports provide the same level of analysis for each geographic area. In addition, given the lack of uniform reporting standards and large action area for this opinion, it is not feasible to present a comprehensive basin-specific analysis of pesticide detections.

Over half a billion pounds of herbicides, insecticides, and fungicides were used annually from 1992 to 2011 to increase crop production and reduce insect-borne disease (Stone et al. 2014)

During any given year, more than 400 different types of pesticides are used in agricultural and urban settings. The distributions of the most prevalent pesticides in streams and groundwater correlate with land use patterns and associated present or past pesticide use (Gilliom 2006). When pesticides are released into the environment they frequently end up as contaminants in aquatic environments. Depending on their physical properties, some are rapidly transformed via chemical, photochemical, and biologically mediated reactions into other compounds known as degradates. These degradates may become as prevalent as the parent pesticides depending on their rate of formation and their relative persistence. Another dimension of pesticides and their degradates in the aquatic environment is their simultaneous occurrence as mixtures (Gilliom 2006). Mixtures result from the use of different pesticides for multiple purposes within a watershed or groundwater recharge area. Pesticides generally occur more often in natural water bodies as mixtures than as individual compounds. Fish exposed to multiple pesticides at once may also experience additive and synergistic effects. If the effects on a biological endpoint from concurrent exposure to multiple pesticides can be predicted by adding the potency of the pesticides involved, the effects are said to be additive. If, however, the response to a mixture leads to a greater than expected effect on the endpoint, and the pesticides within the mixture enhance the toxicity of one another, the effects are characterized as synergistic. These effects are of particular concern when the pesticides share a mode of action.

From 1992 to 2001, the USGS sampled water from 186 stream sites, bed sediment samples from 1,052 stream sites, and fish from 700 stream sites across the continental U.S. Pesticide concentrations were detected in streams and groundwater within most areas sampled with substantial agricultural or urban land uses. NAWQA results detected at least one pesticide or degradate in more than 90 percent of water samples, more than 80 percent of fish samples, and more than 50 percent of bed sediment samples from streams in watersheds with agricultural, urban, and mixed land use (Gilliom 2006). Compounds commonly detected included 11 agriculture-use herbicides and the atrazine degradate deethylatrazine; 7 urban-use herbicides; and 6 insecticides used in both agricultural and urban areas. Mixtures of pesticides were detected more often in streams than in ground water and at relatively similar frequencies in streams draining areas of agricultural, urban, and mixed land use. Water from streams in these developed land use settings had detections of two or more pesticides or degradates more than 90 percent of the time, five or more pesticides or degradates about 70 percent of the time, and 10 or more pesticides or degradates about 20 percent of the time (Gilliom 2006). NAWQA analysis of all detections indicates that more than 6,000 unique mixtures of 5 pesticides were detected in agricultural streams (Gilliom 2006). The number of unique mixtures varied with land use. More than half of all agricultural streams and more than three-quarters of all urban streams sampled had concentrations of pesticides in water that exceeded one or more benchmarks for aquatic life. Exceedance of an aquatic life benchmark level indicates a strong probability that aquatic species are being adversely affected. However, aquatic species may also be affected at levels below benchmark criteria. In agricultural streams, most concentrations that exceeded an aquatic life benchmark involved chlorpyrifos (21 percent), azinphos methyl (19 percent), atrazine (18 percent), DDE (16 percent), and alachlor (15 percent) (Gilliom 2006). Organochlorine pesticides that were discontinued 15 to 30 years ago still exceeded benchmarks for aquatic life and fish-eating wildlife in bed sediment or fish tissue samples from many streams.

Stone et al. (2014) compared pesticide levels for streams and rivers across the conterminous U.S. for the decade 2002−2011 with previously reported findings from the decade of 1992−2001. Overall, the proportions of assessed streams with one or more pesticides that exceeded an aquatic life benchmark were very similar between the two decades for agricultural (69 percent during 1992−2001 compared to 61 percent during 2002−2011) and mixed-land-use streams (45 percent compared to 46 percent). Urban streams, in contrast, increased from 53 percent during 1992−2011 to 90 percent during 2002−2011, largely because of fipronil and dichlorvos. Agricultural use of synthetic organic herbicides, insecticides, and fungicides in the continental U.S. had a peak in the mid-1990s, followed by a decline to a low in the mid-2000s (Stone et al. 2014). During the late-2000s, overall pesticide use steadily increased, largely because of the rapid adoption of genetically modified crops and the increased use of glyphosate. The herbicides that were assessed by USGS represent a decreasing proportion of total use from 1992 to 2011 because glyphosate was not previously included in the national monitoring network.

EPA has consulted with NMFS under Section 7(a)(2) of the ESA on the registration of several pesticides with respect to their effects on ESA-listed Pacific salmonids and designated critical habitat under NMFS' jurisdiction[14]. These consultations evaluated pesticides registered for use under one of the four use patterns covered under the PGP. In many cases, these consultations concluded that EPA's re-registration and subsequent use of these pesticides according to the registered labels jeopardize the continued existence and/or adversely modify designated critical habitat for these species. The use of these pesticides for non-PGP use patterns are part of the baseline for ESA-listed salmonids, and, as agricultural uses are ongoing and not subject to consultation, agricultural uses of these pesticides are part of the cumulative effects as well. This series of consultations are listed in Table 15 of the *Risk Characterization* of this opinion.

8 EFFECTS OF THE ACTION

Section 7 of the ESA regulations define "effects of the action" as the direct and indirect effects of an action on the species or designated critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but are reasonably certain to occur. This includes effects on prey resources and "legacy effects" of the action, such as the redistribution of pollutants by stormwater or disturbed sediment and maternal or dietary transfer of accumulated toxicants.

To evaluate the effects in this opinion, we conduct a risk assessment (Section 8.1) in which we consider the likelihood of exposure to the stressors of the action of individuals of species and essential features of designated critical habitat and the potential for adverse responses. We then integrate the information to characterize the risk of adverse effects to identified environmental values, referred to as assessment endpoints. In this risk assessment section, we analyze the risks posed by the discharges without consideration of EPA's decision-making process or protective control measures in the PGP to minimize or prevent adverse effects. We evaluate EPA's process to determine the effectiveness of the PGP program in a programmatic analysis (Section 8.2)..

The programmatic analysis evaluates the decision-making process and the protective control measures EPA intends to establish to protect ESA-listed species or designated critical habitat from the adverse direct or indirect effects of the activities authorized by the PGP. As part of this analysis, we analyze the past performance of the PGP and in individual and general permits that

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[14] NMFS Pesticide Consultations with EPA, http://www.nmfs.noaa.gov/pr/consultation/pesticides.htm

the EPA has issued and consider the performance of those controls as indicative of how well the controls of the PGP are likely to work. For many programmatic consultations, the action agency has structured the program so that neither species nor designated critical habitat are exposed to the stressors of the action until there is a separate ESA section 7 consultation addressing site specific activities that will result in exposure. However, in this instance, EPA intends to authorize a large number of discharges without subsequent ESA section 7 consultations, except for those discharges that do not qualify for coverage under the general permit and for which the discharger must seek an individual permit. Accordingly, if there is overlap with species, EPA's programmatic action will result in exposure of species and designated critical habitat to the action.

8.1 Risk Assessment

In the risk assessment portion of this consultation we were concerned with the potential adverse effects of discharges of pesticides under the four use patterns eligible for coverage under the PGP on ESA-listed species and designated critical habitat under NMFS' jurisdiction. Due to the scope and complexity of the action and the uncertainty regarding the type and location of discharges that will actually occur, this analysis applies a qualitative strength of evidence assessment of risks. As noted above, this risk assessment portion considers the effects to adverse endpoints resulting from pesticide discharges without consideration of the effectiveness of EPA's program in minimizing or preventing risk.

The risk assessment portion integrates elements of EPA's ecological risk assessment framework (ERA-Framework, USEPA 1998) into NMFS' assessment approach. The risk assessment is organized in three phases:

1) Problem formulation examines the stressors of the action, the action area, its environmental baseline, and the status of the species and designated critical habitat in order to formulate risk hypotheses[15] on how species may respond to exposures to the stressors of the action. Risk hypotheses organize the analysis by positing the relationships among exposure to stressors, response to stressors, and environmental values, referred to as assessment endpoints. Once the risk hypotheses are formulated, the analyses proceed through a exposure → response → risk characterization path. A risk hypothesis is disproved when there is little or no likelihood of adverse effects to the assessment endpoints, and no further analysis of that hypothesis is merited in the opinion.
2) The exposure and response analysis evaluates how individuals of species and essential features of designated critical habitat may be affected and determines whether stressor exposures would result in adverse responses representing the assessment endpoints. For example, reduced number of viable eggs would represent an effect to the assessment endpoint reduced fecundity.
3) The risk characterization considers the population-level implications of adverse responses representing the assessment endpoints to determine if these are sufficiently large to affect population parameters (e.g., assessment endpoints such as recruitment or reproductive

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[15] NOTE: Moved into text – this is important. Risk hypotheses are statements that organize an analysis by describing the relationships among stressor, exposure, and the environmental values to be protected (also referred to as the assessment endpoints).

rate). Effects to the conservation value of the physical and biological features of designated critical habitat are evaluated at this point in the assessment.

8.1.1 Problem Formulation

The problem formulation integrates what is known about the status of the species and designated critical habitat (Section 6) and baseline conditions (Section 7) with the proposed action (Section 3) and the stressors resulting from that action (discussed below) to identify the types of effects that may occur as a result of the action and formulate risk hypotheses to be evaluated in the *Exposure and Response Analysis* (Section 8.1.2) and *Risk Characterization*.

Stressors of the Action

The EPA focused on the active ingredients of pesticide formulations when it registered pesticides pursuant to FIFRA. The PGP authorizes discharges for the use patterns eligible for CWA coverage under the PGP. Many of these pesticide active ingredients persist in the aquatic environment long after their intended uses (see Table 8). In addition, these active ingredients also include adjuvants, surfactants and other additives that were not evaluated in the FIFRA registration process.

The EPA permits more than 4,000 potentially hazardous additives for use in pesticide formulations. For example, nonylphenols are ingredients that may be included in the formulations of pesticide and are common wastewater contaminants from industrial and municipal sources. A national survey of streams found that nonylphenol was among the most common organic wastewater contaminants in the U.S. and was detected in more than fifty percent of the samples tested (Kolpin et al. 2002). The common pesticide additive xylene is a neurotoxin and the additive coal tar is a known carcinogen. To complicate matters, several permitted additives are also registered pesticide active ingredients.

Because other components of pesticide formulations in addition to the active ingredients may be toxic, we considered the effects of adjuvants, surfactants and other additives in the formulations of those pesticides as well as the effects of the active ingredients.

Table 8. Persistence of some commonly used pesticides in surface water and aquatic sediments (Barbash 2007).

Use Class	Chemical Class	Example	Half Life in Surface Water	Half Life in Aquatic Sediment
Herbicides	Amino acid Derivatives	Glyphosate	~2 months	~8 months
	Chlorphenoxy acid	2,4-D	~2 days	~2 months
	Triazines	Atrazine Simazine	~2 years ~3 weeks	~2 months ~8 months
	Urea	Diuron	~3 weeks	~8 months
Insecticides	Carbamates	Carbaryl	~1 week	~2 months
	Organophosphates	Chlorpyrifos Diazinon Malathion	~1 week ~2 months ~2 days	~2 months ~8 months ~3 weeks
	Pyrethroids	Permethrin	~14-21 days	~30-40 days

The 2012 through 2014 annual reports for PGP authorizations identify 260 individual pesticide products containing one or more of 101 individual active ingredients. These represent only those permit holders that were required to submit annual reports under the 2011 PGP. In areas where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur, annual reports were required for the 114 out of the 284 PGP applicants submitting an NOI under the 2011 PGP. Twenty-eight of the PGP applicants submitting an annual report had certified that ESA-listed species were present in at least a portion of their application area and twenty-one of those not required to submit an annual report certified that ESA-listed species were present in the at least a portion of their application area.

Below we described the four use patterns that would be authorized under the PGP: 1) mosquito and other flying insect pest control, 2) weed and algae pest control, 3) animal pest control, and 4) forest canopy pest control.

Mosquito and Other Flying Insect Pest Control. This use pattern includes any application of pesticides in, over or near waterbodies where these pests spend at least part of their life cycle. Applications may occur to prevent disease outbreaks or other health reasons or to support recreational activities. The variety of pesticides and formulations that are used will commonly depend on the life stage of mosquito that is being controlled.

To control larval stages, formulations of *Bacillus thuringiensis israelensis* and *B. sphaericus* are common while formulations of carbaryl, chlorpyrifos, deltamethrin, malathion and sumithrin are common to control flying adults. The Idaho Mosquito and Vector Control Association, founded by Idaho State Department of Agriculture and the State Health Department currently identifies 30 mosquito control districts with 28 active and submitting NOI under the 2011 PGP. Different formulations of *Bacillus thuringiensis* and *B. sphaericus* are applied to mosquito breeding habitats when their larvae are in the first to third instar stages of life, although some districts will also apply methoprene or temephos (in the formulation Abate®). To control flying adult mosquitoes, these districts apply ultra-low volumes of insecticides, which include a malathion-based ultra-low volume concentrate, naled, and pyrethroids[16].

The Massachusetts counties through which the Connecticut River flows, Hampden, Hampshire, and Franklin counties, are not served by a mosquito control district and there are no NOI or annual reports specifically for this area of Massachusetts under this use pattern. However, a statewide NOI was filed by the State Reclamation and Mosquito Control Board. The only annual report provided under the NOI was for 2012, reporting use of 2281 gallons of a phenothrin-piperonyl butoxide formulation. As an indicator of what may be used over the permitting period for the 2016 PGP, the Central Massachusetts Mosquito Control Project (www.cmmcp.org) reports that it applies different formulations of *Bacillus thuringiensis* and *B. sphaericus* to control mosquito larvae, also supplemented with formulations of methoprene. To control flying adult mosquitoes, ultra-low volumes of formulations of sumithrin, d-phenothrin, and etofenprox are used. Annual reports filed under 2011 PGP NOI for Bristol and Essex counties, which include waters where sturgeon occur, indicated that formulations of *Bacillus* and methoprene were applied.

The State of New Hampshire Department of Health and Human Services may use permethrin, sumithrin, and resmethrin commonly with piperonyl butoxide to enhance the insecticidal activity

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[16] Idaho State Department of Agriculture: http://www.kellysolutions.com/ID/searchbyproductname.asp

of the pyrethroid by decreasing insect ability to detoxify the pesticide (NH DHHS 2008). There were 565 active ingredients for this use pattern identified in annual reports filed under the 2011 PGP. The top three pesticide classes identified were microbials (e.g., *Bacillus* spp.), the juvenile hormone mimic methoprene, and pyrethroids plus piperonyl butoxide. The only annual reports from New Hampshire for this use pattern were from the Town of Hampton, which applied a wide variety of pesticides, including formulations containing *Bacillus*, methoprene, and pyrethroids with piperonyl butoxide. The City of Portsmouth, and the towns of Newfields, Newton, and Stratham, NH all filed NOI for mosquito control under the 2011 PGP, but like many other NOI, did not identify the pesticides that were to be used. Overall, the annual reports identify the use of 24 individual active ingredients with formulations containing *Bacillus*, methoprene, or pyrethroids making up greater than 80 percent of reported applications.

Weed and Algae Pest Control. The aquatic weed and algae control pesticide use pattern includes the application of pesticides in, over or near waterbodies to control algae and other submergent or emergent nuisance aquatic plants to protect sensitive aquatic habitats and to maintain recreational uses. This is a broad use pattern covering many types of aquatic habitats.

There are a variety of formulations and application methods for this use pattern. For example, the pesticides that the EPA currently authorizes for aquatic weed and algae control in Idaho include 2,4-D, copper compounds, diquat, endothall, fluridone, glyphosate and triclopyr. Application methods include boom sprayers, spreaders, backpack sprayers and aerial applications. Applications under this use pattern include spot treatments or large-scale treatments of several acres. These applications are usually made when the target plants are present and not dormant. Because these factors can vary widely between regions and individual waterbodies, these applications may occur at any time of year.

The annual reports filed pursuant to the 2011 PGP identified 30 individual active ingredients under this use pattern. Dominant pesticides accounting for greater than 50 percent of reported applications included pyridine carboxylic acids (e.g., aminopyralid, chlopyralid) and formulations of glyphosate and 2,4-D, followed by sulfonyl ureas (e.g., chlorsulfuron, metsulfuron).

Animal Pest Control. The Animal Pest Control use pattern includes the application of pesticides in, over or near waterbodies to control a wide variety of aquatic animals. These uses include fisheries management, invasive species eradication and equipment maintenance.

Aquatic nuisance animal pests include a range of taxa including vertebrates and invertebrates such as insects, mollusks or crustaceans in a variety of aquatic habitats. Examples of the types of pesticides authorized for this use pattern include sodium chlorate and rotenone, which are currently authorized by the EPA use in Idaho. In addition, the EPA authorizes other pesticides such as antimycin-A and (3-trifluoromethyl-4-nitrophenol) (commonly known as TFM) for other areas under this use pattern. Applications are usually made over an entire waterbody and applications methods include drip-feed devices, backpack sprayers, boat bailers and aerial applications. Treatments are usually made several years apart and may occur at any time of year.

There were 25 active ingredients for this use pattern identified in annual reports filed under the 2011 PGP. The dominant pesticides, accounting for approximately 50 percent of reported applicatioms include the substituted benzene chlorthalonil, organophosphates (i.e., diazinon, chlorpyrifos, and acephate), spinosyns, indoxacarb, and azoxystrobin.

Forest Canopy Pest Control. The forest canopy pest control use pattern includes pesticide applications in and over forest canopies where these pesticides may enter waters of the U.S.. These applications usually occur over areas in response to specific pest outbreaks. Examples of such pests include gypsy moths, southern pine beetles and locust borers. This is a broad use category and covers a wide range of aquatic habitats with a variety of pesticide formulations and application methods. For example, the EPA authorizes carbaryl, chlorpyrifos and dimethoate for use in Idaho under this use pattern. Other pesticides including diflubenzuron, disparlure, malathion and trichlorfon are authorized by the EPA for forest canopy pest control in other locations. Application methods include hand sprayers, aerial applications and drip or overhead irrigation systems. These applications may occur at any time of year. Annual reports identify 16 active ingredients used for forest canopy pest control under the 2011 PGP. Pyridinecarboxylic acids (i.e., clopyralid and picloram), various formulations of 2,4-D, and the sulfonyl ureas (i.e., metsulfuron and chlorsulfuron) account for greater than 70 percent of reported applications.

Examples of Pesticides and Their Effects

Pesticides are classified according to chemical similarity and these different groups affect species through different modes of action. Some pesticides have been reported to have few, if any, adverse consequences for aquatic organisms, including endangered or threatened species. For example, despite a half-life that is estimated to be about two months in clean river water that is low in sediment, bromacil is not toxic to invertebrates and is only slightly toxic to practically non-toxic to fish. A report for the Bureau of Land Management' use of bromacil indicates that plausible worst case aquatic concentrations resulting from ground application ranged from 0.001 to 0.003 mg/L{ENSR International, 2005 #3249}. Meanwhile the 48-hour median lethal concentration where half of exposed die (LC50) for bromacil in rainbow trout is 36 mg/L, in bluegill sunfish is 127 mg/L and in sheepshead minnows is 162 mg/L (USEPA 1992). The 96-hour LC_{50} in fathead minnow is 182 mg/L (Call et al. 1987). The microbial insecticide *Bacillus thuringiensis* does not adversely affect aquatic vertebrates, including brook trout, white suckers and smallmouth bass even a month after aerial applications (Abbott Laboratories 1982), although it may adversely affect non-target invertebrates, including butterflies (Lepidoptera) (USEPA 1986b). Some chemicals have more severe consequences for organisms that are exposed to them. For example, organophosphates and carbamates inhibit acetylcholinesterase; organotins prevent the formation of adenosine triphosphate; pyrethroids keep sodium channels in neuronal membranes open, which affects the peripheral and central nervous systems and cause a hyper-excitable state; symptoms include tremors, lack of coordination, hyperactivity and paralysis; rotenone which inhibits respiratory enzymes; and limonene which affects the sensory nerves of the peripheral nervous system. The following sections summarizes the toxicity of some of these pesticide classes.

Botanicals

The botanicals include cube resins (other than rotenone) and rotenone. Rotenone is used as a fish toxin (piscicide) and is expected to be highly toxic to fish, including endangered and threatened species of fish. The assessment for rotenone in EPA's BE used modeled concentrations in ponds. Surface waters of a warm water pond are likely to reach peak concentrations of 250 μg/L, and have a predicted 21-day average of 26 μg/L and a 60-day average of 9 μg/L (USEPA, 2008). Coldwater ponds also reach a peak concentration of 250 μg/L, but show increased persistence with a 21-day average of 173 μg/L and a 60-day average of 105 μg/L. Similarly, based on a target treatment rate of 200 μg/L, surface waters of a warm water pond reach peak concentrations of 200 μg/L, and have a predicted 21-day average of 21 μg/L and 60-day average of 7 μg/L.

Meanwhile, Cheng and Farrell (2007) reported that rotenone was not toxic to juvenile rainbow trout when they were exposed at concentrations of 5.0 µg/L during 96-hour tests, but 100 percent of the juveniles died when at concentrations of 6.6 µg/L for 96 hours. Johnson and Finley (1980) reported 96-hour LC_{50} for rotenone was 23 µg/L for rainbow trout, but 2.6 µg/L for channel catfish. Finlayson et al. (2010) exposed rainbow trout for 4 and 8 hours to concentrations of synergized and non-synergized formulations of rotenone. Exposing rainbow trout to a CFT Legumine formulation of rotenone at 5.3 µg/L for an average of eight hours killed half of the rainbow trout. Exposure to a Nusyn-Noxfish formulation of rotenone at 6.2 µg/L for an average of 8 hours also killed half of the rainbow trout.

In addition, populations of aquatic invertebrates have been eliminated in streams that have been treated with rotenone. Binns (1967) reported that aquatic invertebrate populations in the Green River, Wyoming were almost completely eliminated following rotenone treatments. Mangum and Madrigal (1999) reported that the richness of Ephemeroptera in the Strawberry River in north eastern Utah had been reduced by 67-100 percent, Plecoptera by 67-100 percent and Trichoptera by 61-100 percent after two rotenone treatments, of 3 mg/L for 48 hours. In Great Basin National Park, rotenone treatments reduced species in these taxa by 99 percent for one month. More recently, a study of effects to non-target invertebrate taxa at exposures representative of rotenone use in river systems determined that invertebrate species whose breathing structures have membranes specific for gas exchange, and gill-like lamellae were more vulnerable to rotenone than species with different breathing structures (e.g. the “plastron breathers” *A. imperator* and *D. capensis*) (Dalu et al. 2015).

Carbamates

The carbamates whose uses would be authorized by the proposed PGP include carbaryl, asulam and sodium salt. Numerous authors have studied and reported the responses of vertebrate species exposed to carbamates (Zinkl et al. 1977, Shea and Berry 1983, Hanazato 1991, Sharma et al. 1993, Beyers et al. 1994, Beyers and Sikoski 1994, Relyea and Mills 2001, Relyea 2004, Boran et al. 2007, Davidson and Knapp 2007). Carbaryl, which is also known by the trade name Sevin, is an example of the group known as N-methyl carbamates, which includes other pesticides like carbofuran and methomyl. These chemicals act as neurotoxicants by impairing nerve cell transmission in vertebrates and invertebrates; specifically, they interfere with normal nerve transmissions and, as a result, can affect a wide array of physiological systems. Organophosphates have the same mode of action and produce similar physiological responses.

From the BE, based on a target application rate of 1 lb AI/acre, 2 applications with a 7 day interval, EPA‘s model predicts surface water concentrations of carbaryl of 11.5 µg/l for peak, 8.2 µg/l for the 21-day average, and 4.2 µg/l for the 60-day average (USEPA, 2007). Beyers and Sikoski (1994) studied the toxicity of technical carbaryl (1-napthyl methylcarbamate, 99 percent) and Sevin-4-Oil (a formulation containing 49 percent carbaryl and petroleum distillates) to Federally endangered Colorado squawfish (*Ptychocheilus lucius*) and bonytail (*Gila elegans*). In Colorado squawfish, median lethal concentrations for technical carbaryl were 1.31 mg/L (95 percent confidence interval: 1.23-1.40 mg/L) and were 3.18 mg/L (95 percent confidence interval: 2.87-3.52 mg/L) for Sevin-4-Oil. In bonytail, median lethal concentrations for technical carbaryl were 2.02 mg/L (95 percent confidence interval: 1.78 -2.25 mg/L) and were 3.31 mg/L (3.06,-3.55 mg/L) for Sevin-4-Oil. Because Colorado squawfish and bonytail are about as sensitive to carbaryl as cutthroat trout (*Oncorhynchus clarki*), rainbow trout, Atlantic salmon

(*Salmo salar*) and brook trout (*Salvelinus fontinalis*), these results should also be applicable to ESA-listed Atlantic salmon and listed steelhead (Beyers and Sikoski 1994).
Carlson (1972) exposed fathead minnows to five treatments of carbaryl (8, 17, 62, 210 and 680 µg/L) in a flow through system for nine months; capturing the life cycle of the species. Fathead minnows showed reduced number of eggs per female and reduced number of eggs spawned when exposed to 680 µg/L; none of the eggs that were spawned hatched. Zinkl et al. (1987) reported that carbaryl killed rainbow trout when they were exposed to concentrations at or above 1,000 µg/L for as few as 90 minutes. In this same study, trout exposed to concentrations of 250 – 4,000 µg/L for 24 hours exhibited 61 to 91 percent AChE inhibition.

Exposure to carbaryl appears to make cutthroat trout more susceptible to predation, perhaps by inhibiting AChE activity in brain and muscle. Cutthroat trout experienced higher predation rates when exposed to carbaryl at concentrations of 200 µg/L, 500 µg/L and 1,000 µg/L. At 200 µg/L, an increase in predation was evident (Labenia et al. 2007). Little et al. (1990) reported similar results from their studies of the effects of exposing rainbow trout fry (0.5-1.0 g) to carbaryl at 10, 100 and 1,000 µg/L for 96 hours. At all of these exposure concentrations, significantly more rainbow trout were consumed compared with unexposed fish. At concentrations of 1,000 µg/L, exposed rainbow trout fry experienced significant reductions in swimming capacity, swimming activity, prey strike frequency, daphnids consumed, percent consuming daphnids and percent survival from predation.

Organophosphates

The organophosphates include acephate, chlorpyrifos, diazinon, dichlorvos, dimethoate, malathion, naled, temephos, trichlorfon and triclorfon. Like carbamates, these chemicals act as neurotoxicants by impairing nerve cell transmission in vertebrates and invertebrates; specifically, they interfere with normal nerve transmissions and, as a result, can affect a wide array of physiological systems.

Chlorpyrifos is highly toxic to freshwater fish, aquatic invertebrates and estuarine and marine organisms. According to the BE, the application rate may be as high as 0.025 lb per acre. The modeled Estimated Environmental Concentrations (EEC) assumed that 10 percent of the applied rate may drift to surface water resulting in concentrations of 1.5 – 18.5 µg/L chlorpyrifos in surface water at depths of six inches to six feet. The EPA (1989) reported that application of concentrations as low as 0.01 pounds of active ingredient per acre may cause fish and aquatic invertebrate deaths. The 96-hour LC50 for chlorpyrifos is 0.009 mg/L in mature rainbow trout, 0.098 mg/L in lake trout, 0.806 mg/L in goldfish, 0.01 mg/L in bluegill sunfish and 0.331 mg/L in fathead minnow (USEPA 1986a). Therefore, mature rainbow trout exposed to chlorpyrifos concentrations produced by application rates of 0.025 lbs of chlorpyrifos per acre would be expected to have a 50 percent probability of dying after 96 hours of exposure (alternatively, we would expect about half of an exposed population of rainbow trout to die as a result of their exposure to these concentrations of chlorpyrifos for 96 hours).

When fathead minnows were exposed to Dursban (a formulation of chlorpyrifos) growth was reduced within 30 days at 2.68 micrograms/liter and within 60 days at 1.21 µg/L. The maturation rate of first-generation fish was reduced at all Dursban exposure concentrations and reproduction was significantly reduced at concentrations of at least 0.63 micrograms/liter. Growth rates and estimated biomass of 30-day-old second-generation fish were significantly reduced when they were exposed at concentrations of 0.12 micrograms/liter (Jarvinen et al. 1983). Carp (*Cyprinus carpio*) fingerlings exposed to concentrations of chlorpyrifos ranging from 0.120 to 0.200 mg/L for 96 hours had acute toxicities at concentrations of 0.160 mg/L. When these carp were exposed for 1, 7 and 14 days at concentrations of 0.0224 mg/L and 0.0112 mg/L, they exhibited irregular, erratic and darting swimming movements, hyper-excitability and loss of equilibrium and sinking to the bottom. Caudal bending was also reported during exposures (Halappa and David 2009).

Diazinon exposures have been implicated in five fish kills reported in California since 2002. One of these fish kills occurred in June 2002 and consisted of 2,000 salmon that were found dead in the Tembladera Slough and the Old Salinas River channel in Monterey County, California. Monterey County Agricultural Commissioner staff indicated that a small number of applications of diazinon had been made in the general area when the fish kill occurred. Water samples collected from the sites detected diazinon in four of six samples with concentrations ranging from 0.095 – 0.183 µg/L. Gill samples from all five fish showed recent exposure to chlorpyrifos with concentrations ranging from 5 - 40 µg/kg. Methidathion, another organophosphate, was also detected at low concentrations in the water but was absent in gill tissue. Although concentrations of diazinon in the water column were well below median lethal concentrations for fish that had been observed in the laboratory, peak concentrations probably had not been detected because diazinon concentrations had probably dissipated in the few days between the occurrence of the fish kill and sampling.

The EPA’s BE evaluated calculated EECs for diazinon in surface water resulting from the highest application rate on crop types chosen from pesticide usage data from 1992 - 1997. Based on a target application rate of 3.0 pounds AI per acre (almonds), EPA’s model predicts surface water concentrations of diazinon of 8.89 ppb for peak, 7.94 ppb for the 21-day average, and 6.39 ppb for the 60-day average. A peak of 72.7 ppb, a 21-day average of 58.9 ppb, and a 60-day average of 45.7 ppb were calculated for potatoes with an application rate of 4.0 pounds AI per acre. An application rate of 1.0 pounds AI per acre was use for blueberries, predicting a peak of 37.7 ppb, a 21-day average of 32.8 ppb, and a 6-day average of 22.4 ppb. Estimates were also calculated for peaches, apples, and cucumbers, with the highest EECs resulting from application to cucumbers at a rate of 4.0 pounds AI per acre.

Diazinon also affects the olfaction of juvenile salmon, which mediates a suite of fish behaviors involved in feeding, predator avoidance, kin recognition, spawning, homing and migration. For example, (Moore and Waring 1996)studied the effects of diazinon exposure on olfaction in Atlantic salmon parr. They first exposed male parr to diazinon concentrations (0, 0.1, 1.0, 2.0, 5.0, 10 and 20 µg/L) for 30 minutes and determined the parrs’ ability to detect priming odorant released by female salmon that synchronizes spawning and also has a role as a primer on male plasma steroids and gonadotropin production. At 1.0 µg/L, diazinon significantly reduced the capacity for parr to detect the priming odorant by 22 percent (compared with controls); at 20 µg/L, diazinon inhibited olfaction by 79 percent. Olfaction was affected for up to 4-5 hours following exposure.

Moore and Waring (1996) also studied the effect of longer-term exposure to diazinon on male parrs’ plasma reproductive steroid levels after the males were exposed to the urine of ovulating females. Diazinon concentrations of 0.3 – 45 µg/L abolished the induction of male hormones, although levels of testosterone and one ketotestosterone were not significantly affected by the diazinon exposure. Milt production was reduced by about 28 percent at concentrations of diazinon ranging from 0.3 - 45 µg/L. We would expect these outcomes to impair Atlantic salmon’s ability to detect and respond to reproductive scents and increase their probability of missing spawning opportunities, which would reduce the lifetime reproductive success of individuals that experience this response.

Scholz et al. (2000) also studied the effects of 24 hour exposures to diazinon on the swimming and feeding behavior of juvenile coho salmon. They reported statistically significant effects on swimming and feeding behaviors in the presence of an alarm cue following exposures at concentrations of diazinon at 1 and 10 µg/L (compared to control fish) and reduced homing at 0.1 µg/L.

EPA's BE also evaluated temephos. Two models were used to calculate temephos concentration, one for tidal waters and one for non-tidal waters. Liquid temephos is applied by air directly to tidal marshes to control heavy infestations of mosquito larvae. For the tidal water scenario, EPA assumed complete mixing of temephos and that 100% of the application reaches the water. Calculations are included for application rates of 0.5, 1.0 and 1.5 ounces of product (43% active ingredient). Using the highest application rate (1.5 oz/A) and shallowest water depth (1 cm), modeling results in a peak concentration of 453 µg/L temephos for tidal waters. A concentration of approximately 1.0 µg/L is needed for 100% mortality of *Aedes* mosquito larvae. For non-tidal waters, temephos is typically applied in one or two treatments per year depending upon need (numbers of breeding mosquitoes). Application rates for the 5%, 2%, and 1% granular products vary from 0.05 – 0.5 pounds of active ingredient per acre (the higher rate is for highly polluted waters). Therefore, using the highest application rate (0.5 lbs AI/A) and double application rate with the shortest interval results in a peak concentration of 25.2 µg/L; a 21-Day average concentration of 2.8 µg/L; and a 90-Day average of 1.0 µg/L.

Temephos shows a wide range of toxicity to aquatic organisms, depending on the formulation. Generally, the technical grade compound is considered moderately toxic while the emulsifiable concentrate and wettable powder formulations are highly to very highly toxic. The most sensitive species of fish is the rainbow trout with a temephos LD_{50} ranging from 0.16 mg/L to 3.49 mg/L (Johnson and Finley 1980). Other 96-hour LD_{50} values are reported as: coho salmon 0.35 mg/L, largemouth bass 1.44 mg/L, channel catfish 3.23 mg/L to >10 mg/L, bluegill sunfish 1.14 mg/L to 21.8 mg/L, and Atlantic salmon 6.7 mg/L to 21 mg/L (Johnson and Finley 1980, Kidd et al. 1991).

Trichlorfon is also highly toxic to several species of fish and aquatic invertebrates, including species like Daphnia and stoneflies that are prey for fish. LC_{50} (96-hour) values for trichlorfon are 0.18 mg/L (48-hour) in Daphnia, 0.01 mg/L in stoneflies, 7.8 mg/L in crayfish, 1.4 mg/L in rainbow trout, 2.5 mg/L in brook trout, 0.88 mg/L in channel catfish and 0.26 mg/L in bluegill (Hudson et al. 1984, Hill and Camardese 1986).

Pyrethroids, Pyrethrins, and Synergists

The pyrethroids, pyrethrins and synergists (substances which enhance the toxicity of a pesticide) whose uses would be authorized by the PGP include permethrin, permethrin, mixed cis, trans, resmethrin, sumithrin, piperonyl butoxide and n-octyl bicycloheptene dicarboximide. The latter substances, piperonyl butoxide and n-octyl bicycloheptene dicarboximide (mgk-264) are synergists that enhancing pesticide toxicity by inhibiting an organism's ability to detoxify the pyrethroid. As we described previously, formulations of these pesticides are used to control adult mosquitoes.

Paul et al. (2005) compared the toxicity of permethrin plus a synergist and technical formulations of permethrin, sumithrin and resmethrin to brook trout (*Salvelinus fontinalis*) and brown trout

(*Salmo trutta*). They reported that the toxicity of the synergized permethrin formulation was significantly increased in 24, 48 and 96-hour tests, compared to tests with the technical formulation. There was little difference in the toxicity of synergized and technical formulations of sumithrin until 48 hours had elapsed. They reported that many test fish were strongly intoxicated by either formulation of permethrin or sumithrin, but the synergized formulations of both chemicals affected fish at lower concentrations. Intoxication was potentially severe enough to reduce the survival of these fish in the wild. Finally, they tested the ability of exposed fish to swim against a current and concluded that fish exposed for 6 hours to synergized permethrin and resmethrin had far less swimming stamina than those exposed to technical formulations. They did not find a difference in the effect on swimming between the synergized and technical formulation of sumithrin. They concluded that the synergized formulations of these pesticides appeared to cause a faster response than the technical formulations and this response increased the lethal and sublethal effect of the insecticides on the trout.

Inert Ingredients

Some of the other ingredients of formulations of these pesticides are also toxic. For example, piperonyl butoxide is a common constituent of insecticide containing formulations (for example, it is a common synergist in formulations of synthetic pyrethroids) and is toxic to aquatic invertebrates and fish. The EPA (2006) reported an LC_{50} for rainbow trout of 1.9 mg/L. In longer term exposures piperonyl butoxide affects fish and aquatic invertebrates at concentrations as low as 0.11 mg/L. Piperonyl butoxide is highly toxic to aquatic invertebrates with a reported EC_{50} of 0.51 mg/L for *Daphnia magna* (USEPA 2006).

As another example, methoxychlor is a co-constituent in formulations with malathion. Formulated products are more toxic than methoxychlor alone. It is also an organo-chlorine insecticide that is toxic to fish and aquatic invertebrates. Johnson and Finley (1980) reported LC_{50}s less than 20 µg/L and one 96-hour LC_{50} of 1.7 µg/L was reported for Atlantic salmon (Howard 1991).

Representative Pesticides Evaluated in the Biological Evaluation

The pesticides evaluated in EPA's BE were selected based on the anticipated risk to ESA-listed species, expected use by Operators not required to submit annual reports, and the frequency at which they were identified in annual reports as agents applied under the 2011 PGP (Table 9). We summarize EPA's analysis in this opinion to describe risk of the discharges to be authorized under the 2016 PGP, as it was identified by EPA. Annual reports included some, but not all of these pesticides. For a number of annual report-pesticides the BE did not assess the use patterns identified in the annual report. In most cases, this is attributable to the identification of more than one use pattern under the annual report.

Table 9. Representative pesticides evaluated by EPA for the PGP (pestides identified in annual reports are in boldface).

MOSQUITOCIDES (Adulticides)	WEED AND ALGAE PEST CONTROL
Naled	Endothall
Permethrin	**2,4-D**
Resmethrin	**Copper (i.e., sulfate and chelate)**
Malathion	Diquat
Sumithrin	**Glyphosate**
Chlorpyrifos	Fluridone
MOSQUITOCIDES (Larvacides)	**Triclopyr**

Bacillus thuringiensis israelensis **Methoprene** **Temephos** **Bacillus sphaericus**	**Imazapyr** **Acrolein**
ANIMAL PEST CONTROL	FOREST CANOPY PEST CONTROL
Rotenone (Fish) Antimycin A (Fish) Sodium chlorate (Mollusk) TFM (3-trifluoromethyl-4-nitrophenol) (Lamprey) **Diazinon**	Malathion **Carbaryl** Diflubenzuron **Bacillus thuringiensis kurstaki** Disparlure Chlorothalonil

Pesticides Identified in Annual Reports

Pesticides are grouped among classes based on source (e.g., botanical, *Bacillus*) or chemical properties (e.g., azoles, neonicitinoids). For example, pesticides identified in the annual reports for the 2011 PGP are classified in Table 11. These pesticides do not represent all classes and active ingredients that were applied under the PGP because annual reports are not required of for-hire applicators or Operators who are small entities and do not discharge to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur. Table therefore represents data from all large entities, whether or not they discharge to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur, and from those small entities discharging to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur.

Table 10. Pesticides identified in annual reports. Those reported to be used in areas where ESA-listed species or designated critical habitat under NMFS' jurisdiction occur are in boldface.

Pesticide Class	Mosquito	Aquatic Weed	Animal Pest	Forest Canopy
Aldehyde		**Acrolein**		
Amide		Napropamide		
Anthranilic diamide			Chlorantraniliprole	
Azole	Fenbuconazole	Prothioconazole	Fenbuconazole	
Benzoic acid		**Dicamba**, Mesotrione		Dicamba
Benzoylcyclohexanedione		Diquat dibromide		
Botanical	Abscisic acid	Cytokinin (as kinetin)	Cube Resins other than rotenone **Rotenone**	**Verbenone**
Chlorophenoxy acid or ester		**2,4-D**, MCPA		**2,4-D**
Chloropyridinyl		**Triclopyr**		Triclopyr
Coumarin			Brodifacoum	
Cyclohexenone derivative		Clethodim, Sethoxydim		
Diacylhydrazine			Methoxyfenozide Tebufenozide	
Dithiocarbamate-ETU		Mancozeb, Metam-sodium	Ferbam, Mancozeb	
Imidazolinone		Imazamox, **Imazapic** **Imazapyr**		Imazapic
Inorganic		potassium salts of phosphorous acid Copper ethanolamine Copper ethylene-diamine Copper hydroxide Copper sulfate pentahydrate Copper triethanolamine	Phosphorous acid Copper hydroxide Manganese	
Juvenile hormone mimic	**S-Methoprene**			
Bacillus	**B. sphaericus** **B. thuringiensis** **B. thuringiensis subspecies israelensis**	B. thuringiensis subspecies israelensis	B. thuringiensis subspecies Kurstaki	B. thuringiensis subspecies israelensis
Neonicotinoid	Imidacloprid		Acetamiprid Clothianidin Imidacloprid Thiamethoxam	
N-Methyl Carbamate	Carbaryl		Carbaryl	
N-phenylphthalimide		**Flumioxazin**		
Organophosphonate	Diazinon		Acephate	Fosamine
Organophosphorus	**Naled**, Temephos		Chlorpyrifos, Diazinon	
Oxadiazine	Indoxacarb		Indoxacarb	

Pesticide Class	Mosquito	Aquatic Weed	Animal Pest	Forest Canopy
Petroleum derivative	Aliphatic petroleum solvent **Mineral Oil**	**o-Xylene**		
Pheromone				**3-Methyl-2-cyclohexen-1-one**
Amino Acid Derivative		**Glyphosate**		Glyphosate
Polyalkyloxy Compound	POE isooctadecanol			
Pyrethroid	Bifenthrin **Permethrin w/ Piperonyl butoxide**		Permethrin Pyrethrins	
Pyrethroid Ether	Ethofenprox			
Pyridazinone		Norflurazon		
Pyridinecarboxylic acid		**Aminopyralid, Clopyralid, Fluroxypyr** **Picloram-potassium**		Clopyralid Picloram-potassium
Quinazoline			Fenazaquin	
Spinosyn	Spinetoram **Spinosad**		Spinetoram	
Strobin	Azoxystrobin		Azoxystrobin	
Substituted Benzene		Chlorothalonil Dichlobenil	Chlorothalonil	
Sulfonylurea		**Chlorsulfuron** **Metsulfuron** **Sulfometuron**		Chlorsulfuron Metsulfuron
Triazine		Indaziflam		
Unclassified		Dazomet Endothall Fluridone Fosetyl-Al Quinclorac		
Uracil		Bromacil		
Urea		**Diuron**		
Xylylalanine			Metalaxyl-M	

Risk Hypotheses for Evaluating Pesticide Discharges under the PGP

Figure 6.1.1-1 in EPA's BE for the 2016 PGP illustrates the pathways by which pesticide discharges (stressor sources) under the different use patterns may cause direct and indirect effects to ESA-listed species (Figure 6). Pesticides act directly to reduce survival and fitness of ESA-listed individuals and indirectly through reducing the survival and fitness of species upon which ESA-listed species rely for forage, shelter, and the maintenance of habitat quality (e.g., riparian vegetation shades water, influencing temperature).

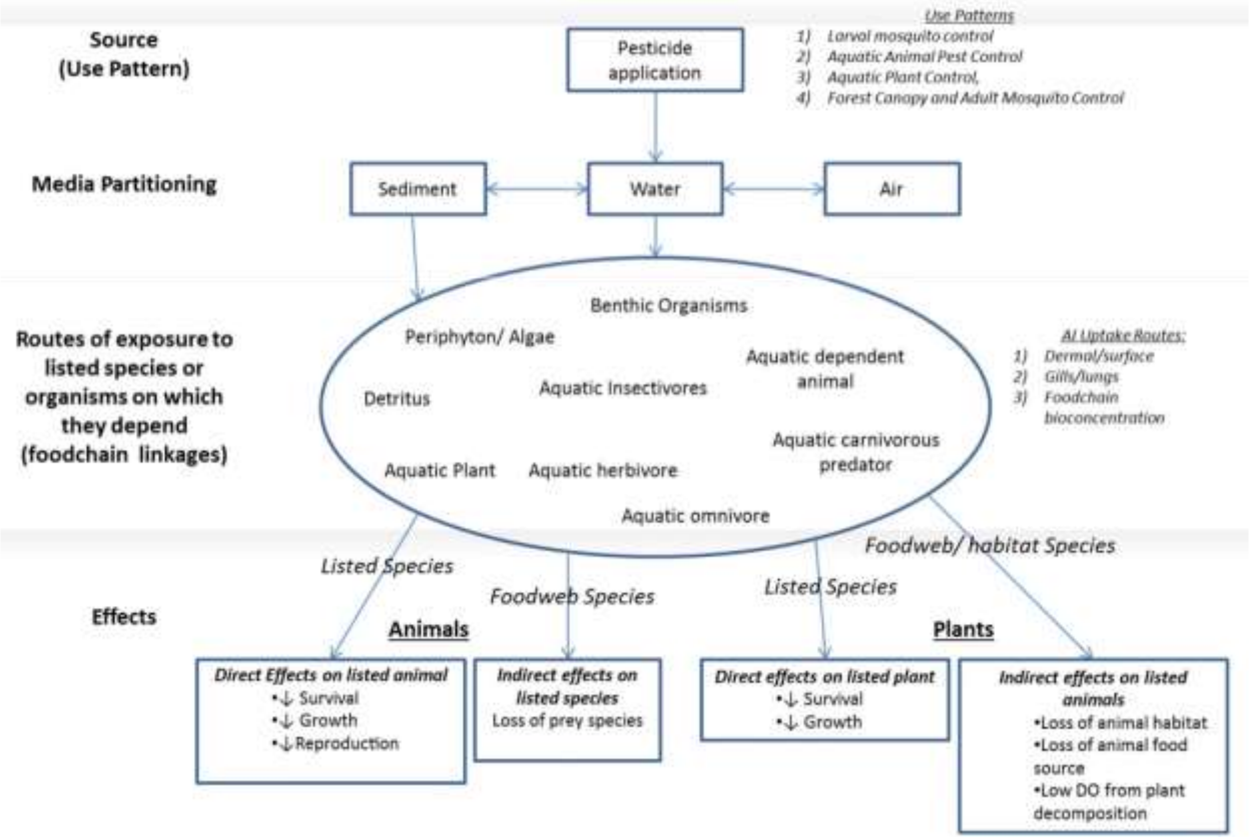

Figure 6. Generalized pathways for pesticides effects to ESA-listed species and designated critical habitat under NMFS' jurisdiction (USEPA 2016a).

The objective of the risk assessment portion of this programmatic opinion is to determine whether pesticides discharge under the use patterns eligible for coverage under the PGP, in the absence of controls and requirements under the PGP, would directly or indirectly adversely affect individual survival or fitness such that the extinction risk of ESA-listed populations or species would be increased or that designated critical habitat necessary for the persistence of ESA-listed species would be destroyed or adversely modified. Generally speaking, the values to be protected are the survival and fitness of individuals and the value of designated critical habitat for conservation of an ESA-listed species. Risk hypotheses are constructed by placing information on the stressors of the action, pesticides, in context of species and essential features of designated critical habitat potentially affected bythese discharges. Pesticide products, including the active ingredients, inert ingredients such as adjuvants and surfactants and metabolites and degradates affect organisms through various toxic mechanisms potentially resulting in effects such as direct lethality, disrupted growth and maturation, reduced offspring survival, or reduced reproductive capacity. Given the scope of the PGP, it is not possible to evaluate all exposures and potential consequences of the authorized discharges.

Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in exposures to toxicants that will affect the survival and fitness of individuals through:

- direct mortality
- reduced growth

  - altered behavior
  - reduced fecundity (i.e., reduced reproductive output or offspring survival)
- Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in exposures to toxicants that will affect the survival and fitness of individuals through:
  - reduction in extent of inhabitable area/avoidance
  - reduction in prey species

Effects to designated critical habitat analysis includes direct and indirect effects on biological elements within the spatial extent of designated critical habitat (e.g., prey, plant cover) affecting the value of the habitat for the conservation of the species. Since the stressors of the action are toxicants, it is the biological features specified in designated critical habitat that may be affected by the action. . The overarching risk hypothesis for evaluating effects to designated critical habitat is:

- Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in adverse effects to designated critical habitat features that are essential to the conservation of the species

8.1.2 Exposure and Response Analysis

The exposure and response analysis evaluates whether individuals of ESA-listed species may be exposed and respond adversely to the stressors of the action, as proposed by the risk hypotheses arrived at in the problem formulation.

Exposures to Pesticide Active Ingredients and Formulations

The *Action Area* where pesticide discharges occur includes large areas over which EPA has permitting authority (see Figure 1, Figure 2, and Figure 3, plus Pacific Islands and Territories). The composition of pesticide products discharge and the timing, frequency, intensity, duration and location, of exposures resulting from individual discharges and aggregate exposures resulting from repeated discharges in one location, or within the home range or migration route of individuals, or within or near essential features of designated critical habitat are unknown. The number of individuals of each species and life stage occurring in affected waters at the time of such discharges are also unknown, especially considering that the numbers of individuals vary with the season, environmental conditions, and changes in population size due to recruitment and mortality over the course of a year. For these reasons, all species and life stages identified in section 6.2, *Species and Designated Critical Habitat in the PGP Action Area* are expected to be exposed to the stressors of the action.

EPA's BE assessment addressed this uncertainty by evaluating representative locations and exposure scenarios. The BE used modeled peak or chronic EECs based on environmental fate characteristics and pesticide use data compiled by EPA-OPP. To estimate EECs for an active ingredient (AI) and use pattern, EPA modeled scenarios intended to represent sites in areas that are highly vulnerable to either runoff, erosion, or spray drift. For ecological risk assessment, EPA relies on a standard water body to receive the edge-of-field runoff estimates. The standard water body is of fixed geometry and includes the processes of degradation and sorption expected to occur in ponds, canals, and low-order streams (e.g., first and second order streams). The water body is assumed to be static (no outflow) as a conservative measure. For pesticides applied directly to water to control aquatic pests (3 of the 4 use patterns covered in the PGP), EPA calculated EECs based on the allowable rates specified by the AI label as well as fate characteristics of the AI. These calculations also assumed static conditions (i.e., little or no dilution or transport) as a conservative measure. In terms of defining exposure of ESA-listed species to AIs. That is to say, AI concentration remaining at a site after its intended use is achieved is assumed to be equal to the modeled AI concentration given its maximum application rate for a given use pattern and its fate properties in air, water, sediment, and soil. EPA stated that this assumption is likely to result in a conservative (i.e., high) estimate of the AI EEC in many cases.

NMFS notes that while EECs provide information, they do not integrate repeated exposures that may be necessary to control a pest species in a given area (e.g., mosquito control), exposure to multiple AIs and adjuvants in product formulations, or multiple exposures that may occur over the spatial extent of individual's home range or migration route. Further, the use of EECs does not address exposures in the shallow backwater pools that are important to salmonid rearing. NMFS also notes that exposures of rockfish, coral and Nassau grouper were not included in these analyses. EPA did not provide modeling data for exposures in marine waters, so any assessment for these species would have to be based on EPA's exposure estimates for other waters, where available. Most monitoring data reporting the detection of pesticides or degradates in environmental media are not realistic indicators of exposure because, unless the data are the result of a structured targeted monitoring program, detected pesticide levels are the result of an unknown prior application or an unknown product formulation, under an unknown use pattern. Ideally targeted monitoring is conducted before pesticide application, at the time of discharge, and after application has ceased to capture information on exposure intensities from background conditions to peak EEC at the time of discharge to the end of exposure period of interest. Further, as "snapshots in time," monitoring data do not capture the peak exposure concentration of a single or multiple AIs, surfactants, and adjuvants in the product formulation(s) used and likely miss exposures to less persistent chemicals.

Responses Considered in EPA's BE

Research conducted over several decades has established that many, but not all, pesticides pose serious risks to survival, development, growth, or reproductive success of aquatic organisms as a direct result of the exposure or because of the chemical's effect on their behavioral patterns. The effects of pesticides on salmonids are well-researched. Meanwhile, information linking exposures to current-use pesticide with such effects has only been collected over the past ten years for corals (Jones and Kerswell 2003, Jones et al. 2003, Raberg et al. 2003, Jones 2004, Negri et al. 2005, Watanabe et al. 2006, Cantin et al. 2007, Markey et al. 2007, Watanabe et al. 2007, Negri et al. 2009, Sheikh et al. 2009, Negri et al. 2011, van Dam et al. 2012a, van Dam et al. 2012b, Bladow et al. 2015, Ross et al. 2015, van Dam et al. 2015) and sturgeon (Cope et al. 2011, Filizadeh and Islami 2011, Frew and Grue 2015). No studies were found for such effects specifically in rockfish or grouper[17]. The available information on pesticides effects on cetaceans and other marine mammals report tissue concentrations and blood chemistry factors which are difficult to link to adverse effects. Further, much of the existing data on pesticides effects on sea turtles evaluates persistent organic chlorines (e.g., DDT, chlordane, dieldrin) which are no longer

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[17] ISI Web of Science search 08/26/2016 **TOPIC:** (rockfish or bocaccio or grouper) *AND* **TOPIC:** (pesticide or herbicide or insecticide or fungicide or piscicide)

registered for use in the U.S. and their use is therefore not eligible for coverage under the PGP[18]. The absence of published data for the effects of pesticides on specific species groups does not indicate that such effects do not exist. It is particularly difficult to conduct laboratory research of any kind on very large or long-lived species due to legal restrictions (i.e., the ESA and the Marine Mammal Protection Act) and logistical considerations (e.g., lab space, species water and feed requirements, etc). Given the scope and uncertainty in the exposures, EPA evaluated risk for representative pesticides exposures of standard laboratory species representing (i.e., surrogates for) ESA-listed species present in Massachusetts and Idaho (Table 11).

Table 11. Summary of types of surrogate species EPA used to assess direct effects of active ingredients on ESA-listed species in Idaho and Massachusetts in the biological evaluation effects analyses.

Common Name	Scientific Name	Surrogate organism type
Chinook Salmon	*Oncorhynchus tshawytscha*	Freshwater fish
Sockeye Salmon	*Oncorhynchus nerka*	
Steelhead	*Oncorhynchus mykiss*	
Shortnose Sturgeon	*Acipenser brevirostrum*	
Atlantic Sturgeon	*Acipenser oxyrinchus*	
Green Sea Turtle	*Chelonia mydas*	Saltwater fish
Hawksbill Sea Turtle	*Eretmochelys imbricata*	
Kemp's ridley Sea Turtle	*Lepidochelys kempii*	
Leatherback Sea Turtle	*Dermochelys coriacea*	
Loggerhead Sea Turtle	*Caretta caretta*	

The use of surrogate species cultured for use in standard laboratory tests provides certainty on the expected responses of control organisms. The species used include, but are not limited to, fathead minnow, rainbow trout, flagfish, bluegill, Atlantic silverside, and sheepshead minnow. To assess direct and indirect effects, EPA selected the most sensitive (i.e., lowest) acute and chronic[19] endpoints from available data for each species group (Table 12) and compared those with the EEC to obtain risk quotients (RQ). NMFS has modified this table to include effects on coral photosynthetic symbionts (zooxanthellae).

The RQ was then evaluated against the level of concern (LOC, Table 13). EPA uses LOCs to interpret the risk quotient and to analyze potential risk to non-target organisms and the need to consider regulatory action. When an RQ exceeds the LOC for a particular category, for example, the LOC of 0.05 for ESA-listed threatened and endangered species, EPA presumes a risk of concern to that category. In general, the higher the RQ, the greater the potential risk. If the RQ for a given assessment endpoint was greater than the LOC, EPA would report the exposure as "Likely to Adversely Affect" (LAA) for those ESA-listed species represented by that assessment endpoint. EPA states that this was likely a conservative interpretation in many cases because there may be no actual potential exposure of a given ESA-listed species to an AI use pattern.

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[18] ISI Web of Science search terms 08/26/2016 **TOPIC:**(loggerhead or ridley or leatherback or hawksbill) *AND* **TOPIC:** (pesticide or herbicide or insecticide or fungicide or piscicide)

[19] For EPA analyses, acute endpoints reflect mortality of half of exposed organisms after a 96 hour exposure. The chronic endpoints are those that can be directly associated with organism-level apical endpoints such as breeding success and development. PBL NOTE: Undefined term.

NMFS notes that this conservatism also reflects a large degree of uncertainty associated with the subsequent assessments in the BE.

Table 12. Summary of assessment endpoints for use in the risk quotient methodology of assessing risk (USEPA 2004).

Assessment Endpoint	Species Type	Endpoint Type
Acute Direct Toxicity and Indirect Effects (forage species/prey)	Freshwater fish Freshwater Invertebrates Estuarine/Marine Fish Estuarine/Marine Invertebrates	LC_{50}
Acute Direct Toxicity (coral symbionts)	Aquatic plant	EC50 or NOEC
Chronic Direct Toxicity and Indirect Effects (forage species/prey)	Freshwater Fish Freshwater Invertebrates Estuarine/Marine Fish Estuarine/Marine Invertebrates	NOEC

Table 13. Summary of Levels of Concern used in Assessing Estimated Environmental Concentrations.

Risk Presumption	Risk Quotient	Level of Concern	Response threshold used to evaluate EEC
Acute High Risk	EEC/LC50 or EC50	0.5	Acute threshold: Lowest tested EC50 or LC50 for freshwater fish and invertebrates and estuarine/marine fish and invertebrates acute toxicity tests
Acute Restricted Use	EEC/LC50 or EC50	0.1	
Acute ESA-listed Species	EEC/LC50 or EC50	0.05	
Chronic Risk	EEC/NOEC	1.0	Chronic Threshold: Lowest NOEC for freshwater fish and invertebrates and estuarine/marine fish and invertebrates Early life-stage or full life-cycle tests
Plants: Acute Listed Endangered Species (e.g., zooxanthellae)	EEC/EC50 or NOEC	1.0	Lowest EC05 or NOEC for both seedling emergence and vegetative vigor for both monocots and dicots

The outcome of these analyses, summarized in Table 14, indicate frequent, and often large magnitude of RQ exceedences over the LOC. These RQs are based on peak EEC and not actual post application under the four use patterns eligible for coverage under the PGP. However, they also reflect single exposure events to a single A.I., not actual pesticide products as they are applied.

Table 14. Results of risk analyses from EPA's biological evaluation analysis of pesticide uses authorized under the PGP.

Risk Scenario: Specie group and pesticide use pattern	Number of pesticides examined in the BE	Maximum ratio of acute threshold to peak estimated exposure	Percentage of scenarios with elevated acute risk based on LOCs	Maximum ratio of chronic threshold to estimated chronic exposure concentration	Proportion of scenarios with elevated chronic risk
Estuarine Fish (surrogate for sea turtles – see Table 11)[a]					
aquatic animal pest	5	474	67%	636	100%
aquatic weed	8	78	50%	60	100%
forest pest	5	7	67%	355	50%
Mosquito	8	26	83%	66	75%
Estuarine Invertebrates (Indirect effects – forage species)[a]					
aquatic animal pest	5	102	33%	636	100%
aquatic weed	8	417	86%	256	100%
forest pest	5	143	80%	3,186,667	100%
Mosquito	8	529	100%	4,022	100%
Freshwater Fish					
aquatic animal pest	5	308,556	80%	647	100%
aquatic weed	8	119	88%	43	43%
forest pest	5	2	60%	9	25%
Mosquito	8	16	75%	32	71%
Freshwater Invertebrates (Indirect effects – forage species)					
aquatic animal pest	5	390,625	80%	1,113	100%
aquatic weed	8	275	88%	1,634	57%
forest pest	5	80	100%	918,000	100%
Mosquito	7	2,291	100%	2,000	60%
Aquatic nonvascular plants[a]					
aquatic animal pest	1	0.116	100%	-	none
aquatic weed	4	316	67%	-	none
Mosquito	1	0.264	100%	-	none

[a] EPA's BE did not assess pesticide effects for Nassau grouper, rockfish, or coral species. In this opinion, the estuarine fish data are considered surrogate data for Nassau grouper and rockfish, estuarine invertebrate data are considered surrogate data for coral species, and aquatic nonvascular plants data are considered surrogate data for the zooxanthellae of coral species.

Responses to Degradates

Pesticides are transformed into other compounds over time by chemical, photochemical and biologically-mediated reactions; these other compounds are generally called "degradates" or "metabolites" (Boxall et al., 2004; Gilliom et al., 2006). Degradates, like their parent compounds, have the potential to adversely affect water quality, depending on their toxicity. Sinclair and Boxall (2003) reported that 41 percent of degradates were less toxic than their parent compounds, 39 percent had toxicities similar to their parents, 20 percent were more than 3 times more toxic than their parent compound and 9 percent were more than 10 times more toxic.

For example, the major metabolite of carbaryl is 1-naphthol, which is formed by abiotic and microbially mediated processes and has been reported to represent up to 67 percent of the applied carbaryl in degradation studies. This degradate is more toxic than carbaryl itself. Shea and Berry (1983) compared 10-day acute lethalities between carbaryl and 1-naphthol in goldfish (*Carassius auratus*) and killifish (*Fundulus heteroclitus*). They concluded that 1-naphtol was about five times more toxic than carbaryl in goldfish and twice as toxic as carbaryl in killifish. In addition, fish exposed to 1-naphthol showed neurological trauma including erratic swimming behaviors and increased opercula beats following 4-hour exposures at 5 mg/L and 24-hour exposures at 10 mg/L. They did not observe any of these symptoms in the carbaryl treatments.

Responses to Mixtures

Most aquatic species are likely to be exposed to mixtures of pesticides, their degradates and other chemicals that exist in the environment. Once in a mixture, co-occurring pesticides (including their degradates) can either 1) act independently of one another (called an "independent" effect); 2)have additive effects (for example, this might be expected for pesticides with a common mode of action and similar chemical structure); 3) have synergistic effects in which their combined toxicity is greater than their additive toxicity; or 4) have combined toxicity that is less than their additive toxicity (called an "antagonistic" effect).

As an example of synergistic effects, (Relyea and Mills, 2001; 2004) exposed amphibians to a combination of pesticides and chemical cues mimicking natural predators and found that these combinations induced stress and, as a result, increased the mortality rates of the amphibians (see also Sih et al., 2004). For some species, exposing amphibians to combinations of pesticides and natural stressors produced mortality rates that were substantially greater than mortality rates associated with each individual stressor. For example, carbaryl was up to 46 times more lethal to gray treefrog tadpoles (*Hyla versicolor*) when they were exposed to a combination of this pesticide and chemical cues emitted by aquatic predators (Relyea and Mills, 2001). When they were exposed to malathion at concentrations of 5 mg/L, 42 percent of the gray treefrog tadpoles died when predator cues were absent, but 82 percent died when predator cues were present (Rhatigan, 2004).

Mixtures containing malathion resulted in additive effects (when mixed with DDT, toxaphene), synergistic effects (when mixed with Baytex, parathion, carbaryl, perthane) and antagonistic effects (when mixed with copper sulfate) (Macek, 1975). Mixtures of diazinon and parathion killed more bluegill sunfish than predicted. Tierney et al. (2008) exposed juvenile steelhead to environmentally realistic concentrations of a mixture that included chlorpyrifos, diazinon and malathion (the realistic mixture contained chlorpyrifos at 13.4 ng/L; diazinon at 157 ng/L; and malathion at 46.3 ng/L, respectively). Exposures to this mixture for 96 hours compromised the ability of juvenile steelhead to detect changes in odorant concentrations, which would impair behaviors that rely on smell such as homing and migration.

Mixtures that paired two organophosphates produced a greater degree of synergism than mixtures containing one or two carbamates, particularly mixtures containing malathion coupled with either diazinon or chlorpyrifos (Laetz et al. 2009). At the highest exposure treatment, 1.0 EC_{50} (malathion at 37.3 µg/L, chlorpyrifos at 2 µg/L, diazinon at 72.5 µg/L), binary combinations produced synergistic toxicity. Coho salmon exposed to combinations of diazinon and malathion as well as chlorpyrifos and malathion all died (Laetz et al. 2009). Fish exposed to these organophosphate mixtures showed toxic signs of inhibition of AChE, including loss of equilibrium, rapid gilling, altered startle response and increased mucus production before dying.

Organophosphate combinations were also synergistic at the lowest concentrations tested. Diazinon and chlorpyrifos were synergistic when combined at 7.3 µg/L and 0.1 µg/L, respectively. The pairing of diazinon (7.3 µg/L) with malathion (3.7 µg/L) produced severe (> 90 percent) AChE inhibition including classical signs of poisoning as well as death with some combinations. For binary combinations of malathion, diazinon and chlorpyrifos synergism was likely to occur at exposure concentrations that were below the lowest used in this work (i.e., chlorpyrifos concentrations lower than 0.1 µg/L; diazinon concentrations lower than 7.3 µg/L; malathion concentrations lower than 3.7 µg/L.

Responses Not Considered in EPA's Biological Evaluation

Response as a result of impacts to prey base of Southern Resident Killer Whale

We evaluated the potential effects of EPA's issuance of their PGP on designated critical habitat by first reviewing the essential features or primary constituent elements of designated critical habitat for listed designations. Based on our analysis, the primary features that may be affected by pesticide discharges under the four use patterns eligible for coverage under the PGP are those designated as "prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth."Salmon are a significant contributor to the overall ecological food web throughout their range. Two significant indirect effects of the proposed action to Chinook, coho, sockeye and chum salmon and steelhead could result in the further loss of prey species for southern resident killer whales. Such reductions would also likely result in the loss of nutrient transport to freshwater systems that are important to Pacific salmonids themselves (Ford et al. 2010). Bilby et al. (1996) demonstrate that juvenile and older age classes of salmon grow more rapidly with the appearance of spawners because these younger fish will feed on eggs and spawner carcasses. Salmon carcasses in rivers and streambanks are a significant source of food to a wide number of animals and affect the overall productivity of nutrient-poor systems (Bilby et al. 1996, Cederholm et al. 2000). Bilby et al. (1996) showed that up to 45 percent of the carbon in cutthroat trout and 40 percent of the carbon in young coho comes from the decaying carcasses of the previous generation of salmon. Increased body size is directly correlated to increases in over winter survival and marine survival. They suggest that reduced nutrient transport is one important indicator of ecosystem failure and is contributing to the observed reductions in abundance we have seen in many salmon populations, which could further diminish the success of recovery efforts. Given many salmon populations comprise the prey component of killer whale designated critical habitat, any additional reduction in prey attributable to the PGP could adversely modify their designated critical habitat.

Based on killer whale stomach contents from stranded whales and field observations of predation, Ford et al. (1998) determined that 95 percent of the diet of resident killer whales consists of fish, with roughly 66 percent being Chinook salmon. The authors suggested that killer whales might preferentially hunt Chinook salmon because these fish have large body sizes and a high fat content. A reduction in Pacific salmon – Chinook salmon in particular– from effects from the proposed action is likely to have adverse effects on the fitness of southern resident killer whales and their population viability. As noted earlier, a 50 percent reduction in killer whale calving has been correlated with years of low Chinook salmon abundance (Ward et al. 2009).

A reduction in the number of adult Chinook salmon in the Puget Sound would reduce the forage base for southern resident killer whales. Southern resident killer whales are not restricted to Puget Sound, but do spend a large portion of time in Puget Sound, the Strait of Juan de Fuca and

Haro Strait. Prey losses could also be realized throughout their range, including Oregon and California. Such reductions in prey could impede recovery.

Response of Coral Species

The EPA’s BE did not asses exposure or response of coral species and Nassau grouper because discharges to marine environments were not expected to result in exposures to these species. The PGP does not cover drift, but in this opinion drift of pesticides resulting from the four use patterns eligible for coverage under the PGP discharges is considered an indirect effect of the action. Land based pesticides do reach and accumulate in reef habitats and enter the food web (Whitall et al. 2015, Salvat et al. 2016). Research indicates that land-sourced herbicides have implications on coral health through effects on the photosynthesizing symbionts, particularly in combination with elevated water temperatures associated with climate change (Negri et al. 2011, van Dam et al. 2012a).

For marine coral and fish species in Puerto Rico and the Pacific Islands, the mosquito control use pattern is a potential source of pesticide exposures that can directly attributable to a use pattern eligible for coverage under the PGP. Early morning aerial applications use ultra low-volume atomizers to maximize contact time with flying mosquitoes. Naled, an organophosphate for the control of mosquitos has a short residual half-life in water (< 1 day), degrading to dichlorvos, both classified as very highly toxic to aquatic invertebrates. Dichlorvos half-life ranges from hours to days in the presence of reduced sulfur species indicative of near coastal marine environments (Gan et al. 2006). Dichlorvos has been reported to persist in seawater for as long as 180 days (Lartiges and Garrigues 1995).

A study by Pierce et al. (2005) investigated the potential for off-shore transport of toxic concentrations of naled and permethrin resulting from routine mosquito control operations. The study confirmed tidal transport of naled and its degradation product, dichlorvos, to the Florida Keys National Marine Sanctuary 14 hours after application at concentrations of 0.1 µg/L for naled and 0.6 µg/L dichlorvos 1 km away from the application site. Permethrin was detected adjacent to application routes at concentrations ranging from 5.1 to 9.4 µg/L 2-4 hours after application.

Since this was a targeted monitoring study, and the only study available of its kind, (i.e., the source and application rate and timing of the pesticide was known) NMFS will use these concentrations as EECs for the pesticides in evaluating toxicity data to assess the hazards posed by discharges eligible for coverage under the PGP for reef-dwelling ESA-listed coral species.

Data provided by EPA in the BE for this consultation indicate an LC50 as low as 0.92 µg/L dichlorvos (95 percent confidence interval of 0.7-1.1 µg/L) for nauplii of the marine copepod species *Tigriopus brevicornis* (Forget et al. 1998). Using the targeted monitoring data from Pierce et al. (2005), this results in an RQ of 0.65 (i.e., 0.6 ug/L EEC/ LC50 0.92 ug/L), far exceeding the acute LOC for ESA-listed species of 0.05 (see Table 13). The data also included a record for responses of the coral species *Acropora tenuis* to dichlorvos, reporting a NOEC for dissociation of soft tissues from the skeleton of a-symbiont juveniles at 0.1 ug/L dichlorvos after 10 days. Using the targeted monitoring EEC, this provides an RQ that is 6-fold EPA’s LOC. This study examined the effects of dichlorvos to coral both with and without symbiont colonization and found that the same exposure intensity resulted in significant tissue detachment in symbiont-colonized coral juveniles, with 18 percent of colony fragments affected (Watanabe et al. 2006).

The lowest invertebrate LC50 reported in the data EPA provided for naled was 460 µg/L for oysters exposed for four days (Lowe 1965, USEPA 1992). Chronic values were not found for naled in EPA's dataset. Toxicity data provided by EPA from its Ecotoxicology Knowledgebase (ECOTOX)[20] reported a 4-day LC50 for naled as low as 4.3 ug/L under static exposure (i.e., exposure media was not renewed during the study) of Korean shrimp (Schoettger 1970) providing an RQ of 0.023, which is below the acute listed-species LOC of 0.05 used by EPA. The ECOTOX record for this datum indicates gaps in descriptors for control type and test type and also because the accompanying flow-through test (i.e., exposure media continually pumped through exposure chambers) resulted in LC50 of 15.4 ug/L, suggesting that the results reported by this study were affected by the test conditions affecting response to pesticide exposure. The lowest NOEC reported in ECOTOX was for the growth of opossum shrimp at 0.2 ug/L naled after 31 days exposure (USEPA 1992). Using the targeted monitoring data, this produces an RQ that is twice EPA's LOC of 1.0 for chronic NOECs. The EPA-supplied data may have excluded this NOEC because the ECOTOX record notes that "control data were presented without accompanying methodology," meaning that the data source did not indicate the type of media used for controls (e.g., natural water, reconstituted lab water, inclusion of chemical carriers).

The implications for coral species based on these data suggest adverse effects would occur to coral species as a result of naled use for mosquito control. More recent laboratory work evaluated the implications of exposures resulting from mosquito control with naled on larva of the coral species *Porites astreoides*. Larval survivorship, settlement and post-settlement survival of coral exposed to naled, dichlorvos, and permethrin (Ross et al. 2015). Due to recent pesticide application activity near the source seawater from which the exposure solutions were prepared, the dilution water used in the study contained low background concentrations of pesticides. The controls contained 0.62 ug/L permethrin, 0.7 ug/L naled, and 0.4 ug/L dichlorvos. Larval survival 18 to 20 hours after initiating the study was 80 percent in seawater to which no additional pesticide was added and 60 percent in seawater to which an additional 0.1 ug/L naled was added. At the end of the study, total naled and dichlorvos concentrations were 0.63 and 0.53 ug/L, respectively. Based on the 2006 Watanabe et al. study, adverse effects may occur in coral species due to exposures to the degradate dichlorvos to discharges of naled under the mosquito control use pattern.

Considering the proximity of Puerto Rico coral reefs to areas that may be treated with mosquitocides, exposures to permethrin adjacent to application areas are also pertinent. Pierce et al. (2005) compared the observed permethrin concentrations to acute toxicity thresholds for mysid shrimp, but more recent and more relevant data are available for *Acropora millepora* showing 50 percent inhibition of fertilization at 1 ug/L permethrin and larval settlement reductions of 60-100 percent at this same exposure level (Markey et al. 2007).

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[20] Accessed 9/1/2016, https://cfpub.epa.gov/ecotox/advanced_query.htm, Some of these data to not pass EPA's restrictive data screening protocol.

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Figure 7. Aerial image example showing the proximity of coral reef crest to shore (Loiza, Puerto Rico).

Response of Nassau Grouper

The EPA-supplied data for marine fish did not include LC50s for naled. Only LC50 data for dichlorvos was provided. These LC50 concentrations were all much higher than the EEC of 0.6 from the Pierce et al. study (2005, Figure 8). EPA's screened ECOTOX LC50 data for saltwater fish species exposed to naled were also much higher than those for invertebrates and higher than the EEC from Pierce et al (2005), ranging from 130 to 2800 µg/L. Adverse effects to Nassau grouper are therefore not expected to occur as a result of discharges of naled under the mosquito control use pattern.

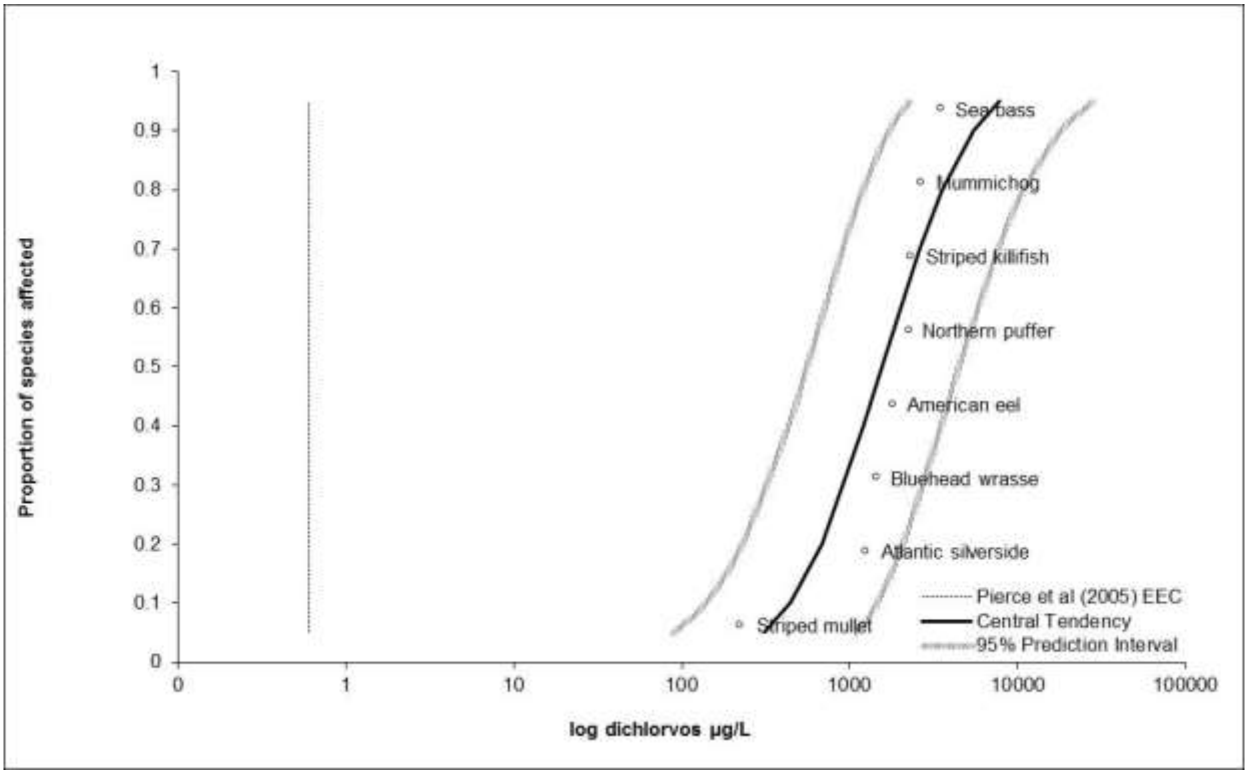

Figure 8. Distribution of LC50s for marine fish species exposed to dichlorvos for four days releative to the concnetration reported in Pierce et al. (2005).[21]

The amount of data for saltwater exposures to permethrin does not allow generation of a sensitivity distribution. The screened ECOTOX data provided by EPA include a 96 hour LC50 of 16 µg/L for sheepshead minnow (Sappington et al. 2001). The data provided by EPA is current up to 2010. More recently an LC50 of 8 µg/L was reported for juvenile red drum (Parent et al. 2011). The available 96 hour LC50 data in ECOTOX for freshwater fish bracket these values, ranging from 1.2 µg/L to greater than 10 mg/L. Considering the proximity of habitats where Nassau grouper may occur to locations where pesticides would be used to control mosquitoes (i.e., mangroves, seagrass, coral reefs), the use of pyrethroid insecticides like permethrin could pose risk to Nassau grouper.

8.1.3 Risk Characterization

The risk characterization evaluates the implications of the exposure and response results, and other available evidence for the assessment endpoints identified in the risk hypotheses to

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[21] log probit fit, SSD_Generator_V1.xlt from https://www3.epa.gov/caddis/da_software_ssdmacro.html

determine whether the responses rise to population-level effects. To review, the risk hypotheses evaluated are:

Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in exposures to toxicants that will affect the survival and fitness of individuals through:

  - direct mortality
  - reduced growth
  - altered behavior
  - reduced fecundity (i.e., reduced reproductive output or offspring survival)

- Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in exposures to toxicants that will affect the survival and fitness of individuals through:
  - reduction in extent of inhabitable area/avoidance
  - reduction in prey species
- Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in adverse effects to designated critical habitat features that are essential to the conservation of the species

Analyses in NMFS Opinions

EPA has consulted with NMFS under section 7(a)(2) of the ESA on the registration of several pesticides on the West Coast[22]. The outcomes of those consultations identifying risks to ESA-listed salmonids are summarized in Table 15. In a 2008 opinion NMFS concluded that current use of chlorpyrifos, diazinon, and malathion is likely to jeopardize the continued existence of 27 listed salmonid ESUs/DPSs. This opinion was remanded back to NMFS by the U.S. Court of Appeals for the 3rd Circuit and these pesticides are now being reassessed under the interagency effort to develop interim scientific approaches to assess the impact of pesticides on ESA-listed species and designated critical habitat, as required by ESA and as recommended by the April 2013 NAS report. In 2009, NMFS further determined that the current use of carbaryl and carbofuran is likely to jeopardize the continued existence of 22 ESUs/DPSs and the current use of methomyl is likely to jeopardize the continued existence of 18 ESUs/DPSs of listed salmonids. NMFS and EPA plan to revisit this analysis as well.

In 2010 NMFS issued an opinion that concluded pesticide products containing azinphos methyl, disulfoton, fenamiphos, methamidophos, or methyl parathion are not likely to jeopardize the continuing existence of any listed Pacific salmon or destroy or adversely modify designated critical habitat. NMFS also concluded that the effects of products containing bensulide, dimethoate, ethoprop, methidathion, naled, phorate, or phosmet are likely to jeopardize the continued existence of some listed Pacific salmonids and to destroy or adversely modify designated habitat of some listed salmonids. In 2011, NMFS issued an opinion on the effects of four herbicides and two fungicides. NMFS concluded that products containing 2,4-D are likely to jeopardize the existence of all listed salmonids, and adversely modify or destroy the designated critical habitat of some of these ESUs and DPSs. Products containing chlorothalonil or diuron

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[22] See: http://www.nmfs.noaa.gov/pr/consultation/pesticides.htm

were also likely to adversely modify or destroy designated critical habitat, but not likely to jeopardize listed salmonids. NMFS also concluded that products containing captan, linuron, or triclopyr BEE do not jeopardize the continued existence of any ESUs/DPSs of listed Pacific salmonids or adversely modify designated critical habitat. In 2012 NMFS issued an opinion on oryzalin, pendimethalin, and trifluralin that concluded each of these chemicals are likely to jeopardize the continued existence of some listed Pacific salmonids, and adversely modify designated critical habitat of some listed salmonids. Also in 2012, NMFS concluded EPA's proposed registration of thiobencarb, an herbicide authorized for use in California only on rice, is not likely to jeopardize the continued existence or adversely modify the designated critical habitat of listed Pacific salmonid species. Finally, in 2015 NMFS concluded that the EPA's proposed registration of the pesticide active ingredient diflubenzuron is likely to jeopardize the continued existence of 23 ESA-listed Pacific salmonid species and is likely to destroy or adversely modify designated critical habitat of 23 listed Pacific salmonids. Also in this opinion, NMFS found that the active ingredients fenbutatin oxide and propargite are each likely to jeopardize the continued existence and likely to destroy or adversely modify designated critical habitat of 21 ESA-listed Pacific salmonid species.

Through these opinions, we learned that exposure to some of the chemicals whose discharges could be authorized by EPA's PGP has been demonstrated to have physical, physiological, or neural effects on individuals that have been exposed and these effects alter the growth, survival, fecundity, and behavior of individuals resulting in increased probability of being captured and killed by predators.

Because the proposed PGP will authorize discharges of formulations of pesticides on, over or near waters of the U.S., NMFS, in this opinion and the opinions summarized above, consider those components of formulations that might be toxic to endangered or threatened species under our jurisdiction as integral to the actions we evaluate. Piperonyl butoxide, nonylphenol and nonylphenol polyethoxylates are examples of "inert" ingredients that may be formulated in pesticide products or added as adjuvant ingredients during pesticide applications. Piperonyl butoxide is a common synergist in formulations of synthetic pyrethroids. Nonylphenol and nonylphenol polyethoxylates are common ingredients in detergents, cosmetics and other industrial products. Toxicity evaluations using the freshwater amphipod, *Hyalella azteca***,** demonstrated a piperonyl butoxide-pyrethrin mixture to be "very highly toxic" under EPA's classification system. A national survey of streams found that nonylphenol was among the most common organic wastewater contaminants in the U.S. and was detected in more than 50 percent of the samples tested. The median concentration of nonylphenol in streams was 0.8 µg/L and the maximum concentration detected was 40.0 µg/L. Related compounds were also detected at a relatively high frequency (Kolpin et al. 2002).

Table 15. Conclusions for ESA section 7 consultations identifying risk of pesticide re-registration to ESA-listed salmonids (Pesticides identified in annual reports are in boldface).

Use	Active Ingredient	Jeopardy to species?	Destruction or adverse modification to Designated Critical Habitat?	Date of opinion
Acaricide	Propargite	21 of 28 species	21 of 26 species	1/7/2015
Herbicide	Oryzalin	10 of 28 species	10 of 26 species	5/31/2012
	Pendimethalin	16 of 28 species	14 of 26 species	5/31/2012
	Trifluralin	16 of 28 species	14 of 26 species	5/31/2012
	2, 4-D	**28 of 28 species**	**6 of 26 species**	**6/30/2011**
	Diuron	**no jeopardy**	**9 of 26 species**	**6/30/2011**
	Bensulide	3 of 28 species	3 of 26 species	8/31/2010
Insecticide	Fenbutatin-oxide	21 of 28 species	21 of 26 species	1/7/2015
	Dimethoate	5 of 28 species	5 of 26 species	8/31/2010
	Disulfoton	1 of 28 species	1 of 26 species	8/31/2010
	Ethoprop	3 of 28 species	3 of 26 species	8/31/2010
	Methidathion	12 of 28 species	11 of 26 species	8/31/2010
	Methyl parathion	8 of 28 species	8 of 26 species	8/31/2010
	Naled	**22 of 28 species**	**20 of 26 species**	**8/31/2010**
	Phorate	15 of 28 species	14 of 26 species	8/31/2010
	Phosmet	20 of 28 species	23 of 26 species	8/31/2010
	Carbofuran*	22 of 28 species	20 of 26 species	3/31/2009
	Carbaryl*	**22 of 28 species**	**20 of 26 species**	**3/31/2009**
	Methomyl*	18 of 28 species	16 of 26 species	3/31/2009
	Chlorpyrifos*	**27 of 28 species**	**25 of 26 species**	**11/18/2008**
	Diazinon*	27 of 28 species	25 of 26 species	11/18/2008
	Malathion*	**27 of 28 species**	**25 of 26 species**	**11/18/2008**
Insecticide and fungicide	Diflubenzuron	23 of 28 species	23 of 26 species	1/7/2015

*Malathion, Diazinon and Chlorpyrifos were remanded back to NMFS and carbofuran, carbaryl, and methomyl are scheduled for reanalysis

Analyses in EPA's Biological Evaluation

EPA's BE assessment identified numerous pesticide scenarios that resulted in elevated acute and chronic risk for individuals representing ESA-listed species and the essential biological elements of their designated critical habitat (Table 14). Many RQs were orders of magnitude greater than the LOC, suggesting population level effects are likely to occur. While the BE did not specify the types of sublethal responses represented by the chronic endpoints selected for their analysis, NMFS' review of the source documentation used by EPA in developing its BE confirms that these included measures representing the assessment endpoints of growth (e.g., length, weight) and fecundity (e.g., number of viable eggs), but not behavior. The EPA does not typically evaluate effects on behavior inits assessments because the linkage between individual effects and population-level effects is *"...uncertain and not quantitative given our present state of knowledge."* However, implications for behavior affecting predation vulnerability and habitat use (e.g., avoidance) as indicated for salmonids in NMFS' prior consultations suggest such effects could also occur in other ESA listed species under NMFS' jurisdiction.

NMFS' also notes that while EPA's assessments incorporated conservative measures, they did not integrate the risk of the actual pesticide mixtures (adjuvants, surfactants and synergists) used under the PGP use patterns. The assessment also did not take into account multiple exposures occurring during the course of the season or over the spatial extent of individual home ranges or migration routes.

Risk Characterization Summary

The species jeopardy and designated critical habitat adverse modification determinations in prior NMFS opinions for pesticide re-registrations and the analyses in EPA's BE indicate that pesticide discharges under these use patterns will result in exposures to toxicants that will affect the survival and fitness of individuals through direct mortality, reduced growth, altered behavior, and reduced fecundity of salmonids, sea turtles, rockfish, sturgeon, coral, and Nassau grouper. Further, discharges under these use patterns are expected to result in exposures to toxicants that will affect the survival and fitness of individuals through reduction in extent of inhabitable area/avoidance and reduction in prey species, affecting the prey component of designated critical habitat essential features for the following species: leatherback sea turtle, southern resident killer whale, green sturgeon, eulachon, bocaccio, yelloweye rockfish, steelhead, and chum, sockeye, chinook, and coho salmon.

> ***Taking into consideration that: (1) the composition, timing, frequency and location of discharges for use patterns eligible for coverage under the 2016 PGP are unknown for a majority of the discharges to be authorized, (2) previous NMFS opinions have found jeopardy and adverse modification of designated critical habitat on several of pesticides used under PGP-eligible use patterns, and (3) the BE analyses included RQs that were many orders of magnitude greater than the LOC EPA uses to evaluate exposures, NMFS concludes that:***

- ***Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in exposures to toxicants that will affect the survival and fitness of individuals through:***
  - ***direct mortality***
  - ***reduced growth***
  - ***altered behavior***
  - ***reduced fecundity (i.e., reduced reproductive output or offspring survival)***
- ***Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in exposures to toxicants that will affect the survival and fitness of individuals through:***
  - ***reduction in extent of inhabitable area/avoidance***
  - ***reduction in prey species***

- ***Pesticide discharges under the four use patterns eligible for coverage under the PGP will result in adverse effects to designated critical habitat features that are essential to the conservation of the species***

8.2 Programmatic Analysis

Because the risk characterization concluded that exposures to pesticides and use patterns eligible for coverage under the 2016 PGP potentially cause adverse effects to assessment endpoints, and therefore to population-level effects for *NMFS' Listed Resources of Concern* and adverse effects to the conservation value of designated critical habitat designated for these species. The conclusion presented in EPA's BE is that the additional requirements provided in the proposed 2016 PGP will likely reduce the potential for adverse effects to ESA-listed species from pesticide applications under FIFRA labeling. The following excerpts from EPA's BE describes the mechanisms through which the PGP accomplishes this goal.

> *"...Both the Services can review NOIs and request EPA to put permit coverage on hold and recommend protective measures prior to discharge authorization..."*
>
> *"...Applicators must minimize the discharge of pesticides to waters of the U.S. from the application of pesticides through the use of Pest Management Measures, and, to the extent not determined by the Decision-maker, use only the amount of pesticide and frequency of pesticide application necessary to control the target pest, and use equipment and application procedures appropriate for this task..."*
>
> *"...Applicators must perform regular equipment maintenance (e.g., calibration, cleaning and repair) to ensure correct application as required by pesticide labels and minimize the potential for leaks, spills, and unintended/accidental release of pesticides from pesticide containers into waters of the U.S. ..."*
>
> *"...Decision-makers required to submit an NOI must apply IPM-like practices, which include assessment of alternatives to pesticide use, identification of action thresholds, development of species-specific control strategies, source reduction; pre-application surveillance to determine whether pesticide use is necessary, post-application surveillance, and the minimization of environmental impacts..."*
>
> *"...The requirement that no discharge may cause or contribute to an excursion of any applicable numeric or narrative federal, state, territory, or tribal water quality standard..."*
>
> *"...The requirement of post-application visual surveillance of the application area to determine whether pesticide application was effective and notification to the permitting authority if adverse effects are observed..."*
>
> *"...Pesticide discharge management plans requirements that include problem identification, pest management option evaluation, and spill and adverse incident response procedures ..."*
>
> *"...Corrective action requirements (including documentation and reporting provisions) ..."*
>
> *"...Annual reporting requirements standard conditions that address reporting, including 24-hour reporting..."*

In its BE, EPA states that these requirements are expected to result in more environmental awareness regarding the pesticide use patterns, and increase the use of non-chemical pest controls or pesticides and application methods that are less harmful to non-target species. In addition, the BE states that the record keeping requirements in the PGP enhance the availability of information that could be useful in further reducing the likelihood of impacts on ESA-listed species and designated critical habitat under NMFS' jurisdiction. EPA indicates that information reported as part of NOIs required of certain applicators in the proposed action could help identify future permit refinements that will further reduce potential impacts on non-target species while still having their intended benefit of reducing threats of invasive species, human health diseases, and minimizing pest damage. In the 2016 BE, EPA stated that the reporting requirements under the PGP will provide additional opportunities for adaptive management with respect to minimizing impacts on listed aquatic and aquatic-dependent species.

8.2.1 Programmatic Analysis Questions

The issuance of the proposed PGP is treated as a permitting "program" that would authorize discharges of pesticide pollutants, along with the interrelated actions of discharges of pesticides not included in the definition of pesticide pollutants, within the action area during multiple, independent events conducted by multiple, independent permittees over a five-year period. Below we answer the questions that consider if the PGP can be implemented in a manner that insures they do not jeopardize ESA-listed species or destroy or adversely modify designated critical habitat.

Scope: *Has the PGP been structured to reliably estimate the probable number, location, and timing of the discharges that would be authorized by the program to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur?*

In its 2016 BE, EPA states that estimating past pesticide usage is "not feasible" relative to agricultural pesticide use due to the limited data for these use patterns. In its 2011 BE, EPA expected this information to be gathered through the implementation of the PGP's NOI and annual reporting requirements. EPA's NOI and annual reporting requirements provided insight into the number, location and timing of PGP-authorized activities. However, NOIs are submitted for only a very small fraction of discharges. Most pesticide discharges are automatically covered without filing an NOI. EPA estimates the total number of pesticide dischargers under the PGP to be about 35,000. About 350 NOI were submitted under the PGP, so only about 1 percent of PGP-authorized dischargers can be identified through NOI.

NOI are required from all Decision-makers expecting to discharge to waters of the U.S. where *NMFS' Listed Resources of Concern* occur. The current definition of *NMFS' Listed Resources of Concern* in the 2016 PGP includes only those species that were listed prior to 2011[23] and does not include coral species[24]. The PGP's definition of *NMFS' Listed Resources of Concern* will need to be updated if implementation of the PGP is to produce information that allows EPA to reliably estimate the probable number, location, and timing of the discharges to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur.

Not all PGP-authorized dischargers are required to file an NOI. For this reason, EPA's ability to estimate the scope of the discharges authorized by the program to waters where *NMFS' Listed*

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[23] NMFS makes the distinction between "NMFS ESA-listed species of Concern" and "ESA-listed species and designated critical habitat under NMFS' jurisdiction" to indicate EPA's existing definition of species they intend to protect under the PGP (i.e., listed prior to 2011 and excluding coral) versus the ESAESA-listed species currently under NMFS' jurisdiction (i.e., "ESA-listed species and designated critical habitat under NMFS' jurisdiction")

[24] At that time, NMFS agreed with EPA's conclusion that these species would not be exposed to PGP discharges. NMFS has reconsidered that exposure scenario.

Resources of Concern occur is related to the compliance of Decision-makers with the requirement to file an NOI for planned discharges to such waters (see section 0). Discharges are not covered under the PGP if they fail to file an NOI when required to do so. In such cases, the Decision-maker violates the CWA when their decisions result in unauthorized discharges to waters of the U.S. Because not all discharges are required to file an NOI under the PGP, the availability of the PGP may result in inadvertent violations of the CWA by: 1) Decision-makers who fail to self-identify as a Decision-maker and, therefore make no determination as to whether an NOI is required because they expect automatic coverage, or 2) Decision-makers who do file an NOI, but incorrectly conclude that *NMFS' Listed Resources of Concern* are absent from their pest management area. Discharges made under these circumstances are not covered by the PGP and the consequences of such discharges are indirect effects of EPA's issuance of the PGP.

Current information resources for permit applicants to use to identify where these species occur is not up to date and require examining a large volume of information provided in the form of a series of documents. These include maps of varying detail and lists of applicable receiving waters, including detail to the level of individual streams and creeks. In addition, the current PGP materials do not identify coastal waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur: Plum Island sound at the mouth of the Merrimack river or coastal waters of Cape Cod Bay. Similarly, current PGP resources do not identify coastal waters of Puerto Rico, where Nassau grouper and ESA-listed coral species may be exposed.

Cases where discharges in violation of the CWA were made as a result of failure to file an NOI for the PGP when one was required, or were ineligible for coverage due to the selection of an incorrect ESA eligibility criterion, were not identified by EPA under the 2011 PGP. There is no evidence whether EPA actively tried to identify unintentional violators and bring them into compliance with the CWA through the PGP, and there is no mechanism under the PGP to track dischargers expecting coverage, but not required to file an NOI. NMFS is not confident that pesticide discharges to waters where *NMFS' Listed Resources of Concern* occur are compliant with EPA's requirement that Decision-makers for such discharges file an NOI or select the correct ESA Eligibility Criterion.

EPA relied on outreach to inform the regulated community and state and federal regulators of the conditions under which they are required to file an NOI (P. Chumble, USEPA Office of Water, Water Permits Division, pers. comm. to P. Shaw-Allen, NMFS OPR, July 25, 2016). The following sections describe NFMS expectations for outreach effectiveness as it relates to EPA's ability to estimate the number, locations, and timing of discharges to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur, including the subset represented by EPA's current definition of *NMFS' Listed Resources of Concern*.

Federal Facilities within the States of Delaware and Washington

NMFS expects that, as trustees for public lands, Federal Decision-makers will file an NOI when ESA-listed species occur within their pesticide management areas. Thus, for the states of Delaware and Washington, EPA will be able to estimate the number, location, and timing of the discharges to waters where *NMFS' Listed Resources of Concern* for discharges made by federal Decision-makers in the states of Washington and Delaware.

The District of Columbia

Pesticide discharges affecting the Potomac River in the District of Columbia are regulated by the District's Department of Energy and Environment. The department website includes links to

EPA's PGP website and does not provide any additional information. Only two NOIs were filed from the area, one for Rock Creek Park, where sturgeon would not occur and one, certifying eligibility under Criterion F, for Theodore Roosevelt Island in the Potomac River, where sturgeon do occur. In the District of Columbia, the shores of the Potomac are bordered by the Chesapeake and Ohio Canal National Historical Park north of Georgetown University and to the south by other Federally-owned District Lands (e.g., Bolling Airforce Base, memorials, East Potomac Park) and Washington National Airport. Given the dominance of federal lands along the Potomac River shoreline within the District of Columbia, NMFS expects that NOI will be filed for PGP-eligible discharges to the Potomac. Thus EPA will be able to estimate the number, location, and timing of the discharges to waters where *NMFS' Listed Resources of Concern* occur in this area.

Indian Country Lands

Relatively few NOI were filed for PGP-eligible discharges on Indian Country Lands. Eight were filed from Washington State, three from Idaho, and one from Oregon. These were distributed among pest control districts, federal Operators, and local governments. While some tribes have pesticide codes and their own tribal programs, the EPA works cooperatively with tribes to implement pesticide programs on reservations. EPA's involvement with pesticide use on tribal lands leads NMFS to expect that an NOI will be filed for PGP-eligible discharges that may expose *NMFS' Listed Resources of Concern*, thus EPA will be able to estimate the number, location, and timing of discharges to waters where such species occur in in Indian Country Lands.

Massachusetts

It appears that outreach may not have reached all the Decision-makers in Massachusetts. While the 2011 PGP ESA guidance materials identified the Connecticut River downstream of Turners Falls Dam as waters where the endangered shortnose sturgeon occur, the only NOI for pesticide applications to or near the Connecticut River acknowledging the presence of ESA-listed species is for the city of Holyoke. One other NOI was found to include discharges to the Connecticut River, but did not acknowledge the presence of *NMFS' Listed Resources of Concern*. NMFS also notes that the three counties through which the river flows are not included in a mosquito control district, leaving a gap in the usual regulatory Decision-makers for this use pattern in the state. Taken with EPA's outreach to the regulated community and state and federal regulators, this suggests that local Decision-makers in cities and towns along the Connecticut River may be engaging in PGP-eligible pest control, but are unaware of their need to file an NOI under the PGP.

NMFS explored the Commonwealth of Massachusetts websites to determine if information on the PGP was readily available. While the Massachusetts Department of Agricultural Resources (MDAR) is identified as the state pesticide regulator, its website makes no mention of the PGP or other requirements when discharging to waters of the U.S. NMFS asked MDAR whether and how applicators, particularly small ones, are made aware of the PGP coverage/requirements for coverage. The MDAR indicated that, since the PGP is an NPDES permit, outreach to the local regulated community was the responsibility of the Massachusetts Department of Environmental Protection (MDEP) (S.E. Antunes-Kenyon, Pesticide Operations Coordinator, MDAR, pers. comm. to T. LaScola Director, Division of Crop and Pest Services, MDAR, Forwarded to P. Shaw-Allen, NMFS OPR, July 14, 2016). In turn, MDEP indicated that, for the 2011 PGP, they made presentations to the only two companies licensed to apply pesticides to water in the state and that Decision-makers must use one of these applicators for discharges covered under the 2011 PGP (R. Kubit, MDEP, Division of Watershed Management, pers. comm. to P. Shaw-Allen, NMFS OPR, September 7, 2016). MDEP also indicated that conservation commissions within each municipality are expected to inform Decision-makers when their pest control activities require an NOI. A subsequent conversation with Eugene Benson, Director of the Massachusetts Association of Conservation Commissions revealed that the Association was not aware of the PGP or this expectation of its commissions (Eugene Benson, Director of the Massachusetts Association of Conservation Commissions, pers. comm. to P. Shaw-Allen, NMFS OPR, September 12, 2016).

MDEP and Mr. Benson both noted that a state permit is required for aquatic weed control and coordination with the Massachusetts Natural Heritage and Endangered Species Program occurs when discharges may affect endangered and threatened species in waters of concern flagged by that program. Coordination with this state program does not necessarily mean NMFS ESA concerns would be evident because the waters flagged by the Massachusetts Natural Heritage and Endangered Species Program do not include some of the waters where NMFS requires NOI for EPA General Permits. Further, this program is responsible for advising on compliance with state regulations, not federal regulations. NMFS encountered this issue when consulting on EPA's Multisector General Permit. Eve Schluter, Chief of Regulatory Review, Natural Heritage and Endangered Species Program, recognized this issue and has added the following language to the programs stock language for letters responding to regulatory inquiries (E. Schluter, Chief of Regulatory Review, Natural Heritage and Endangered Species Program, pers. comm. to Pat Shaw-Allen, November 17, 2015):

> *If the purpose of your inquiry is to generate a species list to fulfill Endangered Species Act information requirements for a permit, proposal, or authorization of any kind from a federal agency, it is strongly recommended that you obtain your species lists related to your location data from both the National Marine Fisheries Service at (978)281-9328 and the U.S. Fish and Wildlife Service's Information for Planning and Conservation website (IPaC).*

NMFS anticipates that inclusion of the above statement makes it more likely that NOI will be filed for PGP-authorization of pesticide discharges for the control of aquatic weeds in areas where *NMFS' Listed Resources of Concern* occur. However, there is no process to identify inquiries that were for a federal permit or whether the services were contacted in such cases.

Based on the NOI for the 2011 PGP, the aquatic animal pest use pattern in Massachusetts has been limited to control of aquatic invertebrates in cranberry bogs, where NMFS' species of concern are not expected to occur. There is no guarantee this will not change during the 2016 permit term. NMFS expects that state and federal agencies, who were included in EPA outreach efforts, would be the Decision-makers for forest canopy pest control activities. For this use pattern, NOI are expected to be filed and EPA will be able to estimate the number, location, and timing of the discharges to waters where *NMFS' Listed Resources of Concern* occur. While several mosquito control districts filed NOI in Massachusetts, there appears to be an outreach gap for local government Decision-makers under the mosquito and flying pest control use pattern in areas of Massachusetts where mosquito control districts have not yet been established. These areas are the three counties through which the Connecticut River flows.

New Hampshire

The state of New Hampshire requires a special permit from its Division of Pesticide Control for any pesticide discharge to surface waters under Chapter Pes 600, Aquatic Application of Pesticides under RSA 430:31, Pesticides Controls. The State Pesticides Control Board, which oversees the activity of the Division of Pesticide Control, includes a representative from the State Department of Fish and Game. Given EPA's outreach to state regulators and the State's own regulation of pesticide discharges to surface water, NMFS expects State Pesticides Control Board will ensure that NOI will be filed for pesticide discharges to waters of the U.S. where *NMFS' Listed Resources of Concern* occur. Thus, EPA will be able to estimate the number, location, and timing of the discharges to these waters.

Idaho

The State of Idaho includes PGP information on their Department of Environmental Protection website and a link to the PGP on the main page of the Department of Agriculture Pesticides and Chemigation Program's website. The Pesticides and Chemigation Program annual report also indicates that the group made a concerted effort to stay involved in the development of the 2011 PGP and has a future goal to coordinate with EPA and industry on the PGP and biological options for pesticides to protect ESA-listed salmonids. EPA region 10 worked with NMFS to develop best management practices for applications to waters where *NMFS' Listed Resources of Concern* occur. Idaho includes seven mosquito and vector control districts covering all 44 counties. Forest canopy pest applications would likely be directed by the U.S. Forest Service or a state agency. NOI are expected to be filed for these use patterns. Given the breadth of PGP information provided on state websites, complete coverage for the state under mosquito control districts, the involvement of EPA with NMFS in addressing ESA concerns, NMFS expects that local, state, and federal Decision-makers, regardless of use pattern, will file NOI when ESA concerns require that they do so. However, this is not necessarily the case for all private Decision-makers expecting coverage under the PGP.

Puerto Rico

While elkhorn and staghorn coral were listed as threatened species at the time of the 2011 PGP issuance, they were not included among the *NMFS' Listed Resources of Concern* in the PGP because, at that time, NMFS agreed with EPA that exposures to PGP-authorized discharges were unlikely. Since 2011 NMFS has listed the Nassau grouper and an additional five species of corals that occur in Puerto Rico waters. Four NOI were filed prior to 2016 by Decision-makers in Puerto Rico. Three of these were for control of aquatic weeds by individual irrigation districts and one for control of mosquitoes for all 78 municipalities of the island of Puerto Rico. All four certified under Criterion A, no species present. This contrasts with a 2016 Criterion D NOI, declared pest emergency where NMFS resources of concern occur, filed by the Centers for Disease Control for the application of naled, over two of these municipalities, Ponce and San Juan. While NMFS does not have ESA-listed species that occur in inland waterways that may be affected by these discharges, coral reefs (and Nassau grouper) occur close to shore in some areas (<5 meters, Figure 7). Furthermore, as while the PGP does not cover drift or off-site transport, offsite transport is an indirect effect of PGP authorizations. NMFS expects that pesticide transport from PGP-authorized discharges that were not identified in the NOI from coastal municipalities may reach areas where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur as direct and indirect exposures resulting from the PGP-authorized discharges. Given the potential for exposures to PGP-authorized discharges in Puerto Rico, NMSF expects that under the 2016 PGP some Decision-makers in Puerto Rico will fail to correctly identify the presence of *NMFS' Listed Resources of Concern*.

American Samoa, Guam, Johnston Atoll, Midway Island, Northern Marianas, and Wake Island

Only two terminated NOI were from the Pacific islands where EPA is the permitting authority. The terminated NOI were for the use of an anticoagulant on Wake Island to control animal pest species on Joint Base Elmendorf-Richardson. The U.S. Air Force currently administers Johnston Atoll and Wake island. Midway Island is a National Wildlife Refuge managed by the USFWS. The Northern Marianas is a commonwealth territory. Guam and American Samoa are unicorporated territories. The 2011 PGP includes permit conditions only for the island of Guam. Pesticide applications eligible for coverage under the PGP in the remote Pacific Islands are expected to be infrequent. Given the federal involvement in Johnston Atoll, Wake Island and Midway Island, NOI are expected to be filed when discharges from these areas may expose ESA-listed species and designated critical habitat under NMFS' jurisdiction. The effectiveness of outreach to non-federal Decision-makers on these islands is uncertain.

Summary

While some areas where EPA is the permitting authority are more likely to produce NOI where necessary to address ESA-concerns and allow EPA to estimate the number, location, and timing of the discharges to waters where *NMFS' Listed Resources of Concern* occur (e.g., Federal Operators, Tribes working in concert with EPA), gaps are evident for the Connecticut River Valley of Massachusetts, Puerto Rico and possibly the remote Pacific island territories. Gaps are also expected to occur where private Decision-makers fail to file NOI for discharges to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur. NMFS concludes that these gaps result in an uneven ability to estimate the number, location, and timing of the discharges to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur. Ultimately, because not all dischargers are required to file NOI and decisions not to file an NOI are not tracked, Decision-makers from any state or territory may assume they are automatically covered under the PGP after failing to correctly identify the presence of ESA-listed species and designated critical habitat under NMFS' jurisdiction in their pest management area.

NMFS concludes that the PGP, as currently written, will not enable EPA to reliably estimate the probable number, location, and timing of the discharges that would be authorized by the program to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur because EPA's definition of NMFS' Listed Resources of Concern does not include the endangered Atlantic sturgeon (North Atlantic DPS) or threatened Nassau grouper and grouper, elkhorn coral, staghorn coral, lobed star coral, boulder star coral, mountainous star coral, pillar coral, and rough cactus coral.

> ***NMFS also concludes that discharges to waters of the U.S. will be made in violation of the CWA as an indirect effect of EPA's issuance of the PGP through discharges not covered by the PGP due to:***
>
> ***(1) Apparent gaps in outreach resulting in Decision-makers failing to self-identify as Decision-makers under the PGP and subsequently assuming automatic coverage and orchestrating pesticide discharges without determining whether an NOI must be filed, and***

(2) The ungainliness of the existing PGP information resources for identifying where NMFS' Listed Resources of Concern occur, resulting in failures to identify the presence of such species and failures to file an NOI or correctly certify ESA eligibility.

Stressors: *Has the general permit been structured to reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of the discharges that would be authorized (that is, the stressors produced by the actual discharges to waters of the U.S.)?*

EPA's ability to identify the stressors that are discharged to waters of the U.S. is limited to those discharges where *NMFS' Listed Resources of Concern* occur because only these NOI include information on planned discharges either directly, or indirectly, through supporting documentation (e.g., consultation documents, ESA Section 10 permits). To adequately understand the hazards posed by their multiple authorizations, EPA must also collect that information and evaluate the aggregate stressor impacts that have been authorized under the PGP.

In its 2016 BE, EPA states that estimating past pesticide usage is "not feasible" relative to agricultural pesticide use due to the limited data for these use patterns. In its 2011 BE, EPA expected this information to be gathered through the implementation of the 2011 PGP's NOI and annual reporting requirements. EPA's NOI and annual reporting requirements provided some insight into the discharged to waters where *NMFS' Listed Resources of Concern* occur (see section 0 of this opinion). Only applicants certifying ESA eligibility under Criterion D (for declared pest emergencies) and F (the applicant self-certifies that discharges are NLAA) are required to provide information on the pesticides they intend to use in their NOI prior to discharge. Applicants certifying under Criterion B (i.e., discharges are covered under another consultation) are not required to provide further detail such that a reviewer could confirm that the consultation was valid and up to date or determine whether these discharges, taken with other anticipated PGP discharges in the same area, potentially overlap and present an aggregate risk. NOI for Criterion B-certifying applicants are about as frequent as those certifying under Criterion F, totaling 22 and 27 permitees, respectively (about 8 and 10 percent of NOI). It is left to NMFS to review documentation supporting a criterion B certification and confirm that the certification was valid and that the planned discharges, taken with other PGP-authorized discharges, would not present excess aggregate risk to ESA-listed species and designated critical habitat under NMFS' jurisdiction. Under the current permit, through its NOI EPA collects information for a subset of stressors expected to be produced as result of its PGP authorizations prior to discharge to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur. It is up to NMFS review of documentation supporting NOI certified under Criteria B and E to identify the remaining stressors authorized for discharge under the PGP.

A valid and up to date consultation is a consultation for which none of the criteria for reinitiation of consultation under 50 C.F.R. § 402.16 are met, and for which the opinion or letter of concurrence has not been withdrawn or superseded as the result of a later consultation. Consultations can be either formal or informal, and would have occurred only as a result of a separate federal action. Such consultations address the effects of pesticide discharges and discharge-related activities on federally-listed threatened or endangered species and federally-designated critical habitat, and must have resulted in either: 1) A opinion from NMFS finding no likely jeopardy to ESA-listed species and no destruction/adverse modification of federally-designated critical habitat; or 2) Written concurrence from NMFS with a finding that the pesticide discharges and discharge-related activities are not likely to adversely affect federally-listed species or federally-designated critical habitat. If the consultation resulted in a opinion, the pesticide application activities for which permit coverage is being requested must be carried out in full compliance with any reasonable and prudent alternatives in that opinion, and in full compliance with the reasonable and prudent measures and terms and conditions of any incidental take statement in that opinion.

> ***NMFS concludes that through the NOI process EPA would not be able to reliably estimate the stressors that are likely to be produced as a direct or indirect result of all PGP-authorized discharges because only those NOI identifying discharges to waters where NMFS listed Resources of Concern occur will include information on the planned discharges.***

Overlap: *Has the general permit been structured to reliably estimate whether or to what degree specific endangered or threatened species or designated critical habitat are likely to be exposed to stressors of the action that the proposed permit would authorize for discharge into waters where NMFS' Listed Resources of Concern occur?*

In its 2011 BE EPA proposed to use the NOI process to estimate whether or to what degree specific endangered or threatened species are likely to be exposed to the direct or indirect effects of the activities to be authorized by the proposed permit. The NOI form contained a section where the Decision-maker self-certifies whether the planned pesticide applications will overlap with the distribution of ESA-listed species and how ESA concerns are addressed.

The ability of EPA to reliably estimate whether or to what degree specific endangered or threatened species or designated critical habitat are likely to be exposed to stressors authorized for discharge by the PGP also relies on Decision-makers to accurately identify the presence of such species and to file an NOI when it is required. EPA assumes that all NMFS ESA-listed species could potentially overlap in space and time with any use pattern and pesticide eligible for coverage under the 2016 PGP. Again, the definition of *NMFS' Listed Resources of Concern* in the 2016 draft PGP does not include coral or species listed after 2011. These include Nassau grouper, three DPS's of Atlantic sturgeon, and recently listed coral species. Waters where shortnose sturgeon occur were identified under the 2011 PGP overlap with waters where Atlantic sturgeon are found, but NMFS also includes the Taunton River, coastal waters of Cape Cod Bay, Plum Island Sound, the Piscataqua River, and the Cocheco river (tributary to the Piscataqua) among waters of concern for this species. Given the additional species and waters of concern, as currently written the PGP is not structured to allow EPA to collect reliable information on specific endangered or threatened species or designated critical habitat that are likely to be exposed to PGP-authorized discharges. During the course of this consultation, EPA worked with biologists in NMFS' regions to develop a mapping tool that includes these additional waters and will allow PGP applicants to easily check whether their pesticide management areas overlap with areas where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur. However, the use of this tool is not a component of the current draft of the 2016 PGP.

As discussed previously, review of NOI for the Commonwealth of Puerto Rico revealed differences in criterion selection for the same areas by different Decision-makers, Puerto Rico Department of Health and the U.S. Centers for Disease Control. Terminated NOI for discharges within Massachusetts rights of ways for the control of aquatic vegetation included a map of the treated area indicating one of the rights of way treated passes through the Connecticut River, which had been identified as a water of concern for shortnose sturgeon under the 2011 PGP. Annual reports filed while the NOI was active (2013-2013) also listed two hired pesticide applicators that were not either of the companies identified by MDEP as licensed to apply pesticides to water. This is one example where an NOI was filed with an inaccurate ESA Eligibility Criterion A selection. Because an NOI is not required of all PGP-covered dischargers, EPA cannot know whether or how many Decision-makers will make inaccurate determinations that *NMFS' Listed Resources of Concern* are not present leading them to not file an NOI when one is required due to ESA concerns. Such discharges would not be covered under the PGP and would therefore violate the CWA during their discharge activities. Because such decisions are not tracked, EPA would not be able to identify these dischargers and bring them into compliance with the CWA through the PGP. The probability of such errors will likely increase as additional waters of concern are included under the 2016 PGP.

> ***NMFS concludes that EPA will not be able to reliably estimate whether or to what degree specific endangered or threatened species or designated critical habitat are likely to be exposed to stressors resulting from PGP-authorized discharges due to omission of species listed as threatened or endangered under the ESA since issuance of the 2011 PGP.***

Monitoring/Feedback: *Has the general permit been structured to identify, collect, and analyze information about authorized actions that may have exposed endangered or threatened species or designated critical habitat to stressors at concentrations, intensities, durations, or frequencies that are known or suspected to produce physical, physiological, behavioral, or ecological responses that have potential individual or cumulative adverse consequences for individual organisms or essential elements of designated critical habitat?*

In order to continually identify, collect and analyze information that suggests that the discharges of pesticide on, over or near waters of the U.S. may expose endangered or threatened species or designated critical habitat to pesticide at concentrations, durations or frequencies that are known or suspected to produce physical, physiological, behavioral or ecological responses that have potential individual or cumulative adverse consequences for individual organisms or *essential elements* of designated critical habitat, the EPA proposes to require that Operators self-monitor for adverse effects resulting from these discharges. The PGP requires permittees to monitor and report any adverse incidents resulting from activities authorized by the permit. This places the responsibility for oversight largely on the permittees who would have little incentive to do so given that such observations would be a violation of the PGP and potentially result in enforcement responses by the EPA and/or subsequent loss of a pesticide applicator's license. Under the 2011 PGP, no incidents were reported.

In addition, it is unclear how an Operator will have the ability to visually detect all adverse responses to pesticide exposures to ESA ESA-listed species or their designated critical habitat. For example, while Operators might have the ability to observe the mortality of adult or juvenile listed fish, they likely would not have the resources or ability to visually detect the death of the eggs or alevins of these species. Nor would they likely have the resources or ability to observe reductions in the reproduction or growth rates of these species or other sublethal effects as a result of pesticide exposures. Adequate monitoring by the Operator that would be sufficient to insure that no adverse exposures occurred from authorized discharges would be time and resource intensive. Yet, the EPA states in its BE that:

> *"[Visual monitoring by permittees] … should provide valuable information to EPA and the States about where adverse environmental effects are occurring. This knowledge will help EPA identify where problems may remain and where improvements can be made in the next PGP."*

While we agree that these monitoring efforts may improve the PGP over time, it is unlikely that the self-monitoring and self-reporting conditions of the PGP are sufficient such that the EPA can continually identify, collect and analyze information that suggests that the discharges of pesticide on, over or near waters of the U.S. may expose endangered or threatened species or designated critical habitat under NMFS' jurisdiction to pesticide at concentrations, durations or frequencies that are known or suspected to produce physical, physiological, behavioral or ecological responses that have potential individual or cumulative adverse consequences for individual organisms or *essential elements* of designated critical habitat.

The NOI and annual reports also provide information on discharges that may have exposed endangered or threatened species or designated critical habitat to stressors at concentrations, intensities, durations, or frequencies that may have adverse consequences for ESA-listed species and designated critical habitat under NMFS' jurisdiction. However, while all Decision-makers discharging to waters where *NMFS' Listed Resources of Concern* occur are required to submit and NOI, not all are required to submit annual reports. This will result in gaps in information on the actual discharges that were made, since the NOI only identify the planned discharges and will not include the same level of detail as an annual report.

> ***NMFS concludes that EPA will not be able to collect, and analyze information about authorized actions that may have exposed specific endangered or threatened species or designated critical habitat to stressors at concentrations, intensities, durations, or frequencies that are known or suspected to produce physical, physiological, behavioral, or ecological responses that have potential individual or cumulative adverse consequences for individual organisms or essential elements of designated critical habitat because: 1) dischargers will not always be able to observe adverse responses resulting from their pesticide applications, 2) not all dischargers to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur will provide annual reports identifying the actual discharges that were made, and 3) there is a disincentive for discahrgers to report incidents due the the potential for negative consequences.***

Responses of Listed Resources: *Does the general permit have an analytical methodology that considers: a) the status and trends of endangered or threatened species or designated critical habitat; b) the demographic and ecological status of populations and individuals of those species given their exposure to pre-existing stressors in different drainages and watersheds; c) the direct and indirect pathways by which endangered or threatened species or designated critical habitat might be exposed to the discharges to waters of the United States; and d) the physical, physiological, behavior, and ecological consequences of exposing endangered or threatened species or designated critical habitat to stressors from discharges at concentrations, intensities, durations, or frequencies that could produce physical, physiological, behavioral, or ecological responses, given their pre-existing demographic and ecological condition?*

Section 7(a)(2) of the ESA requires Federal Agencies to use the best scientific and commercial data available to insure that any action authorized, funded or carried out by such Agency is not likely to jeopardize the continued existence of any listed resource. EPA requires permittees to be responsible for complying with this requirement by determining whether the specific actions those permittees carry out, as authorized by the proposed general permit, may affect ESA ESA-listed species or designated critical habitat. However, it is unlikely that the majority of Decision-makers would have access to the best scientific and commercial data available, or the necessary training and experience, to make such determinations. For example, it is NMFS' experience with NOIs filed in the state of Idaho by non-federal decision-makers certifying under Criterion F frequently incorrectly self-certify that their discharge is not likely to adversely affect *NMFS' Listed Resources of Concern* (D. Mabe, Idaho State Director, NMFS Protected Resources, pers. comm. to P. Shaw-Allen, NMFS, June 24, 2015).

The 2016 PGP ESA Eligibility Criteria addresses potential issues by either directly or indirectly incorporating NMFS expertise to supply the necessary analytical methodology to evaluate whether ESA-listed species and designated critical habitat under NMFS' jurisdiction may become exposed to and respond adversely to planned discharges.

An NOI certification under Criterion B requires that prior consultation with NMFS determined that the discharge is not likely to adversely affect ESA-listed species or designated critical habitat. Certification under Criterion C requires that the discharges be authorized under a Habitat Conservation Plan under Section 10 permit under the ESA. In both cases, NMFS has already assessed the implications of planned discharges and concludes that they do not pose ESA concerns.

An NOI certification under Criterion D is required for discharges performed in response to a Declared Pest Emergency and the NOI containing information about the discharge that is occurring is filed within 15 days of initial discharge, making it available for NMFS review. NMFS has 30 days to advise EPA whether the discharge(s) described in the NOI meets the eligibility criterion of not likely to adversely affect *NMFS' Listed Resources of Concern*; whether the eligibility criterion could be met with additional conditions; or whether the eligibility criterion is not met. EPA will advise the Decision-maker within 15 days after receiving notification from NMFS whether the discharge or discharges qualify for coverage beyond the 60-day authorization provided under the permit. If EPA identifies additional conditions to qualify discharges as eligible for coverage beyond 60 days under the permit, those conditions remain in effect for the life of the permit. EPA expects to rely on NMFS' determination in identifying eligibility for continuing authorization, either with or without additional conditions.

Review by NMFS is also indicated for Decision-makers certifying their NOI under ESA Eligibility Criteria E or F. Certification under Criterion E requires confirmation from a NMFS Regional Office prior to NOI submission that discharges are not likely to adversely affect "*NMFS' Listed Resources of Concern*." The NOI must include documentation of NMFS acknowledgment that they have determined the discharges are not likely to adversely affect *NMFS' Listed Resources of Concern* and any additional measures NFMS requires for permit eligibility. To maintain eligibility under the PGP for those discharges, those additional measures must be implemented for the duration of coverage under the PGP.

If a discharger self-certifies that discharges are not likely to adversely affect *NMFS' Listed Resources of Concern* under Criterion F, the NOI is required to include information on the pesticides and application protocols used to facilitate review of the discharge along with the rationale supporting the determination whether the discharge is likely to adversely affect *NMFS' Listed Resources of Concern*. The NMFS will, within 30 days of submission of the NOI, advise EPA whether it believes the planned discharges meet the eligibility criteria of not likely to adversely affect *NMFS' Listed Resources of Concern*, whether the eligibility criterion could be met with additional conditions; or whether the eligibility criterion is not met. EPA will advise the Decision-maker as to whether the intended discharges qualify to proceed under the General Permit or whether an individual permit will be required. EPA expects to rely on NMFS' determination in identifying eligibility for authorization, either with or without additional conditions. While the PGP indicates that if EPA does not contact the discharger within 30 days, they may assume that the discharge is authorized without further conditions. The PGP does not indicate that EPA assumes that ESA concerns have been adequately addressed in cases where NMFS has not responded to the NOI.

> ***NMFS concludes that its review of NOI for EPA incorporates into the PGP an analytical methodology that considers: a) the status and trends of endangered or threatened species or designated critical habitat; b) the demographic and ecological status of populations and individuals of those species given their exposure to pre-existing stressors in different drainages and watersheds; c) the direct and indirect pathways by which endangered or threatened species or designated critical habitat might be exposed to the discharges to waters of the U.S.; and d) the physical, physiological, behavior, and ecological consequences of exposing endangered or threatened species or designated critical habitat to stressors from discharges at concentrations, intensities, durations, or frequencies that could produce physical, physiological, behavioral, or ecological responses, given their pre-existing demographic and ecological condition.***

Compliance: *Does the general permit have a mechanism to reliably determine whether or to what degree Operators have complied with the conditions, restrictions or mitigation measures the proposed permit requires when they discharge to waters of the U.S.?*

The EPA must have an effective means of oversight to know or be able to determine reliably whether or to what degree Operators are complying with the conditions, restrictions or mitigation measures the proposed general permit requires when they discharge pesticide on, over or near waters of the U.S. Under the conditions of the permit, any Operator would be required to allow EPA or an authorized representative to: 1) Enter the premises where a regulated facility or activity is located or conducted; 2) Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit; 3) Inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under the permit; and 4) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location. However, the proposed PGP does not provide information regarding the level of oversight EPA plans to carry out. The proposed general permit only states that the Operator must allow EPA to do so.

It is not apparent whether EPA carried out inspections for the 2011 PGP. Since the timing and location of pesticide discharges is often determined by weather conditions and other logistical concerns, EPA is unlikely to be able to schedule an inspection during an actual discharge. The

NMFS opinion for the 2011 PGP included a review of inspection and compliance patterns for general permits recorded in EPA databases indicating that a reduced rate of inspections likely results in a substantial number of undetected permit violations. In the absence of PGP-specific data for the 2011 permit term, EPA-issued individual and general permits from NPDES-permitted sources such as industrial and municipal wastewater, stormwater, and animal feeding operations, were taken as surrogate indicators of compliance performance for EPA-issued PGP? permits. NMFS acknowledges that the PGP-authorized discharges differ from these sources, but in the absence of inspection and compliance data for the 2011 PGP, they are the best available indicator for this aspect of permit performance. NFMS revisited this analysis for the 2016 PGP using data from EPA's Enforcement Compliance History Online database (Accessed September 4th, 2016). Among permits issued by EPA, current data indicate that dischargers with individual permits were more likely to be inspected than dischargers covered under general permits (90 percent versus 17 percent). Noncompliance rates (e.g., effluent violations, reporting violations) were higher among inspected permits, and highest among individual permit holders (Table 16). To make sure that noncompliance rates among inspected permits were not inflated by inspections made in response to reporting violations or reported effluent exceedences (i.e., for-cause inspections), a reanalysis of these data excluded those permits with inspections coded as "case development," "diagnostic," or "non-compliance rates." Very few inspections for cause were identified among the data. The results of this second analysis did not indicate that for-cause inspections inflated noncompliance rates. The occurrence of noncompliance among dischargers that are not inspected is identified through required reporting indicating effluent exceedences, methods violations, or extraordinary discharge incidents and through failures to meet reporting requirements. Overall, noncompliance among inspected dischargers is higher than for uninspected dischargers, but, when inspected, dischargers with EPA-issued general permits are less likely to be found in noncompliance than dischargers with EPA-issued individual permits. This could reflect the dominance of wastewater dischargers among individual permits and a systematic exclusion of dischargers with problematic discharges from coverage under General Permits by EPA.

Table 16. Noncompliance rates among inspected and uninspected dischargers with EPA-issued permits with and without inspections made in response to violations.

Permit Type	Noncompliance Rate Among Inspected Dischargers (inspections for cause excluded)	Noncompliance Rate Among Uninspected Dischargers
EPA-issued General Permit	20 percent (20 percent)	4 percent
EPA-Issued Individual Permit	67 percent (64 percent)	33 percent

Previous investigations of general permits have examined the reliability of self-identification for permit coverage and self-reporting for permit violations. One investigation reported grossly incomplete compliance with State and EPA administered storm water general permits 10 years after implementation (Duke and Augustenborg, 2006). The researchers also determined that general permits administered by EPA attained higher compliance rates than State administered general permits. Another study found a compliance rate of 10 percent under Florida's State wide general permit. Only 14 of the 136 industries examined which should have filed an NOI did so (Cross and Duke, 2008).

Further, inspections and collection of compliance data is only possible for PGP-authorized dischargers who filed an NOI. Cases where discharges in violation of the CWA were made as a result of failure to file an NOI for the PGP when one was required were not identified by EPA under the 2011 PGP. There is no evidence whether EPA actively tried to identify unintentional violators expecting automatic coverage and bring them into compliance with the CWA through the PGP. The implications of the selective requirement to file an NOI were discussed in context of our analysis of EPA's understanding of the scope of its action (Item 1 in this section).

Given the findings the analysis reaffirming the importance of inspections in detecting violations and the expectation that while the work of Duke and Augustenborg (2006) may generally reflect the behavior of a subset of dischargers expecting coverage under the PGP, NMFS expects that the EPA cannot ensure compliance with the protective provisions of NPDES general permits.

> ***NMFS concludes that EPA is not likely to know or be able to reliably determine whether or to what degree Decision-makers comply with the conditions, restrictions or mitigation measures required under the 2016 PGP because the PGP does not specify the level of oversight or inspections that will occur and there does not appear to include a plan to ensure compliance or for identifying cases where an NOI was required but not submitted.***

Adequacy of Controls: *Does the PGP provide EPA a mechanism to prevent or minimize endangered or threatened species or designated critical habitat from being exposed to stressors from discharges at concentrations, durations, or frequencies that a) are potentially harmful to individual listed organisms, populations, or the species, or; b) have ecological consequences that are potentially harmful to individual listed organisms, populations, species or the physical and biological features of their designated critical habitat?*

Controls preventing or minimizing exposure that are specified within the 2016 PGP itself include the requirement that applicators minimize the discharge of pesticides to waters of the U.S.

through the use of Pest Management Measures and use only the amount of pesticide and frequency of pesticide application necessary to control the target pest. Applicators are also required to perform regular equipment maintenance (e.g., calibration, cleaning and repair) to ensure correct application as required by pesticide labels and minimize the potential for leaks, spills, and unintended/accidental release of pesticides from pesticide containers. Decision-makers discharging to waters where *NMFS' Listed Resources of Concern* occur are required to submit an NOI and must apply IPM-like practices, which include assessment of alternatives to pesticide use, source reduction and pre-application surveillance to determine whether pesticide use is necessary.

As stated in Section 0, for those dischargers required to submit an NOI due to ESA concerns, the ESA Eligibility Criteria outlined in the 2016 PGP either directly or indirectly incorporates NMFS expertise. NMFS review of NOI would also identify, or have identified, any additional protective measures necessary to prevent or minimize exposure. The effect of NMFS review was demonstrated under the 2011 PGP. After determining that the controls identified in NOI by Idaho non-federal applicants certifying eligibility under Criterion F were not adequate, NMFS and EPA worked together to develop and require specific best management practices to prevent or minimize exposure. The following paragraph reviews how NMFS expertise is integrated into the ESA Eligibility Criteria and how NMFS review would introduce controls to prevent or minimize exposure.

An NOI certification under Criterion B requires that prior consultation with NMFS determined that the discharge is not likely to adversely affect ESA-listed species or designated critical habitat. Certification under Criterion C requires that the discharges be authorized under a Habitat Conservation Plan under an ESA Section 10 permit. In both cases, NMFS has already assessed the implications of planned discharges, including the need for and measures to prevent or minimize exposures, and concludes that they do not pose ESA concerns.

An NOI certification under Criterion D is required for discharges to waters of the U.S. containing *NMFS' Listed Resources of Concern* that are performed in response to a Declared Pest Emergency Situation. The NOI filed within 15 days of initial discharge is required to include information on the pesticides and application protocols used to facilitate review of the discharge along with the rationale supporting the determination whether the discharge is likely to adversely affect *NMFS' Listed Resources of Concern*, including the description of appropriate measures to be undertaken to avoid or eliminate the likelihood of adverse effects. NMFS will, within 30 days of submission of the NOI, advise EPA whether the past and planned future discharges meet the eligibility criterion of not likely to adversely affect *NMFS' Listed Resources of Concern*; whether the eligibility criterion could be met with additional conditions, including controls that would prevent or minimize exposure; or whether the eligibility criterion is not met. EPA will advise the Decision-maker within 15 days after receiving notification from NMFS whether the discharge or discharges qualify for coverage beyond the 60-day authorization provided under the permit. If EPA identifies additional conditions to qualify discharges as eligible for coverage beyond 60 days under the permit, those conditions remain in effect for the life of the permit. EPA expects to rely on NMFS' determination in identifying eligibility for continuing authorization, either with or without additional conditions.

Review by NMFS is also indicated for Decision-makers certifying their NOI under ESA Eligibility Criteria E or F. Certification under Criterion E requires confirmation from a NMFS Regional Office prior to NOI submission that discharges are not likely to adversely affect *NMFS'*

Listed Resources of Concern. A confirmation indicates that NMFS has evaluated both the potential for effects from the intended discharges and the controls applied to prevent or minimize exposure. The NOI must include documentation of NMFS' acknowledgment that they have determined the discharges are not likely to adversely affect *NMFS' Listed Resources of Concern* and any additional measures, including controls to prevent or minimize exposure, that NFMS requires for permit eligibility. To maintain eligibility under the PGP for those discharges, those additional measures must be implemented for the duration of coverage under the PGP.

If a discharger self-certifies that discharges are not likely to adversely affect *NMFS' Listed Resources of Concern* under Criterion F, the NOI is required to include information on the pesticides and application protocols used to facilitate review of the discharge along with the rationale supporting the determination whether the discharge is likely to adversely affect *NMFS' Listed Resources of Concern*. The NMFS will, within 30 days of submission of the NOI, advise EPA whether it believes the planned discharges meet the eligibility criteria of not likely to adversely affect *NMFS' Listed Resources of Concern*, whether the eligibility criterion could be met with additional conditions, including controls that prevent or minimize exposure; or whether the eligibility criterion is not met. EPA will advise the Decision-maker as to whether the intended discharges qualify to proceed under the General Permit or whether an individual permit will be required. EPA expects to rely on NMFS' determination in identifying eligibility for authorization, either with or without additional conditions. While the PGP indicates that if EPA does not contact the discharger within 30 days, they may assume that the discharge is authorized without further conditions. The PGP does not indicate that EPA assumes that ESA concerns have been adequately addressed in cases where NMFS has not responded to the NOI.

> ***NMFS concludes that components of the PGP intended to reduce discharges or promote the use of less toxic pesticides, in concert with NMFS review of NOI for EPA, serves as the mechanism to prevent or minimize the exposure of endangered or threatened species or designated critical habitat to stressors from discharges: a) at concentrations, durations, or frequencies that are potentially harmful to individual listed organisms, populations, or the species, or; b) to ecological consequences that are potentially harmful to individual listed organisms, populations, the species or essential elements of designated critical habitat.***

9 INTEGRATION AND SYNTHESIS

Here, we integrate information presented in this opinion to summarize the action in its entirety and consequences for ESA-listed species. Through the PGP, EPA would authorize discharges of pesticide pollutants on, over or near waters of the U.S. over the permit period from 2016 to 2021. The EPA estimates the total number of pesticide Decision-makers and Applicators authorized under the 2011 PGP to be about 35,000 and reported that only 357 Operators submitted a NOI. As a result, there is considerable uncertainty regarding the number, location, timing, and composition of discharges to waters of the U.S. authorized that occurred under the 2011 PGP and will occur under the 2016 PGP. Therefore considerable uncertainty remains in this consultation regarding subsequent exposures and responses under the proposed 2016 PGP.

The EPA's BE on the PGP and NMFS opinions on re-registration of several pesticides, establish that pesticides applied according to FIFRA labeling adversely affect ESA-listed species (Table 15). In many cases NMFS opinions conclude that application under FIFRA labeling jeopardizes the continued existence of such species and results in adverse modification of their designated critical habitat (see Table 15 for list of opinions). It is EPA's intention to mitigate this risk through its implementation of the PGP.

The risk analysis of this consultation concludes that, given the uncertainty in the number, location, timing, and composition of discharges, population level effects on salmonid and non-salmonid ESA-listed species in the absence of effective implementation of the protective measures under the PGP that pesticide applications made under FIFRA labelling produces discharges that result in population-level risks to ESA-listed species and designated critical habitat under NMFS' jurisdiction.

The programmatic analysis concluded that, as written, EPA will not be able to reliably estimate the probable number, location, and timing of the discharges that would be authorized by the program to waters where ESA-listed species and designated critical habitat under NMFS' jurisdiction occur for the following reasons:

(1) EPA's definition of *NMFS' Listed Resources of Concern* does not include the endangered Atlantic sturgeon or threatened Nassau grouper and coral species. This definition is used to identify discharges that require that an NOI be submitted and include information on planned discharges, either directly or indirectly. This incomplete definition also prevents EPA from being able to estimate whether or to what degree specific endangered or threatened species or designated critical habitat are likely to be exposed to stressors resulting from PGP-authorized discharges.

(2) EPA would not be able to reliably estimate the stressors that are likely to be produced as a direct or indirect result of all PGP-authorized discharges because only those NOI identifying discharges to waters where NMFS listed Resources of Concern occur will include information on the planned discharges.

(3) EPA is not likely to know or be able to determine whether or to what degree Decision-makers comply with the conditions, restrictions, or mitigation measures require under the 2016 PGP. This is because most PGP-authorized dischargers are automatically covered under the PGP, have no reporting requirement and thus EPA will not be able to identify and inspect a representative number of dischargers to determine compliance.

(4) The self-monitoring and self-reporting conditions of the PGP do not enable EPA to continually identify, collect, and analyze information about authorized actions that may have exposed ESA-listed species or designated critical habitat to stressors at concentrations, intensities, durations, or frequencies that are known or suspected to produce physical, physiological, behavioral, or ecological responses that have potential individual or cumulative adverse consequences for individual organisms or essential elements of designated critical habitat.

(5) Dischargers will not always be able to observe adverse responses resulting from their pesticide applications and not all dischargers will provide annual reports identifying their discharges. Because of this, the EPA would not know if exposures are occurring at concentrations, durations, or frequencies that are known, or suspected to, produce adverse effects to ESA-listed species or essential elements of designated critical habitat.

This consultation focused on those discharges that potentially expose ESA-listed species to stressors at intensities, frequencies, and/or durations that would result in adverse responses such that their loss or impairment may affect the populations to which they belong. The requirement that all Decision-makers making discharges to waters where *NMFS' Listed Resources of Concern* submit an NOI incorporates NMFS expertise either directly or indirectly to assist EPA in identifying discharges that may result in adverse effects and making sure its authorizations prevent or minimize exposures to avoid adverse effects.

The success of this approach requires that:

(1) every discharge authorized under the PGP has a Decision-maker;

(2) that Decision-maker is able to determine whether *NMFS' Listed Resources of Concern* are present in any of their pesticide management areas;

(3) that Decision-maker files an NOI when required to do so due to ESA concerns;

(4) that NMFS reviews the NOI to determine whether the eligibility criterion has been met, could be met with additional conditions, or whether the eligibility criterion is not met;

(5) that EPA relies on NMFS' determination in identifying eligibility for authorization, making any additional condition a requirement for coverage or requiring an individual permit if NMFS determined that eligibility criteria cannot be met; and,

(6) if found eligible for coverage under the PGP, that the Decision-maker proceeds with the discharges identified in the NOI and reviewed by NMFS, implementing any additional controls required for coverage.

These conditions are not necessarily met under the 2016 PGP. Discharges are not covered under the PGP if a Decision-maker fails to file an NOI when required to do so. In such cases, the Decision-maker violates the CWA upon discharge. Because not all discharges are required to file an NOI under the PGP, the availability of the PGP may result in inadvertent violations of the CWA by Decision-makers who fail to self-identify as needing to file an NOI. This may occur when Decision-maker incorrectly conclude that *NMFS' Listed Resources of Concern* are absent from their pest management area. Discharges made under these circumstances are not covered by the PGP and the consequences of such discharges are indirect effects of EPA's issuance of the PGP.

Resources for permit applicants to use to identify where these species require updating and improvement. While shortnose sturgeon are an anadromous species, current PGP resources do not include Plum Island sound at the mouth of the Merrimack river or coastal waters of Cape Cod Bay where sea turtles and sturgeon may become exposed to PGP-authorized discharges. Finally, current PGP resources do not identify coastal waters of Puerto Rico, where Nassau grouper and ESA-listed coral species may be exposed.

Cases where discharges in violation of the CWA were made as a result of failure to file an NOI under the 2011 PGP when an NOI was required were not identified by EPA. There is no evidence whether EPA actively tried to identify unintentional violators and bring them into compliance with the CWA through the PGP. Further, there is no mechanism under the PGP to track dischargers expecting coverage, but not required to file an NOI.

The EPA's issuance of the 2016 PGP without effective support for the regulated community to recognize the requirements of Decision-makers under the PGP, or make correct determinations on the presence or absence of ESA-listed species, exposes the regulated community to an increased risk of unknowingly making discharges in violation of the CWA and the ESA, thus placing ESA-listed species and designated critical habitat at risk.

Based on our evaluation of PGP implementation in the different areas where EPA has permitting authority, species vulnerable to the indirect effects of EPA's issuance of the PGP are those that occur in Idaho, Massachusetts, and Puerto Rico. Because the timing, intensity, frequency, and duration of these exposures cannot be known, NMFS must give benefit of the doubt to these species and designated critical habitat, including the physical and biological features of designated critical habitat that will be affected by toxicants. (designated by an asterisk *):

- Idaho
    - salmon, Chinook (Snake River fall-run ESU)*
    - salmon, Chinook (Snake River spring/summer-run ESU)*
    - salmon, sockeye (Snake River ESU)*
    - steelhead (Snake River Basin DPS)*
- Washington
    - Designated Critical Habitat (Chinook Salmon) for Southern resident killer whale
- Massachusetts
    - Atlantic sturgeon (Gulf of Maine DPS
    - Atlantic sturgeon (New York Bight DPS)
    - shortnose sturgeon
    - green sea turtle (North Atlantic DPS)
    - hawksbill sea turtle
    - Kemp's ridley sea turtle
    - leatherback sea turtle
    - loggerhead sea turtle (Northwest Atlantic DPS)
- Puerto Rico
    - Nassau Grouper
    - elkhorn coral
    - staghorn coral
    - lobed star coral
    - boulder star coral
    - mountainous star coral
    - pillar coral
    - rough cactus coral

10 CUMULATIVE EFFECTS

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

During this consultation, NMFS searched for information on future state, tribal, local or private actions that were reasonably certain to occur in the action area. NMFS conducted electronic searches of business journals, trade journals and newspapers using electronic search engines. Those searches produced no evidence of future private action in the action area that would not require Federal authorization or funding and is reasonably certain to occur. As a result, at the spatial and temporal scale of this programmatic action, NMFS is not aware of any specific actions of this kind that are likely to occur in the action area during the near future.

The future intensity of specific non-Federal activities in the action area is molded by difficult-to-predict future economy, funding levels for restoration activities, and individual investment decisions. However, due to their additive and long-lasting nature, the adverse effects of non-Federal activities that are stimulated by general resource demands, and driven by changes in human population density and standards of living, are likely to compound in the future. Specific human activities that may influence water quality and contribute to declines in the abundance, range, and habitats of ESA-listed species or the conservation value of designated critical habitat in the action area include the following: urban and suburban development; shipping; infrastructure development; water withdrawals and diversion; recreation, including off-road vehicles and boating; expansion of agricultural and grazing activities, including alteration or clearing of native habitats for domestic animals or crops; and introduction of non-native species which can alter native habitats or out-compete or prey upon native species.

Activities which degrade water quality will continue into the future. These include conversion of natural lands, land use changes from low impact to high impact activities, water withdrawals, pesticide pollution from agricultural applications and irrigation water return, effluent discharges, the progression of climate change, the introduction of nonnative invasive species, and the introduction of contaminants and pesticides from nonagricultural upland uses other than those covered by the PGP. Nationally, water quality in more than 36,000 miles of rivers and streams are impaired by pesticides (USEPA 2016b). While some of these impairments include persistent organochlorines that are no longer in use (e.g., DDT, chlordane), many of these pesticides are potentially discharges under the PGP (e.g., 2,4-D, carbofuran, chlorpyrifos, cypermethrin, permethrin, malathion, simazine).

Under Section 303(c) of the CWA individual states are required to adopt water quality standards to restore and maintain the chemical, physical, and biological integrity of the nation’s waters. EPA must approve of state water quality standards and this approval is subject to ESA section 7 consultation. While some of the stressors associated with non-federal activities which degrade water quality will be directly accounted for in section 7 consultations between NMFS and EPA, some may be accounted for only indirectly, while others may not be accounted for at all. In particular, many non-point sources of pollution, which are not subject to CWA NPDES permit and regulatory requirements, have proven difficult for states to monitor and regulate. Non-point source pollution have been linked to loss of aquatic species diversity and abundance, coral reef degradation, fish kills, seagrass bed declines and toxic algal blooms (Gittings et al. 2013). Non-point sources of pollution are expected to increase as the human population continues to grow. States will need to address increases in non-point source pollution in the future to meet the state’s approved water quality standards and designated water body use goals. Given the challenges of monitoring and controlling non-point source pollution and accounting for all the potential stressors and effects on ESA-listed species, chronic stormwater discharges will continue to result in aggregate impacts.

While specific actions were not identified, the collective impact of ongoing activities contribute to climate change and is discussed in the Comprehensive Environmental Baseline provided in Appendix B.

11 CONCLUSION

After considering the current status of ESA-listed species, the environmental baseline, the potential effects of the action, and the cumulative effects of concurrent and future nonfederal actions in context of the controls, monitoring, and feedback loops, and integration of NMFS expertise through the ESA Eligibility Criteria, it is NMFS' opinion that EPA's reissuance of the PGP will likely jeopardize the continued existence of Southern Resident Killer Whale, Chinook salmon (Snake River fall-run, Snake River spring/summer-run), sockeye salmon (Snake River ESU), steelhead (Snake River Basin), Atlantic sturgeon (Gulf of Maine and New York Bight DPSs), shortnose sturgeon, green sea turtle (North Atlantic DPS), hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), Nassau grouper, elkhorn coral, staghorn coral, lobed star coral, boulder star coral, mountainous star coral, pillar coral, and rough cactus coral.

After placing the current status of the designated critical habitat, critical habitat proposed for designation listing under the ESA, the environmental baseline, the potential effects of the action, and the cumulative effects of concurrent and future nonfederal actions in context of the controls monitoring and feedback loops, and integration of NMFS expertise through the ESA Eligibility Criteria, it is NMFS' opinion that EPA's reissuance of the PGP will is likely to destroy or adversely modify designated critical habitat for Chinook salmon (Snake River fall-run ESU, Snake River spring/summer-run ESU), sockeye salmon (Snake River ESU), and steelhead (Snake River Basin DPS).

12 REASONABLE AND PRUDENT ALTERNATIVE AND INCIDENTAL TAKE STATEMENT

Because we have concluded that the proposed general permit fails to comply with the requirements of section 7(a)(2) of the ESA, we have provided a Reasonable and Prudent Alternative (RPA) that would allow EPA to comply with those requirements. Regulations implementing Section 7 of the Act (50 CFR 402.02) define RPAs as alternative actions, identified during formal consultation, that: (1) Can be implemented in a manner consistent with the intended purpose of the action; (2) Can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) Are economically and technologically feasible for the action agency to implement; and (4) Would, in NMFS' opinion, avoid the likelihood of jeopardizing the continued existence of endangered or threatened species or resulting in the destruction or adverse modification of critical habitat. Because the general permit, for purposes of endangered or threatened species under NMFS' jurisdiction, authorizes discharges in the District of Columbia, Idaho, Massachusetts and New Hampshire, all Indian lands and Federal lands in Delaware, and Washington State, the RPA described below applies only in those locations. In addition, this RPA is not applicable to discharges to waters of the United States on Federal lands for which an existing consultation covers those activities.

The goal of the RPAs and RPMs below is to ensure that the potential for exposure of ESA-listed species and designated critical habitat ("NMFS' Listed Resources of Concern") to PGP-authorized discharges is accurately identified, that NMFS will receive all NOI and annual reports associated with such discharges, and that these NOI and annual reports will contain the necessary information that will allow NMFS to advise EPA on its authorization of such discharges with respect to EPA's obligations under the ESA. The RPAs will allow EPA to demonstrate that it is able to satisfy the requirements of section 7(a)(2) of the ESA by: (1) reliably estimating the probable number, location and timing of the discharges that would be authorized by the permit when NMFS Listed Resources of Concern may be exposed; (2) reliably estimating whether or to what degree specific endangered or threatened species or designated critical habitat are likely to be exposed to authorized discharges and (3) reliably determining whether or to what degree operators have complied with the conditions of the permit. By extension, effective identification of the potential for ESA concerns and subsequent engagement of NMFS expertise, where necessary, contributes to EPA's ability to prevent or minimize endangered or threatened species or designated critical habitat from being exposed to: a) stressors from discharges at concentrations, durations, or frequencies that are potentially harmful to individual listed organisms, populations, or the species or the essential features of designated critical habitat, or; b) ecological consequences that are potentially harmful to individual listed organisms, populations, the species or the essential features of designated critical habitat.

12.1 RPA

The 2016 PGP Reasonable and Prudent Alternative (RPA) consists of two elements that EPA must implement in their entirety to ensure that PGP-authorized actions are not likely to jeopardize the continued existence of endangered or threatened species under the jurisdiction of NMFS or destroy or adversely modify critical habitat that has been designated for any of these species. This RPA ensures that EPA complies with the requirements of section 7(a)(2) of the ESA.

12.1.1 2016 PGP RPA Element One

Rationale: While the 2011 and 2016 PGPs provide an additional layer of protection over restrictions provided by the FIFRA registrations, the programmatic analysis in the biological opinion for the 2011 PGP concluded that EPA's issuance of the PGP was likely to jeopardize the continued existence of 33 endangered or threatened species under NMFS' jurisdiction and result in the destruction or adverse modification of critical habitat designated for 29 of those species. Since issuance of the 2011 PGP, NMFS has listed additional species that occur within the action area as threatened or endangered under the ESA. This includes Nassau grouper, three DPS of Atlantic sturgeon, and 13 domestic coral species. In addition, NMFS issued updated ESA-listings for two DPS of green sea turtle and the Middle Columbia River steelhead trout.

The 2016 PGP applies protective measures throughout the permit for discharges that may expose "NMFS Listed Resources of Concern as defined in Appendix A of the permit." However, Appendix A of the draft 2016 PGP identifies NMFS Listed Resources of Concern as:

> *"...federally-listed endangered and threatened species and federally-listed critical habitat for which NMFS' 2011 Endangered Species Act Section 7 Consultation Biological Opinion on the U.S. Environmental Protection Agency's Proposed Pesticides General Permit concluded the draft 2011 PGP, absent any additional mitigating measures, would either jeopardize the continued existence of such species or destroy or adversely modify such critical habitat. The Biological Opinion included a Reasonable and Prudent Alternative, implemented through this permit, to avoid likely jeopardy to listed species or adverse modification of critical habitat. Additional information, including maps noting where these resources overlap with PGP areas of coverage is available at www.epa.gov/npdes/pesticides. "*

RPA: In order for the 2016 PGP to provide protection of species listed and critical habitat designated by NMFS since the 2011 PGP, the definition of NMFS Listed Resources of Concern must be amended. In addition, the web address provided with the definition is currently inactive as EPA is updating its websites. The RPA would have EPA change the definition of NMFS Listed Resources of Concern in Appendix A to read:

> *"...federally-listed endangered and threatened species and federally-listed designated critical habitat for which NMFS' 2016 Endangered Species Act Section 7 Consultation Biological Opinion on the U.S. Environmental Protection Agency's Proposed Pesticides General Permit concluded the* ***2016 PGP****, absent any additional mitigating measures, would either jeopardize the continued existence of such species or destroy or adversely modify such critical habitat. The Biological Opinion included a Reasonable and Prudent Alternative, implemented through this permit, to avoid likely jeopardy to listed species or adverse modification of critical habitat. Additional information, including maps noting where these resources overlap with PGP areas of coverage is available at* ***[insert a functioning website address that will remain on throughout the permit term]****."*

12.1.2 2016 PGP RPA Element Two

Rationale: EPA must improve the tools available for the 2016 PGP applicants to identify the presence of ESA-listed species under NMFS's jurisdiction to ensure that 2016 PGP applicants are able to easily and accurately identify the presence of NMFS Listed Resources of Concern in their pesticide application area. EPA also needs to make it clear in the NOI form the type of information needed for self-certification of no adverse effects to NMFS Listed Resources of Concern to ensure NMFS receives the correct information to be able to review NOIs. Based on input from our regions and apparent gaps in the locations for which NOI were submitted, NMFS is not confident that PGP applicants accurately identified the presence of ESA-listed species under NMFS' jurisdiction and thus their requirement to submit an NOI.

RPA: As in the 2011 PGP, the 2016 PGP will require applicants to identify whether they must submit an NOI due to discharges made to waters of the U.S. where ESA-listed species under NMFS' jurisdiction occur. The 2016 PGP needs to make it clear in the NOI form the type of information needed for self-certification of no adverse effects to NMFS Listed Resources of Concern to ensure NMFS receives the correct information to review NOIs. The 2016 PGP will provide improved tools and clarifications in the ESA procedures for applicants:

a) EPA, with assistance and data from NMFS, has developed a user friendly webmap for permit applicants to determine whether they are required to submit an NOI due to overlap with NMFS Listed Resources of Concern. EPA will provide a clear link to this webmap on the main web page for the 2016 PGP and will be available for use upon issuance of the 2016 PGP.

b) The 2016 PGP NOI instructions for the required rationale on the NOI form (item 2.g. under section D) must include the following clarifying language (in bold face):

> Your rationale supporting your determination that you meet the criterion for which you are submitting this NOI, **for example, the *specific* BMPs applied, visual monitoring, equipment and/or site inspections, and other** appropriate measures that will be undertaken to avoid or eliminate the likelihood of adverse effects. For certifications pursuant to Criterion D, indicate whether the discharge is likely to

adversely affect NMFS Listed Resources of Concern in response to a pest emergency and, if so, any feasible measures to avoid or eliminate such adverse effects; for example, it is not sufficient to state that "integrated pest management procedures will be applied" without describing the specific measures to be taken (attach additional pages as necessary):

12.2 Incidental Take Statement

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

The measures to avoid or minimize take described below are non-discretionary and must be undertaken by the EPA so that they become a binding condition of any applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The EPA has a continuing duty to regulate the activity covered by this incidental take statement. The protective coverage of section 7(o)(2) may lapse if the EPA: (1) Fails to assume and implement the terms and conditions; or (2) Fails to require any applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the general permit. In order to monitor the impact of incidental take, the EPA must report the progress of the action and its impact on the species to NMFS OPR as specified in the incidental take statement (50 CFR§402.14(i)(3)). The reporting requirements will be established in accordance with 50 CFR220.45 and 228.5.

12.2.1 Amount of Take

ESA Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent, of such incidental taking on the species (50 CFR § 402.14 (i)(1)(i).). When, as here, the precise location and number of events resulting in incidental take is unknown, NMFS may identify a surrogate rather than an amount or level of incidental take. A "surrogate (e.g., similarly affected species or habitat or ecological conditions) may be used to express the amount or extent of anticipated take provided that the biological opinion or ITS: The surrogate describes the causal link between the surrogate and take of the listed species, explains why it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of the listed species, and sets a clear standard for determining when the level of anticipated take has been exceeded." (50 C.F.R. § 402.14).

The proposed action in the 2016 PGP is anticipated to cause incidental of ESA-listed species under NMFS' jurisdiction in the action area. Incidental take due to this action cannot be accurately quantified or monitored as a number of individuals because the action area includes large areas over which EPA has permitting authority and the exact location, composition, time, and frequency of the individual discharges that will be authorized under the 2016 PGP are unknown. We are therefore not able to quantify how many individuals of each species and life stage exist in affected waters, especially considering that the numbers of individuals vary with the season, environmental conditions, and changes in population size due to recruitment and mortality over the course of a year. In addition, currently we have no means to determine which deaths or injuries in populations across the entire range of the ESA-listed species and designated critical habitat covered in this opinion are due to the discharges authorized under the PGP versus other environmental stressors, competition, and predation.

Because we cannot determine the amount of take, NMFS identifies, as a surrogate for the allowable extent of take, the ability of this action to proceed without any adverse incident, defined below, to non-target species, that is attributed to any pesticide discharged in accordance with the general permit in waters where ESA-listed species under NMFS' jurisdiction occur. An adverse incident to fish is considered attributable to a pesticide discharged in accordance with the general permit if that pesticide is known to have been discharged prior to, and near or upstream of the adverse incident and there is evidence that the pesticide caused the adverse incident (e.g. the detection of pesticide, adjuvants, surfactants, or degradates in water samples from the area or in tissue samples of affected fish). An adverse incident means an unusual or unexpected incident that an Operator has observed upon inspection or of which the Operator otherwise become aware, in which**:**

- There is evidence that a person or non-target organism has likely been exposed to a pesticide, and
- The person or non-target organism suffered a *toxic or adverse effect.*

The phrase *toxic or adverse effects* includes effects that occur within waters of the United States on non-target plants, fish or wildlife that are unusual or unexpected (e.g., effects are to organisms not otherwise described on the pesticide product label or otherwise not expected to be present) as a result of exposure to a pesticide and may include:

- Distressed or dead juvenile and small non-target aquatic organisms
- Washed up or floating non-target aquatic organisms
- Non-target aquatic organisms swimming abnormally or erratically
- Non-target aquatic organisms lying lethargically at water surface or in shallow water
- Non-target aquatic organisms that are listless or nonresponsive to disturbance
- Stunting, wilting, or desiccation of non-target submerged or emergent aquatic plants
- Other dead or visibly distressed non-target aquatic organisms (amphibians, turtles, invertebrates, etc.)

The phrase, *toxic or adverse effects,* also includes any adverse effects to humans (e.g., skin rashes) or domesticated animals that occur either from direct contact with or as a secondary effect from a discharge (e.g., sickness from consumption of plants or animals containing pesticides) to Waters of the United States that are temporally and spatially related to exposure to a pesticide (e.g., vomiting, lethargy).

The association of take with adverse pesticide incidents in waters where ESA-listed species and designated critical habitat occur relates to the expectation that individuals of ESA-listed species would be similarly affected during such incidents and take of the ESA-listed individuals may not be detected due to co-occurring events such as scavenging, decay, or submergence. Further, the occurrence of a single incident would indicate an unknown number of future incidents will likely occur. Any incident where non-target organisms appear injured or killed as a result of PGP-authorized discharges to waters of the United States containing NMFS listed species will be considered an exceedance of take.

12.2.2 Reasonable and Prudent Measures

To satisfy its obligations pursuant to section 7(a)(2) of the ESA, the EPA must: (1) Monitor the direct, indirect, and cumulative impacts of the activities authorized by the issuance of the general permit; and (2) Evaluate the direct, indirect, or aggregate impacts of the activities authorized by the issuance of the general permit and the consequences of those effects on ESA-listed species under NMFS' jurisdiction. The purpose of the monitoring is to provide data for the EPA to use to identify necessary modifications to the general permit in order to reduce exposures to ESA-listed species under NMFS' jurisdiction. NMFS believes all measures described as part of the proposed action, together with use of the Reasonable and Prudent Measures and Terms and Conditions described below, are necessary and appropriate to minimize the likelihood of incidental take of ESA-listed species due to implementation of the proposed action.

The EPA shall:

Monitor any incidental take or surrogate measure of take that occurs from the action;

Ensure that permit applicants discharging to waters where ESA-listed species under NMFS' jurisdiction occur are aware of the ESA requirements; and

Report annually to NMFS OPR on the monitoring results from the previous year.

12.2.3 Terms and Conditions

1) To be exempt from the prohibitions of section 9 of the ESA, the EPA must comply with the following condition. This condition implements the reasonable and prudent measures described above. These conditions are non-discretionary.

   The EPA shall include the following instructions requiring reporting of adverse incidents to fish in the general permit:

   "Notwithstanding any of the other adverse incident notification requirements of this section, if an Operator becomes aware of an adverse incident affecting a federally listed threatened or endangered species or its federally designated critical habitat, which may have resulted from a discharge from the Operator's pesticide application, Operator must immediately notify NMFS in the case of an anadromous or marine species, or FWS in the case of a terrestrial or freshwater species. This notification must be made by telephone, to the contacts listed on EPA's website at https://www.epa.gov/npdes/pesticide-permitting, immediately upon the Operator becoming aware of the adverse incident, and must include at least the following information:

   a. The caller's name and telephone number;
   b. Operator name and mailing address;
   c. The name of the affected species;
   d. How and when the Operator became aware of the adverse incident;

e. Description of the location of the adverse incident;

f. Description of the adverse incident and the pesticide product, including the EPA pesticide registration number, for each product applied in the area of the adverse incident; and

g. Description of any steps the Operator has taken or will take to alleviate the adverse impact to the species

Additional information on federally-listed threatened or endangered species and federally-designated critical habitat is available from NMFS (www.nmfs.noaa.gov) for anadromous or marine species or FWS (www.fws.gov) for terrestrial or freshwater species. Note: In an adverse incident affecting federally listed threatened or endangered species or designated critical habitat, the Operator should leave the affected organisms alone, make note of any circumstances likely causing the death or injury, note the location and number or extent of aquatic organisms involved and, if possible, take photographs. In some circumstances, the Operator may be asked to carry out instructions provided by the Services to collect specimens or take other measures to ensure that evidence intrinsic to the specimen is preserved."

2) EPA will develop an outreach strategy specifically targeted towards awareness of ESA species under the 2016 PGP. The outreach strategy will be developed and implemented in coordination with NMFS, and the target audience identified, within 6 months of the implementation date of the 2016 PGP. The need for additional outreach and NMFS review will be revisited as necessary during the annual report reviews described in RPA Element 3.

3) Under the RPA in the 2011 opinion, EPA provided NMFS with summaries of the current registered application rates, the expected environmental concentrations (EECs) of pesticides in water resulting from those applications, and the toxicity information used to assess the risk to endangered and threatened species as presented in the EPA's most recent FIFRA risk assessment documents for all pesticides identified by PGP applicants that apply pesticides to areas with NMFS Listed Resources of Concern under Part 1.1.2.4, criteria D and F of the 2011 PGP. EPA also provided to NMFS the original risk assessment documents from which these summaries were derived for those pesticides under the 2011 PGP. This information was helpful for NMFS to provide guidance to the 2011 PGP applicants on how to prevent or minimize adverse exposures to ESA-listed species and designated critical habitat.

   EPA will continue to provide NMFS with its most recent FIFRA risk assessment documents containing the current registered application rates, the expected environmental concentrations of pesticides in water resulting from those applications, and the toxicity information used to assess the risk to endangered and threatened species for all pesticides identified by PGP applicants that apply pesticides to areas with NMFS Listed Resources of Concern under Part 1.1.2.4, criteria D and F, of the 2016 PGP. This information will be provided as part of the annual reports.

4) To insure implementation of the 2016 PGP, EPA must monitor and evaluate the information obtained through its NOI and annual reports. In the NOI, the operator must identify where and when such discharges would occur, what those discharges would be

and of which use patterns these discharges would consist. NMFS will have the opportunity to review every discharge that might result in exposure to endangered and threatened species or designated critical habitat under NMFS jurisdiction. NMFS will then determine whether the planned discharge or discharge(s) (future discharge or discharges in the case of Declared Pest Emergency Situations) meets the general permit's eligibility criteria of not likely to adversely affect NMFS Listed Resources of Concern, would meet it with additional conditions or would not meet the eligibility criteria. The NOI process is designed to ensure that no individual discharge or combination of discharges is likely to adversely affect listed species or designated critical habitat, with the limited exception of discharges in response to a Declared Pest Emergency Situation, described below. While the general permit does authorize discharges to address Declared Pest Emergency Situations prior to review of discharges by NMFS, this authorization has significant limits. The PGP specifies that a Declared Pest Emergency Situation is an event defined by public declaration by a federal agency, state, or local government, beginning less than ten days after identification of a pest problem posing significant risk to human health and the environment or significant economic loss. Once NMFS has reviewed a past or ongoing discharge pursuant to the NOI process for declared pest emergencies and provided its determination to EPA on whether the discharge(s) meet or could have met the eligibility criteria, any conditions or prohibitions applied by EPA remain in effect for the life of the permit for that discharger. This element of the RPA is designed to prevent repeated declarations of pest emergencies by the same operator, with a recurring 60 day of discharge authorization under the general permit without any conditions or prohibitions in place.

EPA will meet with NMFS within 6 months of the issuance of the 2016 PGP to develop a strategy for analyzing and summarizing the annual reports that will be submitted by PGP discharges. EPA will use this strategy to develop a summary report and continue to provide the report, and its source information, to NMFS for each year of the permit term until the permit expires in 2021. The strategy will include measures to ensure continuity in the process in the event of staffing changes. The 1st report will come April 15, 2018. EPA will meet with NMFS within 3 weeks of the receipt of the report by NMFS to review the information in the annual report.

13 REINITIATION NOTICE

This concludes formal consultation on the U.S. Environmental Protection Agency's issuance of the Pesticides General Permit. As provided in 50 CFR 402.16, Reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

> (a) If the amount or extent of taking specified in the incidental take statement is exceeded;
>
> (b) If new information reveals effects of the action that may affect ESA-listed species or designated critical habitat in a manner or to an extent not previously considered;
>
> (c) If the identified action is subsequently modified in a manner that causes an effect to the ESA-listed species or designated critical habitat under NMFS' jurisdiction that was not considered in the biological opinion;
>
> (d) If a new species is listed or critical habitat is designated that may be affected by the identified action in a way not considered in this opinion;

A determination that Decision-makers who should file NOIs for discharges to waters of the United States containing ESA-listed species under NMFS' jurisdiction have failed to do so or that Decision-makers incorrectly identify Criterion A or F as applicable to their proposed discharges shall constitute new information reveals effects of the action that may affect ESA-listed species or designated critical habitat in a manner or to an extent not previously considered and require reinitiation pursuant to (b), above.

For those facilities with endangered species protection certifications in the NOI based on an existing formal consultation, any instance where the amount or extent of take specified in the incidental take statement is exceeded requires that the U.S. Environmental Protection Agency must immediately request reinitiation of Section 7 consultation.

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APPENDIX A

COMPREHENSIVE STATUS OF THE SPECIES AND DESIGNATED CRITICAL HABITAT IN THE ACTION AREA

The ESA-listed species and designated critical habitats which occur within the action area that fall under NMFS' jurisdiction and may be exposed to the pesticide discharges and experience direct or indirect effects of those exposures are identified in Table 1 and Table 2.

Table 1. NMFS endangered and threatened species and designated critical habitat considered in this opinion.

Species	ESA Status	Designated Critical Habitat	Recovery Plan
Marine Mammals – Cetaceans			
Southern Resident Killer Whale *(Orcinus orca)*	E – 70 FR 69903	71 FR 69054	73 FR 4176
Salmonids			
salmon, Chinook (*Oncorhynchus tshawytscha*)			
- California coastal	T – 64 FR 50393	70 FR 52488	– –
- Central Valley spring-run	T – 64 FR 50393	70 FR 52488	79 FR 42504
- Lower Columbia River	T – 64 FR 14308	70 FR 52630	78 FR 41911
- Upper Columbia River spring-run	E – 64 FR 14308	70 FR 52630	72 FR 57303
- Puget Sound	T – 64 FR 14308	70 FR 52630	72 FR 2493
- Sacramento River winter-run	E – 59 FR 440	58 FR 33212	79 FR 42504
- Snake River fall-run	T – 59 FR 42529	58 FR 68543	– –
- Snake River spring/summer-run	T – 59 FR 42529	64 FR 57399	– –
- Upper Willamette River	T – 64 FR 14308	70 FR 52630	76 FR 52317b
salmon, chum (*Oncorhynchus keta*)			
- Columbia River	T – 64 FR 14507	70 FR 52630	78 FR 41911
- Hood Canal summer-run	T – 64 FR 14507	70 FR 52630	72 FR 29121
salmon, coho (*Oncorhynchus kisutch*)			
- Central California coast	E – 61 FR 56138	65 FR 7764	– –
- Oregon coast	T – 63 FR 42587	73 FR 7816	78 FR 41911
- Southern Oregon & Northern California coasts	T – 62 FR 24588	64 FR 24049	– –
- Lower Columbia River	T – 70 FR 37160	81 FR 9251	78 FR 41911
salmon, sockeye (*Oncorhynchus nerka*)			
- Ozette Lake	T – 64 FR 14528	70 FR 52630	74 FR 24706
- Snake River	E – 56 FR 58619	58 FR 68543	– –
trout, steelhead (*Oncorhynchus mykiss*)			
- California Central Valley	T – 71 FR 834	70 FR 52488	79 FR 42504
- Central California coast	T – 71 FR 834	70 FR 52488	– –
- South-Central California coast	T – 71 FR 834	70 FR 52488	– –
- Southern California	E – 71 FR 834	70 FR 52488	– –
- Northern California	T – 71 FR 834	70 FR 52488	– –

Species	ESA Status	Designated Critical Habitat	Recovery Plan
- Lower Columbia River	T – 71 FR 834	70 FR 52630	74 FR 50165
- Middle Columbia River	T – 71 FR 834	70 FR 52630	– –
- Upper Columbia River	T – 74 FR 42605	70 FR 52630	72 FR 57303
- Upper Willamette River	T – 71 FR 834	70 FR 52630	76 FR 52317b
- Snake River Basin	T – 71 FR 834	70 FR 52630	– –
- Puget Sound	T – 72 FR 26722	81 FR 9251	– –
Atlantic Salmon (*Salmo salar*) - Gulf of Maine DPS	E – 74 FR 29344	74 FR 29300	70 R 75473
Non-Salmonid Anadromous Species			
Eulachon (*Thaleichthys pacificus*)	T – 75 FR 13012	76 FR 65323	– –
Shortnose sturgeon (*Acipenser brevirostrum*)	E – 32 FR 4001	– –	63 FR 69613
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)			
- Gulf of Maine DPS	T – 77 FR 5880	81 FR 35701 (Proposed)	– –
- New York Bight DPS	E - 77 FR 5880		
- Chesapeake Bay DPS			
Green sturgeon, (*Acipenser medirostris*) - Southern DPS	T – 71 FR 17757	74 FR 52300	– –
Marine Fish			
Bocaccio *(Sebastes paucispinis)*	E – 75 FR 22276	79 FR 68041	– –
Yellow Eye Rockfish (*Sebastes ruberrimus*)	T – 75 FR 22276	79 FR 68041	– –
Nassau Grouper	T – 79 FR 51929		
Sea Turtles			
Green Turtle *(Chelonia mydas) – North Atlantic DPS*	E – 43 FR 32800	63 FR 46693	63 FR 28359
Hawksbill Turtle *(Eretmochelys imbricata*)	E – 35 FR 8491	63 FR 46693	57 FR 38818
Kemp's Ridley Turtle *(Lepidochelys kempii)*	E – 35 FR 18319	– –	75 FR 2496
Olive Ridley Turtle (*Lepidochelys olivacea*)			
Pacific Coast of Mexico breeding populations	E – 43 FR 32800	– –	63 FR 28359
all other populations	T – 43 FR 32800		
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710	63 FR 28359
Loggerhead Turtle (*Caretta carettaCaretta caretta*)			
- Northwest Atlantic and North Pacific DPS	E – 76 FR 58868	79 FR 39856	63 FR 28359
Corals			
Elkhorn Coral (*Acropora palmata*) Staghorn Coral (*Acropora cervicornis*)	T – 71 FR 26852	73 FR 72210	80 FR 12146

Species	ESA Status	Designated Critical Habitat	Recovery Plan
Coral Species - *Mycetophyllia ferox* - The *Orbicella:* *O.faveolata* O. franksi *O. annularis* - Pillar *(Dendrogyra cylindrus)* *- The Acropora* *A. globiceps A. jacquelineae* *A. lokani A. pharaonis* *A. retusa A. rudis* *A. speciosa A. tenella* *- Anacropora spinosa* *- Euphyllia paradivisa* *- Isopora crateriformis* *- Montipora australiensis* *- Pavona diffluens* *- Porites napopora* *- Seriatopora aculeata*	T – 79 FR 54122	– –	– –

The following sections describe the status of species that occur in the action area and the threats to those species and where applicable, their designated critical habitat.

1 *CETACEANS*

1.1 Southern Resident Killer Whale

Status. The Southern Resident killer whale DPS was listed as endangered in 2005 in response to the population decline from 1996 to 2001, small population size, and reproductive limitations (i.e., few reproductive males and delayed calving). This species occurs in the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait during the spring, summer and fall. During the winter, they move to coastal waters primarily off Oregon, Washington, California, and British Columbia. We used information available in the final rule, the 2012 Status Review (NMFS 2013) and the 2011 Stock Assessment Report (NMFS 2014) to summarize the status of this species.

The most recent abundance estimate for the Southern Resident DPS is 87 whales in 2012. This represents an average increase of 0.4 percent annually since 1982 when there were 78 whales. Population abundance has fluctuated during this time with a maximum of approximately 100 whales in 1995 (NMFS 2013). As compared to stable or growing populations, the DPS reflects a smaller percentage of juveniles and lower fecundity (NMFS 2014) and has demonstrated weak growth in recent decades.

Life history. Southern Resident killer whales are geographically, matrilineally, and behaviorally distinct from other killer whale populations. The DPS includes three large, stable pods (J, K, and L), which occasionally interact (Parsons et al. 2009). Most mating occurs outside natal pods, during temporary associations of pods, or as a result of the temporary dispersal of males (Pilot et al. 2010). Males become sexually mature at 10 – 17 years of age. Females reach maturity at 12 – 16 years of age and produce an average of 5.4 surviving calves during a reproductive life span of approximately 25 years. Mothers and offspring maintain highly stable, life-long social bonds, and this natal relationship is the basis for a matrilineal social structure. They prey upon salmonids, especially Chinook salmon (Hanson et al. 2010).

Threats. Current threats to its survival and recovery include: contaminants, vessel traffic, and reduction in prey availability. Chinook salmon populations have declined due to degradation of habitat, hydrology issues, harvest, and hatchery introgression; such reductions may require an increase in foraging effort. In addition, these prey contain environmental pollutants (e.g., flame retardants; PCBs and DDT). These contaminants become concentrated at higher trophic levels and may lead to immune suppression or reproductive impairment (70 FR 69903).

The inland waters of Washington and British Columbia support a large whale watch industry, commercial shipping, and recreational boating; these activities generate underwater noise, which may mask whales' communication or interrupt foraging. The factors that originally endangered the species persist throughout its habitat: contaminants, vessel traffic, and reduced prey. The DPS's resilience to future perturbation is reduced as a result of its small population size (N = 86); however, it has demonstrated the ability to recover from smaller population sizes in the past and has shown an increasing trend over the last several years. NMFS is currently conducting a status review prompted by a petition to delist the DPS based on new information, which indicates that there may be more paternal gene flow among populations than originally detected (Pilot et al. 2010).

Designated critical habitat. The designated critical habitat consists of approximately 6,630 km^2 in three areas: the Summer Core Area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca. It provides the following physical and biological features: water quality to support growth and development; prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and inter-area passage conditions to allow for migration, resting, and foraging.

2 *SALMONIDS*

Salmonids have similar life histories, habitat requirements, and threats. These are discussed in the sections below, before proceeding to describing the essential features of critical habitat for each species.

2.1 The 2016 Status Review for Pacific Salmonids

In May 2016, NOAA Fisheries' West Coast Region completed a five-year status review of all 28 West Coast salmon and steelhead species listed under the ESA (Table 3). Some species, such Oregon Coast coho salmon, mid-Columbia steelhead and Hood Canal chum, rebounded from the lows of past decades. Highly endangered Snake River sockeye have benefitted from a captive broodstock program while Snake River steelhead populations are steady. The California drought and unusually high ocean and stream temperatures over the 5-year period hit many populations hard. In the case of Sacramento River winter-run Chinook salmon, for example, drought conditions and high stream temperatures reduced the 2015 survival of juvenile fish in the first stretch of river to just 3 percent.

Since 1997 NMFS promulgated a total of 29 limits to the ESA section 9(a) take prohibitions for 21 threatened Pacific salmon and steelhead ESUs or Distinct Populations Segments (DPSs)(62

FR 38479, July 18, 1997; 65 FR 42422, July 10, 2000; 65 FR 42485, July 10, 2000; 67 FR 1116, January 9, 2002; 73 FR 7816, February 11, 2008). On June 28, 2005, as part of the final listing determinations for 16 ESUs of West Coast salmon, NMFS amended and streamlined the 4(d) protective regulations for threatened salmon and steelhead (70 FR 37160). NMFS took this action to provide appropriate flexibility to ensure that fisheries and artificial propagation programs are managed consistently with the conservation needs of threatened salmon and steelhead. Under this change, the section 4(d) protections apply to natural and hatchery fish with an intact adipose fin, but not to listed hatchery fish that have had their adipose fin removed prior to release into the wild. Throughout this section discussing listed salmonids, we use the word “species” to apply to DPSs and ESUs.

Table 2. Summary of Current ESA Listing Status, Recent Trends and Summary of Conclusions for the Most Recent Five-year Review for Pacific Salmonids (Northwest Fisheries Science Center 2015, Williams et al. 2016).

Species	ESU/DPS	ESA listing status	Recent risk trend
Chinook	Upper Columbia spring	Endangered	Stable
	Snake River spring/summer	Threatened	Stable
	Snake River fall	Threatened	Improving
	Upper Willamette spring	Threatened	Declining
	Lower Columbia	Threatened	Stable/Improving
	Puget Sound	Threatened	Stable/Declining
	California Coastal	Threatened	Mixed
	Central Valley Spring	Threatened	Decreased risk of extinction
	Sacramento River winter	Endangered	Increased risk of extinction
Coho	Lower Columbia	Threatened	Stable/Improving
	Oregon Coast	Threatened	Improving
	Southern Oregon/Northern California	Threatened	Mixed
	Central California Coast	Endangered	Mixed
Sockeye	Snake River	Endangered	Improving
	Lake Ozette	Threatened	Stable
Chum	Hood Canal summer	Threatened	Improving
	Columbia River	Threatened	Stable
Steelhead	Upper Columbia	Threatened	Improving
	Snake River	Threatened	Stable/Improving
	Middle Columbia	Threatened	Stable/Improving
	Upper Willamette	Threatened	Declining
	Lower Columbia	Threatened	Stable
	Puget Sound	Threatened	Stable
	Northern California	Threatened	Mixed
	Central California Coast	Threatened	Uncertain
	South Central California	Threatened	Declining
	Southern California	Endangered	Uncertain

The most recent status review for Atlantic salmon was published in 2006 (Fay et al. 2006). This review stated that fewer than 1,500 adults have returned to spawn each year since 1998. The Population Viability Analysis estimates of the probability of extinction for the Gulf of Mexico DPS of Atlantic Salmon ranges from 19 percent to 75 percent within the next 100 years, even with the continuation of current levels of hatchery supplementation. The abundance was estimated at 1,014 individuals in 2007, the most recent year for which abundance records are available.

2.2 Salmonid Life Histories

Salmonids exhibit either an ocean-type or stream-type behavior. Ocean-type migrate to the ocean within their first year of life (sub-yearlings). Stream-type salmonids usually migrate to sea at a larger size, after months or years of freshwater rearing. Stream-type salmonids of the genus *Oncorhynchus* include steelhead, coho, and most types of Chinook and sockeye salmon. Stream type salmonids depend more on freshwater conditions than on favorable estuarine conditions. All Pacific salmon species are semelparous (i.e., they die after spawning) and exhibit obligatory anadromy (i.e., there are no recorded landlocked or naturalized freshwater populations; they must spend portions of their lives in both salt and freshwater habitats). Atlantic salmon and some southern populations of steelhead are iteroparous, being capable of returning to the ocean after spawning and returning to freshwaters to spawn again after recovery.

2.3 Threats to Salmonids

Specifically, during all freshwater life stages, salmonids require cool water that is free of contaminants. Water free of contaminants supports survival, growth, and maturation of salmon and the abundance of their prey. In addition to affecting survival, growth, and fecundity, contaminants can disrupt normal behavior necessary for successful migration, spawning, and juvenile rearing. Sufficient forage is necessary for juveniles to maintain growth that reduces freshwater predation mortality, increases overwintering success, initiates smoltification, and increases ocean survival. Natural riparian cover such as submerged and overhanging large wood and aquatic vegetation provides shelter from predators, shades freshwater to prevent increase in water temperature, provides nutrients from leaf litter, supports production of insect prey, and creates important side channels. Riparian vegetation stabilizes bank soils and captures fine sediment in runoff, which maintains functional channel bottom substrate for development of eggs and alevins.

The process of smoltification enables salmon to adapt to the ocean environment. Environmental factors such as exposure to chemicals including heavy metals and elevated water temperatures can affect the smoltification process, not only at the interface between fresh water and saltwater, but higher in the watershed as the process of transformation begins long before fish enter saltwater (Wedemeyer et al. 1980).

The three major threats to Atlantic salmon identified in the listing rule also threaten Pacific salmonids: dams, regulatory mechanisms related to dams, and low marine survival. In addition, a number of secondary threats were identified, including threats to habitat quality and accessibility, commercial and recreational fisheries, disease and predation, inadequacy of regulatory mechanisms related to water withdrawal and water quality, aquaculture, artificial propagation, climate change, competition, and depleted fish communities.

2.4 Salmonid Designated Critical Habitat

The action area for this consultation contains designated critical habitat for anadromous salmonids. NMFS has identified essential features of designated critical habitat for each life stage (e.g., migration, spawning, rearing, and estuary) common for each species. To fully understand the conservation role of these habitats, specific physical and biological habitat features (e.g., water temperature, water quality, forage, natural cover, etc.) were identified for each life stage.

2.4.1 Chinook salmon (9 ESUs)

Life history. There are 9 ESA-listed Chinook salmon ESUs. Chinook are the largest of the Pacific salmon and prefer streams that are deeper and larger than those used by other Pacific salmon species. Chinook salmon ESUs exhibit either “stream-type” or “ocean-type” life histories. Stream-type Chinook salmon reside in freshwater for a year or more following emergence before migrating to salt water. Stream-type ESUs normally return in late winter and early spring (spring-run) as immature adults and reside in deep pools during summer before spawning in fall. Ocean-type Chinook salmon migrate to the ocean within their first year and usually return as full mature adults in fall (fall-run) and spawn soon after river entry. (Healey 1991).

Temperature and stream flow can significantly influence the timing of migrations and spawning, as well as the selection of spawning habitat (Geist et al. 2008, Hatten et al. 2009). All Chinook salmon are semelparous (i.e. they die after spawning). Fall-run Chinook salmon generally spawn in the mainstem of larger rivers and are less dependent on flow, although early autumn rains and a drop in water temperature often provide cues for movements to spawning areas. Spring-run Chinook salmon take advantage of high flows from snowmelt to access the upper reaches of rivers. Chinook salmon primarily feed on small invertebrates and vertebrates, with the diet of adult oceanic Chinook salmon comprised primarily of fish.

Designated critical habitat. Designated critical habitat for the Puget Sound, Lower Columbia River, and Upper Willamette River ESUs for Chinook salmon identify essential features and sites necessary to support one or more Chinook salmon life stage(s). These include biological elements that are vulnerable to the stressors of the action. These include water quality conditions that support spawning and incubation, larval and juvenile development, and physiological transitions between fresh and saltwater. The essential features also include aquatic invertebrate and fish prey species and water quality to support juvenile and adult development, growth, and maturation, and natural cover of riparian and nearshore vegetation and aquatic vegetation. Designated critical habitat for the Snake River fall-run and Snake River spring/summer run Chinook salmon generically designates water quality, food, and riparian vegetation essential features.

2.4.2 Chum salmon (2 ESUs)

Life history. In general, North American chum salmon migrate north along the coast in a narrow coastal band that broadens in southeastern Alaska. Chum salmon usually spawn in the lower reaches of rivers during summer and fall. Redds are dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 100 km from the sea. Juveniles use shallow, low flow habitats for rearing that include inundated mudflats, tidal wetlands and their channels, and sloughs. The duration of estuarine residence for chum salmon juveniles are known for only a few estuaries. Observed residence time ranges from 4 to 32 days, with about 24 days as the most common.

Immature chum salmon disperse over the North Pacific Ocean and maturing adults return to the home streams usually at two to five years of age, and in some cases up to seven years (Bigler 1985). This ocean-type life history means that the survival and growth for juvenile chum salmon depends less on freshwater conditions than on favorable estuarine conditions. Chum salmon feed on a variety of prey organisms depending upon life stage and size. In freshwater Chum salmon feed primarily on small invertebrates; in saltwater, their diet consists of copepods, tunicates, mollusks, and fish.

Designated critical habitat. Areas designated as critical habitat are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. essential features for both chum salmon ESUs include freshwater spawning, rearing, and migration areas; estuarine and nearshore marine areas free of obstructions; and offshore marine areas with good water quality. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity.

2.4.3 Coho salmon (4 ESUs)

Life history. North American coho salmon will migrate north along the coast in a narrow coastal band that broadens in southeastern Alaska. During this migration, juvenile coho salmon tend to occur in both coastal and offshore waters. Coho salmon exhibit a stream-type life history. Most coho salmon enter rivers between September and February. In many systems, coho salmon wait to enter until fall rainstorms have provided the river with sufficiently strong flows and depth. Coho salmon spawn from November to January, and occasionally into February and March. Some spawning occurs in third-order streams, but most spawning activity occurs in fourth- and fifth-order streams with gradients of 3 percent or less. After fry emerge in spring they disperse upstream and downstream to establish and defend territories with weak water currents such as backwaters and shallow areas near stream banks. Juveniles rear in these areas during the spring and summer. In early fall juveniles move to river margins, backwater, and pools. During winter juveniles typically reduce feeding activity and growth rates slow down or stop. By March of their second spring, juveniles feed heavily on insects and crustaceans and grow rapidly before smoltification and outmigration (Olegario 2006), spending only a short time (one to three days) in the estuary with little feeding (Thorpe 1994, Miller and Sadro 2003). After entering the ocean, immature coho salmon initially remain in nearshore waters close to the parent stream. Along the Oregon/California coast, coho salmon primarily return to rivers to spawn as three-year olds, having spent approximately 18 months rearing in fresh water and 18 months in salt water. In some streams, a smaller proportion of males may return as two-year olds. The presence of two-year old males can allow for substantial genetic exchange between brood years. The relatively fixed three-year life cycle exhibited by female coho salmon limits demographic interactions between brood years. This makes coho salmon more vulnerable to environmental perturbations than salmonids that exhibit overlapping generations, i.e., the loss of a coho salmon brood year in a stream is less likely to be reestablished by females from other brood years than for other Pacific salmon.

Coho salmon feed on a variety of prey organisms depending upon life stage and size. While at sea, coho salmon tend to eat fish including herring, sand lance, sticklebacks, sardines, shrimp and surf smelt. While in estuaries and in fresh water coho salmon are significant predators of Chinook, pink, and chum salmon, as well as aquatic and terrestrial insects. Smaller fish, such as fry, eat chironomids, plecoptera and other larval insects, and typically use visual cues to find their prey.

Designated critical habitat. The essential features of designated critical habitat for the Central California Coast and Southern Oregon/Northern California Coast coho salmon ESUs that are vulnerable to the stressors of the action are generically identified as water quality, food, and riparian vegetation. The essential features of designated critical habitat for the Lower Columbia

River and Oregon Coast ESUs are more detailed. They include water quality conditions supporting spawning, incubation and larval development, water quality and forage supporting juvenile development; and natural cover of riparian and aquatic vegetation, water quality conditions supporting juvenile and adult physiological transitions between fresh- and saltwater, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

2.4.4 Sockeye salmon (2 ESUs)

Life history. Most sockeye salmon exhibit a lake-type life history (i.e., they spawn and rear in or near lakes), though some exhibit a river-type life history. Spawning generally occurs in late summer and fall, but timing can vary greatly among populations. In lakes, salmon commonly spawn along "beaches" where underground seepage provides fresh oxygenated water. Incubation is a function of water temperature, but generally lasts between 100 to 200 days (Burgner 1991). Sockeye salmon fry primarily rear in lakes; river-emerged and stream-emerged fry migrate into lakes to rear. Juvenile sockeye salmon generally rear in lakes from one to three years after emergence, though some river-spawned salmon may migrate to sea in their first year. Juvenile sockeye salmon feeding behaviors change as they transition through life stages after emergence to the time of smoltification. In the early fry stage, from spring to early summer, juveniles forage exclusively in the warmer littoral (i.e., shoreline) zone where they depend mostly on fly larvae and pupae, copepods, and water fleas. In summer, underyearling sockeye salmon move from the littoral habitat to a pelagic (i.e., open water) existence where they feed on larger zooplankton; however, flies may still make up a substantial portion of their diet. Older and larger fish may also prey on fish larvae. Distribution in lakes and prey preference is a dynamic process that changes daily and yearly depending on many factors, including: water temperature; prey abundance; presence of predators and competitors; and size of the juvenile. Peak emigration to the ocean occurs in mid-April to early May in southern sockeye populations (<52ºN latitude) and as late as early July in northern populations (62ºN latitude) (Burgner 1991). Adult sockeye salmon return to their natal lakes to spawn after spending one to four years at sea. The diet of adult salmon consists of amphipods, copepods, squid, and other fish.

Designated Critical Habitat. The essential features of designated critical habitat for Lake Ozette sockeye ESU that are potentially affected by the stressors of the action include water quality conditions and forage species supporting spawning, incubation, development, growth, maturation, physiological transitions between fresh and saltwater, and natural cover of riparian and nearshore vegetation and aquatic vegetation. The essential features of designated critical habitat for Snake River sockeye potentially affected by the stressors of the action are identified generically as water quality, food, and riparian vegetation.

2.4.5 Steelhead trout (11 DPSs)

Life history. Steelhead have a longer run time than other Pacific salmonids and do not tend to travel in large schools. They can be divided into two basic run-types: the stream-maturing type (summer steelhead) and the ocean-maturing type (winter steelhead). Summer steelhead enter fresh water as sexually immature adults between May and October (Nickelson et al. 1992, Busby et al. 1996) and hold in cool, deep pools during summer and fall before moving to spawning sites as mature adults in January and February (Barnhart 1986, Nickelson et al. 1992). Winter steelhead return to fresh water between November and April as sexually mature adults and spawn shortly after river entry (Nickelson et al. 1992, Busby et al. 1996). Steelhead typically spawn in small tributaries rather than large, mainstem rivers and spawning distribution often overlaps with coho salmon, though steelhead tend to prefer higher gradients (generally two to seven percent, but up to 12 percent or more) and their distributions tend to extend further upstream than coho salmon. Summer steelhead commonly spawn higher in a watershed than do winter steelhead, sometimes even using ephemeral streams from which juveniles are forced to emigrate as flows diminish. Fry usually inhabit shallow water along banks and stream margins of streams (Nickelson et al. 1992) and move to faster flowing water such as riffles as they grow. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992). In Oregon and California, steelhead may enter estuaries where sand bars create low salinity lagoons. Migration of juvenile steelhead to these lagoons occurs throughout the year, but is concentrated in the late spring/early summer and in the late fall/early winter periods (Shapovalov and Taft 1954, Zedonis 1992). Juveniles rear in fresh water for one to four years, then smolt and migrate to the ocean in March and April (Barnhart 1986). Steelhead typically reside in marine waters for two or three years prior to returning to their natal streams to spawn as four or five-year olds. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby et al. 1996). Females spawn more than once more commonly than males, but rarely more than twice before dying (Nickelson et al. 1992). Iteroparity is also more common among southern steelhead populations than northern populations (Busby et al. 1996).

Steelhead feed on a variety of prey organisms depending upon life stage, season, and prey availability. In freshwater juveniles feed on common aquatic stream insects such as caddisflies, mayflies, and stoneflies but also other insects (especially chironomid pupae), zooplankton, and benthic organisms (Pert 1993 , Merz 2002). Older juveniles sometimes prey on emerging fry, other fish larvae, crayfish, and even small mammals, though these are not a major food source (Merz 2002). The diet of adult oceanic steelhead is comprised primarily of fish and squid (Light 1985, Burgner et al. 1992).

Designated critical habitat. The essential features of designated critical habitat for all steelhead DPSs that are potentially affected by the stressors of the action include water quality conditions and/or forage species supporting spawning, incubation, development, growth, maturation, physiological transitions between fresh and saltwater, and natural cover of riparian and nearshore vegetation and aquatic vegetation.

2.4.6 Atlantic salmon

Status. The Gulf of Maine DPS of Atlantic salmon was first listed as endangered in response to population decline caused by many factors, including overexploitation, degradation of water quality, and damming of rivers, all of which remain persistent threats. The listing was refined to include all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. The USFWS has jurisdiction over this species in freshwater, so the NMFS jurisdiction is limited to potential PGP-authorized discharges from the coastal lands belonging to the Passamoquoddy Tribe at Pleasant Point. We used information available in the 2006 Status Review (Fay et al. 2006) and the Final Rule to List the Expanded Gulf of Maine DPS as Endangered Under the ESA (74 FR 29344) to summarize the status of the species, as follows.

In 2015, NMFS announced a new program to focus and redouble its efforts to protect some of the species that are currently among the most at risk of extinction in the near future with the goal of reversing their declining trend so that the species will become a candidate for recovery in the future. Atlantic salmon is one of the eight species identified for this initiative (NMFS 2015b). These species were identified as among the most at-risk of extinction based on three criteria (1) endangered listing, (2) declining populations, and (3) are considered a recovery priority #1. A priority #1 species is one whose extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction, whose limiting factors and threats are well understood and the needed management actions are known and have a high probability of success, and is a species that is in conflict with construction or other developmental projects or other forms of economic activity (55 FR 24296, June 15, 1990).

Life History. Adult Atlantic salmon in the Gulf of Maine typically spawn in early November and juveniles spend approximately two years feeding on small invertebrates and occasionally small vertebrates in freshwater until they weigh approximately two ounces and are six inches in length. Smoltification (the physiological and behavioral changes required for the transition to salt water) usually occurs at age two for this DPS after which the species migrates more than 4,000 km in the open ocean to reach feeding areas in the Davis Strait between Labrador and Greenland. Adult salmon feed opportunistically and their diet is composed primarily of other fish. The majority (90 percent) spend two winters at sea before reaching maturity and returning to their natal rivers, with the remainder spending one or three winters at sea. At maturity, Gulf of Maine DPS salmon typically weigh between 8 to 15 pounds and average 30 inches in length.

Designated critical habitat. The designated critical habitat includes all anadromous Atlantic salmon streams whose freshwater range occurs in watersheds from the Androscoggin River northward along the Maine coast northeastward to the Dennys River, and wherever these fish occur in the estuarine and marine environment. The essential features identified within freshwater and estuarine habitats of the occupied range of the Gulf of Maine DPS include sites for spawning and incubation, juvenile rearing, and migration. Designated critical habitat and essential features were not designated within marine environments because of the limited of the physical and biological features that the species uses during the marine phase of its life.

3 NON-SALMONID ANADROMOUS FISH

3.1 Southern Pacific eulachon

Status. Eulachon are small smelt native to eastern North Pacific waters from the Bering Sea to Monterey Bay, California, or from 61° N to 31° N (Hart and McHugh 1944, Eschmeyer et al. 1983, Minckley et al. 1986, Hay and McCarter 2000). Eulachon that spawn in rivers south of the Nass River of British Columbia to the Mad River of California comprise the southern population of Pacific eulachon. This species status is classified as “at moderate risk of extinction throughout all of its range” (Gustafson 2010) based upon timing of runs and genetic distinctions (Hart and McHugh 1944, McLean et al. 1999, Hay and McCarter 2000, McLean and Taylor 2001, Beacham et al. 2005). Based on a number of data sources, the 2016 Status Review Update for eulachon reports that the spawning population has increased between 2011 and 2015 and that of the size of some sub-populations is larger than originally estimated in 2010 (Gustafson et al. 2016). The status update does not recommend a change in status because it is too early to tell whether recent improvements in the southern DPS of eulachon will persist. Recent poor ocean conditions taken with given variability inherent in wild populations suggest that population declines may again become widespread in the upcoming return years.

Life Cycle. Adult eulachon are found in coastal and offshore marine habitats (Allen et al. 1988, Hay and McCarter 2000, Willson et al. 2006). Larval and post larval eulachon prey upon phytoplankton, copepods, copepod eggs, mysids, barnacle larvae, worm larvae, and other eulachon larvae until they reach adult size (WDFW and ODFW 2001). The primary prey of adult eulachon are copepods and euphausiids, malacos, tracans, and cumaceans (Smith and Saalfeld 1955, Barraclough 1964, Drake and Wilson 1991, Sturdevant et al. 1999, Hay and McCarter 2000).

Although primarily marine, eulachon return to freshwater to spawn. Adult eulachon have been observed in several rivers along the west coast (Odemar 1964, Minckley et al. 1986, Emmett et al. 1991, Jennings 1996, Wright 1999, Hay and McCarter 2000, Larson and Belchik 2000, Musick et al. 2000, WDFW and ODFW 2001, Moyle 2002). For the southern population of Pacific eulachon, most spawning is believed to occur in the Columbia River and its tributaries as well as in other Oregonian and Washingtonian rivers (Emmett et al. 1991, Musick et al. 2000, WDFW and ODFW 2001). Eulachon take less time to mature and generally spawn earlier in southern portions of their range than do eulachon from more northerly rivers (Clarke et al. 2007).

Spawning is strongly influenced by water temperatures, so the timing of spawning depends upon the river system involved (Willson et al. 2006). In the Columbia River and further south, spawning occurs from late January to March, although river entry occurs as early as December (Hay and McCarter 2000). Further north, the peak of eulachon runs in Washington State is from February through March while Alaskan runs occur in May and river entry may extend into June (Hay and McCarter 2000). Females lay eggs over sand, course gravel or detritial substrate. Eggs attach to gravel or sand and incubate for 30 to 40 days after which larvae drift to estuaries and coastal marine waters (Wydoski and Whitney 1979).

Eulachon generally die following spawning (Scott and Crossman 1973). The maximum known lifespan is 9 years of age, but 20 to 30 percent of individuals live to 4 years and most individuals survive to 3 years of age, although spawning has been noted as early as 2 years of age (Wydoski and Whitney 1979, Barrett et al. 1984, Hugg 1996, Hay and McCarter 2000, WDFW and ODFW 2001). The age distribution of spawners varies between river and from year-to-year (Willson et al. 2006).

Threats. The Biological Review Team 2010 assessment of the status of the southern DPS of eulachon ranked climate change impacts on ocean conditions as the most serious threat to the persistence of eulachon in all four subareas of the DPS: Klamath River, Columbia River, Fraser River, and British Columbia coastal rivers south of the Nass River. Climate change impacts on freshwater habitat and eulachon bycatch in offshore shrimp fisheries were also ranked in the top four threats in all subareas of the DPS. Dams and water diversions in the Klamath and Columbia rivers and predation in the Fraser and British Columbia coastal rivers filled out the last of the top four threats (Gustafson 2010).

Designated critical habitat. The designated critical habitat for the southern population of Pacific eulachon includes freshwater creeks and rivers and their associated estuaries, comprising approximately 539 km (335 mi) of habitat. The physical or biological features potentially affected by the stressors of the action include water quality conditions supporting spawning and incubation, larval and adult mobility, and abundant prey items supporting larval feeding after the yolk sac is depleted, and nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. Eulachon prey on a wide variety of species including crustaceans such as copepods and euphausiids (Hay and McCarter 2000, WDFW and ODFW 2001), unidentified malacostracans (Sturdevant et al. 1999), cumaceans (Smith and Saalfeld 1955) mysids, barnacle larvae, and worm larvae (WDFW and ODFW 2001).

3.2 Shortnose Sturgeon

Status. We used information available in the Shortnose Sturgeon Recovery Plan (NMFS 1998), the 2010 NMFS Biological Assessment (SNS BA 2010), and the listing document (32 FR 4001) to summarize the status of the species. Shortnose sturgeon were listed as endangered throughout its range on March 11, 1967 pursuant to the Endangered Species Preservation Act of 1966. Shortnose sturgeon remained on the list as endangered with enactment of the ESA in 1973. Shortnose sturgeon occur along the Atlantic Coast of North America, from the Saint John River in Canada to the Saint Johns River in Florida. The Shortnose Sturgeon Recovery Plan describes 19 shortnose sturgeon populations that are managed separately in the wild. Two additional geographically separated populations occur behind dams in the Connecticut River (above the Holyoke Dam) and in Lake Marion on the Santee-Cooper River system in South Carolina (above the Wilson and Pinopolis Dams). While shortnose sturgeon spawning has been documented in several rivers across its range (including but not limited to: Kennebec River, ME, Connecticut River, Hudson River, Delaware River, Pee Dee River, SC, Savannah, Ogeechee, and Altamaha rivers, GA), status for many other rivers remain unknown.

Life History. Sturgeon are a long-lived species, taking years to reach sexual maturity. Male shortnose sturgeon tend to sexually mature earlier than females, and sturgeon residing in more northern latitudes reach maturity later than those at southerly latitudes. Sturgeon are broadcast spawners, with females laying adhesive eggs on hard bottom, rocky substrate at upstream, freshwater sites. When the males arrive at the spawning site, they broadcast sperm into the water column to fertilize the eggs. Despite their high fecundity, sturgeon have low recruitment.

Spawning periodicity varies by species and sex, but there can be anywhere from 1 to 5 years between spawning, as individuals need to rebuild gonadal material. There is difficulty in definitively assessing where and how reliably spawning occurs. Presence of eggs, age-1 juveniles and capture of “ripe” adults moving upstream (i.e., likely on a spawning run) serve as strong indicators, but due to their life history and the impacts sturgeon populations have taken, there are additional hurdles to successful spawning. Because sturgeon are iteroparous, and populations in some areas so depleted, eggs deposited at the spawning grounds may not be fertilized if males do not arrive at the spawning grounds that year.

Hatching occurs approximately 94-140 hrs after egg deposition, and larvae assume a bottom-dwelling existence. The yolksac larval stage is completed in about 8-12 days, during which time larvae move downstream to rearing grounds over a 6 – 12 day period. Size of larvae at hatching and at the juvenile stage varies by species. During the daytime, larvae use benthic structure (e.g., gravel matrix) as refugia. Juvenile sturgeon continue to move further downstream into brackish waters, and eventually become residents in estuarine waters for months or years.

Generally, sturgeon are benthic omnivores, feeding on benthic invertebrates that are abundant in the substrate in that area. Shortnose sturgeon forage over sandy bottom, and eat benthic invertebrates like amphipods.

Juvenile shortnose generally move upstream during spring and summer and downstream for fall and winter; however, these movements usually occur above the salt- and freshwater interface. During summer and winter, adult shortnose sturgeon inhabit freshwater reaches of rivers and streams influenced by tides. During summer, at the southern end of its range, shortnose sturgeon congregate in cool, deep, areas of rivers taking refuge from high temperatures. Adult shortnose sturgeon prefer deep, downstream areas with soft substrate and vegetated bottoms, if present. Because they rarely leave their natal rivers, shortnose sturgeon are considered to be freshwater amphidromous (i.e. adults spawn in freshwater but regularly enter saltwater habitats during their life).

Despite the life span of adult sturgeon, the viability of sturgeon populations is highly sensitive to juvenile mortality resulting in lower numbers of sub-adults recruiting into the adult breeding population. This relationship caused Secor et al. (2002) to conclude sturgeon populations can be grouped into two demographic categories: populations having reliable (albeit periodic) natural recruitment and those that do not. The shortnose sturgeon populations without reliable natural recruitment are at more risk. Several authors have also demonstrated that sturgeon populations generally, and shortnose sturgeon populations in particular, are much more sensitive to adult mortality than other species of fish. Sturgeon populations cannot survive fishing related mortalities exceeding five percent of an adult spawning run and they are vulnerable to declines and local extinction if juveniles die from fishing related mortalities (Secor et al. 2002).

Shortnose sturgeon populations are at risk from incidental bycatch, loss of habitat, dams, dredging and pollution. These threats are likely to continue into the future. We conclude that the shortnose sturgeon’s resilience to further perturbation is low.

Threats. The 1998 recovery plan for shortnose sturgeon (NMFS 1998) identify Habitat degradation or loss (resulting, for example, from dams, bridge construction, channel dredging, and pollutant discharges), and mortality (for example, from impingement on cooling water intake screens, dredging, and incidental capture in other fisheries) as principal threats to the species' survival. Introductions and transfers of indigenous and nonindigenous sturgeon, intentional or accidental, may threaten wild shortnose sturgeon populations by imposing genetic threats, increasing competition for food or habitat, or spreading diseases. Sturgeon species are susceptible to viruses enzootic to the west coast and fish introductions could further spread these diseases.

Designated critical habitat. No critical habitat has been designated for shortnose sturgeon.

3.3 Atlantic sturgeon (5 DPSs)

Status. The range of Atlantic sturgeon includes the St. John River in Canada, to St. Johns River in Florida. EPA has NPDES permitting authority throughout New Hampshire, Massachusetts, the District of Columbia, Federally operated facilities in Delaware and Tribal lands in Connecticut, Rhode Island, New York, North Carolina, and Florida The five DPSs of Atlantic sturgeon are Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic.

Life history. Although the Atlantic sturgeon DPSs are genetically distinct, their life history characteristics are the same and are discussed together. As Acipensieriformes, Atlantic sturgeon are anadromous and iteroparus. Like shortnose sturgeon, male Atlantic sturgeon tend to sexually mature earlier than females, and sturgeon residing in more northern latitudes reach maturity later than those at southerly latitudes. Evidence of Atlantic sturgeon spawning has been found in many of the same rivers as shortnose sturgeon (see discussion above). Atlantic sturgeon eggs are between 2.5-3.0mm, and larvae are about 7mm long upon hatching. Generally, sturgeon are benthic omnivores, feeding on benthic invertebrates that are abundant in the substrate in that area. Atlantic sturgeon commonly eat polychaetes and isopods.

As juveniles, Atlantic sturgeon migrate downstream from the spawning grounds into brackish water. Unlike shortnose sturgeon, subadult Atlantic sturgeon (76-92cm) may move out of the estuaries and into coastal waters where they can undergo long range migrations. At this stage in the coastal waters, individual subadult and adult Atlantic sturgeon originating from different DPSs will mix, but adults return to their natal river to spawn.

Threats. Of the stressors evaluated in the 2007 status review (ASSRT 2007), bycatch mortality, water quality, lack of adequate state and/or Federal regulatory mechanisms, and dredging activities were most often identified as the most significant threats to the viability of Atlantic sturgeon populations. Additionally, some populations were affected by unique stressors, such as habitat impediments (e.g., Cape Fear and Santee-Cooper rivers) and apparent ship strikes (e.g., Delaware and James rivers).

Designated critical habitat. The proposed designated critical habitat for Atlantic sturgeon includes tidally-affected accessible waters of coastal estuaries where the species occurs. The essential features of the proposed designated critical habitat for the Atlantic sturgeon DPSs within these rivers do not include plant or animal life that may be affected by the stressors of the action.

From north to south, the rivers and waterways that make up the spatial extent of designated critical habitat are detailed in Table 4.

Table 3. River Systems Included in Proposed Designated Critical Habitat for Atlantic Sturgeon.

Distinct Population Unit	River/Waterway		
Gulf of Maine	Penobscot	Kennebec	Androscoggin
	Piscataqua	Merrimack	
New York Bight	Connecticut	Housatonic	Hudson
	Housatonic		
	Delaware		
Chesapeake Bay	Susquehanna	Potomac	Rappahannock
	York	Mattaponi	Pamunkey
	James		
Carolina	Roanoke	Tar - Pamlico	Neuse
	Cape Fear	Northeast Cape Fear	Pee Dee
	Waccamaw	Bull Creek	Black
	Santee	Rediversion Canal	North Santee
	South Santee	Tailrace Canal	Cooper
	Wateree	Cooper	Congaree
	Santee	Broad	Diversion Canal
	Lake Moultrie	Lake Marion	
South Atlantic	North Fork Edisto	South Fork Edisto	Edisto
	North Edisto	South Edisto	Combahee - Salkehatchie
	Savannah	Ogeechee	Oconee
	Ocmulgee	Altamaha	Satilla
	St. Marys		

3.4 Green sturgeon, southern DPS

Status. The most recent 5-year status review was published in August of 2015. Green sturgeon occur in coastal Pacific waters from San Francisco Bay to Canada. The Southern DPS of green sturgeon includes populations south of (and exclusive of) the Eel River, coastal and Central Valley populations, and the spawning population in the Sacramento River, CA (Adams et al. 2007). We used information available in the 2002 Status Review and 2005 Status Review Update (GSSR 2002, 2005, 2015), and the proposed and final listing rules to summarize the status of the species.

The 2015 status update indicates that DPS structure of the North American green sturgeon has not changed and that many of the principle factors considered when listing Southern DPS green sturgeon as threatened are relatively unchanged. Loss of spawning habitat and bycatch in the white sturgeon commercial fishery are two major causes for the species decline. Spawning in the Feather River is encouraging and the decommissioning of Red Bluff Diversion Dam and breach of Shanghai Bench makes spawning conditions more favorable. The prohibition of retention in commercial and recreational fisheries has eliminated a known threat and likely had a very positive effect on the overall population, although recruitment indices are not presently available.

Life history. As members of the family Acipenseridae, green sturgeon share similar reproductive strategies and life history patterns with other sturgeon species; see discussion for shortnose sturgeon above. The Sacramento River is the location of the single, known spawning population for the green sturgeon Southern DPS (Adams et al. 2007). Green sturgeon have relatively large eggs compared to other sturgeon species (4.34 mm) and grow rapidly, reaching 66 mm in three weeks. Generally, sturgeon are benthic omnivores, feeding on benthic invertebrates that are abundant in the substrate in that area. Little is known specifically about green sturgeon foraging habits; generally, adults feed upon invertebrates like shrimp, mollusks, amphipods and even small fish, while juveniles eat opossum shrimp and amphipods. Juvenile green sturgeon spend 1-3 years in freshwater, disperse widely in the ocean, and return to freshwater as adults to spawn (about age 15 for males, age 17 for females).

Threats. The 2015 status review (NMFS 2015a) for the southern DPS of green sturgeon indicates that many of the principle factors considered when listing Southern DPS green sturgeon as threatened are relatively unchanged. Current threats to the Southern DPS include entrainment by water projects, contaminants, incidental bycatch and poaching. Given the small population size, the species’ life history traits (e.g., slow to reach sexual maturity), and that the threats to the population are likely to continue into the future, the Southern DPS is not resilient to further perturbations. The spawning area for the species is still small, as the species still encounters impassible barriers in the Sacramento, Feather and other rivers that limit their spawning range. Entrainment threat includes stranding in flood diversions during high water events.

Designated critical habitat. Critical habitat for the Southern DPS of green sturgeon was designated on October 9, 2009 (74 FR 52300), including coastal United States marine waters within 60 fathoms deep from Monterey Bay, California to Cape Flattery, Washington, including the Strait of Juan de Fuca, and numerous coastal rivers and estuaries: see the Final Rule for a complete description (74 FR 52300). Essential features identified in this designation that may be affects by the stressors of the action include acceptably low levels of contaminants (e.g., pesticides, PAHs, heavy metals that may disrupt the normal behavior, growth, and viability of subadult and adult green sturgeon) and abundant prey items (benthic invertebrates and fish) for subadults and adults.

4 MARINE FISH

4.1 Bocaccio Puget Sound/Georgia Basin DPS

The bocaccio that occur in the Georgia Basin are listed as an endangered "species," which, in this case, refers to a distinct segment of a vertebrate population. The listing includes bocaccio throughout Puget Sound, which encompasses all waters south of a line connecting Point Wilson on the Olympic Peninsula and Partridge on Whidbey Island; West Point on Whidbey Island, Deception Island, and Rosario Head on Fidalgo Island; and the southern end of Swinomish Channel between Fidalgo Island and McGlinn Island (United States Geological Survey 1979), and the Strait of Georgia, which encompasses the waters inland of Vancouver Island, the Gulf Islands, and the mainland coast of British Columbia.

Status. Bocaccio have always been rare in recreational fisheries that occur in North Puget Sound and the Strait of Georgia; however, there have been no confirmed reports of bocaccio in Georgia Basin for several years. Although their abundance cannot be estimated directly, NMFS' BRT estimated that the populations of bocaccio and yelloweye rockfish are small in size, probably numbering fewer than 10,000 individuals in Georgia Basin and fewer than 1,000 total individuals in Puget Sound (Drake et al. 2010). Georgia Basin bocaccio are most common at depths between 50 and 250 meters (160 and 820 feet).

Life history. Preferred bocaccio habitat is largely dependent upon the life stage of an individual. Larvae and young juveniles tend to be found in deeper offshore regions (1-148 km offshore), but associated with the surface and occasionally with floating kelp mats (Hartmann 1987, Love et al. 2002, Emery et al. 2006). Mating occurs between August and November, with larvae born between January and April (Lyubimova 1965, Moser 1967, Westrheim 1975, Echeverria 1987, Love et al. 2002, MacCall and He 2002).As individuals mature into older juveniles and adults, they transition into shallow waters and settle to the bottom, preferring algae-covered rocky, eelgrass, or sand habitats and aggregating into schools (Eschmeyer et al. 1983, Love et al. 1991). After a few weeks, fish move into slightly deeper waters of 18-30 m and occupy rocky reefs (Feder et al. 1974, Carr 1983, Eschmeyer et al. 1983, Johnson 2006, Love and Yoklavich 2008). As adults, bocaccio may be found in depths of 12-478 m, but tend to remain in shallow waters on the continental shelf (20-250 m), still associating mostly with reefs or other hard substrate, but may move over mud flats (Feder et al. 1974, Kramer and O'Connell 1995, Love et al. 2002, Love et al. 2005, Love and York 2005, Love et al. 2006). Artificial habitats, such as platform structures, also appear to be suitable habitat for bocaccio (Love and York 2006). Adults may occupy territories of 200-400 hectares, but can venture outside of this territory (Hartmann 1987). Adults tend to occupy deeper waters in the southern population compared to the northern population (Love et al. 2002). Adults are not as benthic as juveniles and may occur as much as 30 m above the bottom and move 100 m vertically during the course of a day as they move between different areas (Starr 1998, Love et al. 2002). Prior to severe population reductions, bocaccio appeared to frequent the Tacoma Narrows in Washington State (DeLacy et al. 1964, Haw and Buckley 1971, Miller and Borton 1980).

Prey of bocaccio vary with fish age, with bocaccio larvae starting with larval krill, diatoms, and dinoflagellates (Love et al. 2002). Pelagic juveniles consume fish larvae, copepods, and krill, while older, nearshore juveniles and adults prey upon rockfishes, hake, sablefish, anchovies, lanternfish, and squid (Reilly et al. 1992, Love et al. 2002).

Threats. The 2016 draft recovery plan for rockfish indicates that historical overfishing is recognized as the primary cause of the decline of rockfishes in Puget Sound (Palsson et al. 2008, Drake et al. 2010, Williams et al. 2010), there is some uncertainty about the relative impact of some fisheries today, and of the additional remaining threats, which include degraded water quality and habitat, contaminants, derelict fishing gear, and other threats (Palsson et al. 2008, Drake et al. 2010, WDFW 2013).

Designated critical habitat. NMFS proposed critical habitat designation of approximately 1,185 mi^2 of marine habitat for bocaccio in Puget Sound, Washington. Physical or biological features essential to adult bocaccio include the benthic habitats or sites deeper than 30m (98 ft) that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat are essential to conservation because these features support growth, survival, reproduction, and feeding opportunities by providing the structure for rockfish to avoid predation, seek food and persist for decades. Several attributes of these sites determine the quality of the habitat and are useful in considering the conservation value of the associated feature, and whether the feature may require special management considerations or protection. These attributes are also relevant in the evaluation of the effects of a proposed action in a section 7 consultation if the specific area containing the site is designated as critical habitat. These attributes include: (1) Quantity, quality and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities, (2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities, and (3) the type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

4.2 Rockfish, Yelloweye and Canary (Puget Sound/Georgia Basin)

Status. In July of 2016 NMFS petitioned to delist the canary rockfish based on newly obtained genetic information that demonstrates that the Puget Sound/Georgia Basin canary rockfish population does not meet the DPS criteria and therefore does not qualify for listing under the ESA. Georgia Basin yelloweye rockfish occur through Puget Sound, which encompasses all waters south of a line connecting Point Wilson on the Olympic Peninsula and Partridge on Whidbey Island; West Point on Whidbey Island, Deception Island, and Rosario Head on Fidalgo Island; and the southern end of Swinomish Channel between Fidalgo Island and McGlinn Island (United States Geological Survey 1979), and the Strait of Georgia, which encompasses the waters inland of Vancouver Island, the Gulf Islands, and the mainland coast of British Columbia.

The frequency of yelloweye rockfish in collections from Puget Sound appears to have been highly variable; frequencies were less than 1 percent in the 1960s and 1980s and about 3 percent in the 1970s and 1990s. In North Puget Sound, however, the frequency of yelloweye rockfish has been estimated to have declined from a high of greater than 3 percent in the 1970s to about 0.65 percent in more recent samples. This decline combined with their low intrinsic growth potential, threats from bycatch in commercial and recreational fisheries, loss of nearshore rearing habitat, chemical contamination, and the proportion of coastal areas with low dissolved oxygen levels led to this species' listing as threatened under the ESA.

Although their abundance cannot be estimated directly, NMFS' BRT estimated that the populations of bocaccio, yelloweye rockfish and canary rockfish are small in size, probably numbering fewer than 10,000 individuals in Georgia Basin and fewer than 1,000 total individuals in Puget Sound (Drake et al. 2010).

Georgia Basin yelloweye rockfish are most common at depths between 91 and 180 meters (300 to 580 feet), although they may occur in waters 50 to 475 meters (160 and 1,400 feet) deep. Larval rockfish occur over areas that extend several hundred miles offshore where they are passively dispersed by ocean currents and remain in larval form and as small juveniles for several months (Auth and Brodeur 2006, Moser and Boehlert 1991). They appear to concentrate over the continental shelf and slope, but have been captured more than 250 nautical miles offshore of the Oregon coast (Richardson and Laroche 1979, Moser and Boehlert 1991). Larval rockfish have been reported to be uniformly distributed at depths of 13, 37 and 117 meters below surface. Densities were highest at the 37- and 177-meter depths (Lenarz et al. 1991).

Life history. As with bocaccio, yelloweye habitat varies based upon life stage. Larvae maintain a pelagic existence but as juveniles, move into shallow high relief rocky or sponge garden habitats (Eschmeyer et al. 1983, Richards et al. 1985, Love et al. 1991). Juveniles may also associate with floating debris or pilings (Lamb and Edgell 1986). As adults, yelloweye rockfish move in to deeper habitats. Individuals have been found in waters as deep as 549 m, but are generally found in waters of less than 180 m (Eschmeyer et al. 1983, Love et al. 2002). However, adults continue to associate with rocky, high relief habitats, particularly with caves and crevices, pinnacles, and boulder fields (Carlson and Straty 1981, Richards 1986, Love et al. 1991, O'Connell and Carlisle 1993, Yoklavich et al. 2000). Yelloweyes generally occur as individuals, with loose, residential aggregations infrequently found (Coombs 1979, DeMott 1983, Love et al. 2002). In the Puget Sound region, sport catch records from the 1970's indicate that Sucia Island and other islands of the San Juans as well as Bellingham Bay had the highest concentrations of catches (Delacy et al. 1972, Miller and Borton 1980).

Yelloweye rockfish prey upon different species and size classes throughout their development. Larval and juvenile rockfish prey upon phyto- and zooplankton (Lee and Sampson 2009). Adult yelloweyes eat other rockfish (including members of their own species), sand lance, gadids, flatfishes, shrimp, crabs, and gastropods (Love et al. 2005, Yamanaka et al. 2006).

Designated critical habitat. Physical or biological features essential to the conservation of both adult and juvenile yelloweye rockfish are the same as for adult bocaccio and adult canary rockfish.

4.3 Nassau Grouper

The Nassau grouper (*Epinephelus striatus*) is primarily a shallow-water, insular fish species found from inshore to about 330 feet (100m) depth. The species is distributed throughout the islands of the western Atlantic including Bermuda, the Bahamas, southern Florida and along the coasts of central and northern South America. It is not known from the Gulf of Mexico except at Campeche Bank off the coast of the Yucatan Peninsula, at Tortugas, and off Key West. Adults are generally found near coral reefs and rocky bottoms while juveniles are found in shallower waters in and around coral clumps covered with macroalgae (*Laurencia* spp.) and over seagrass beds. Their diet is mostly fishes and crabs, with diet varying by age/size. Juveniles feed mostly on crustaceans, while adults (>30 cm; 11.8 in) forage mainly on fish. The Nassau grouper usually forages alone and is not a specialized forager.

Under the authority of the Magnuson-Stevens Fisheries Act, NMFS classified the Nassau grouper as “overfished” in its October 1998 “Report to Congress on the status of Fisheries and Identification of overfished Stocks.”

Life History. Nassau grouper exhibit no sexual dimorphism in body shape or color. The species passes through a juvenile bisexual phase, with gonads consisting of both immature spermatogenic and immature ovarian tissue, before maturing directly as male or female. The minimum age at sexual maturity is between four and eight years when reaching a size of 400-500 mm standard length (Olsen and LaPlace 1979, Bush et al. 2006). The major determinant of maturity appears to be size rather than age, as fish raised in captivity reached maturity at 27-28 months (Tucker and Woodward 1994).

Nassau grouper reproduce in site-specific spawning aggregations. Spawning aggregations, of a few dozen up to perhaps thousands of individuals have been reported from the Bahamas, Jamaica, Cayman Islands, Belize, and the Virgin Islands. These aggregations occur in depths of 20-40 m (65.6-131.2 ft) at specific locations of the outer reef shelf edge. Spawning takes place in December and January, around the time of the full moon, in waters 25-26 degrees C (77-78.8 degrees F). Because Nassau grouper spawn in aggregations at historic areas and at very specific times, they are easily targeted during reproduction. Because Nassau grouper mature relatively late (4-8 years), many juveniles may be taken by the fishery before they have a chance to reproduce.

Designated critical habitat. Critical habitat has not been designated for this species.

5 SEA TURTLES

Sea turtles share the common threats described below.

Bycatch: Fishing is the primary anthropogenic threat to sea turtles in the ocean. Fishing gear entanglement potentially drowns or seriously injures sea turtles. Fishing dredges can crush and entrap turtles, causing death and serious injury. Infection of entanglement wounds can compromise health. The development and operation of marinas and docks in inshore waters can negatively impact nearshore habitats. Turtles swimming or feeding at or just beneath the surface of the water are particularly vulnerable to boat and vessel strikes, which can result in serious propeller injuries and death.

Marine Debris: Ingestion or entanglement in marine debris is a cause of morbidity and mortality for sea turtles in the pelagic (open ocean) environment (Stamper et al. 2009). Consumption of non-nutritive debris also reduces the amount of nutritive food ingested, which then may decrease somatic growth and reproduction (McCauley and Bjorndal 1999). Marine debris is especially problematic for turtles that spend all or significant portions of their life cycle in the pelagic environment (e.g., leatherbacks, juvenile loggerheads, and juvenile green turtles).

Habitat Disturbance: Sea turtle nesting and marine environments are facing increasing impacts through structural modifications, sand nourishment, and sand extraction to support widespread development and tourism (Lutcavage et al. 1997, Bouchard et al. 1998, Hamann et al. 2006, Maison 2006, Hernandez et al. 2007, Santidrián Tomillo et al. 2007, Patino-Martinez 2013).

These factors decrease the amount of nesting area available to nesting females, and may evoke a change in the natural behaviors of adults and hatchlings through direct loss of and indirect (e.g., altered temperatures, erosion) mechanisms (Ackerman 1997, Witherington et al. 2003, 2007). Lights from developments alter nesting adult behavior and are often fatal to emerging hatchlings as they are drawn to light sources and away from the sea (Witherington and Bjorndal 1991, Witherington 1992, Cowan et al. 2002, Deem et al. 2007, Bourgeois et al. 2009).

Beach nourishment also affects the incubation environment and nest success. Although the placement of sand on beaches may provide a greater quantity of nesting habitat, the quality of that habitat may be less suitable than pre-existing natural beaches. Constructed beaches tend to differ from natural beaches in several important ways. They are typically wider, flatter, more compact, and the sediments are more moist than those on natural beaches (Nelson et al. 1987) (Ackerman 1997, Ernest and Martin 1999). Nesting success typically declines for the first year or two following construction, even when more nesting area is available for turtles (Trindell et al. 1998, Ernest and Martin 1999, Herren 1999). Likely causes of reduced nesting success on constructed beaches include increased sand compaction, escarpment formation, and changes in beach profile (Nelson et al. 1987, Grain et al. 1995, Lutcavage et al. 1997, Steinitz et al. 1998, Ernest and Martin 1999, Rumbold et al. 2001). Compaction can inhibit nest construction or increase the amount of time it takes for turtles to construct nests, while escarpments often cause female turtles to return to the ocean without nesting or to deposit their nests seaward of the escarpment where they are more susceptible to frequent and prolonged tidal inundation. In short, sub-optimal nesting habitat may cause decreased nesting success, place an increased energy burden on nesting females, result in abnormal nest construction, and reduce the survivorship of eggs and hatchlings. In addition, sand used to nourish beaches may have a different composition than the original beach; thus introducing lighter or darker sand, consequently affecting the relative nest temperatures (Ackerman 1997, Milton et al. 1997).

In addition to effects on sea turtle nesting habitat, anthropogenic disturbances also threaten coastal foraging habitats, particularly areas rich in seagrass and marine algae. Coastal habitats are degraded by pollutants from coastal runoff, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, increased under water noise and boat traffic, as well as structural degradation from excessive boat anchoring and dredging (Francour et al. 1999, Lee Long et al. 2000, Waycott et al. 2005).

Pollutants: Conant (2009) included a review of the impacts of marine pollutants on sea turtles: marine debris, oil spills, and bioaccumulative chemicals. Sea turtles at all life stages appear to be highly sensitive to oil spills, perhaps due to certain aspects of their biology and behavior, including a lack of avoidance behavior, indiscriminate feeding in convergence zones, and large pre-dive inhalations (Milton and Lutz 2003). Milton et al. (2003) state that the oil effects on turtles include increased egg mortality and developmental defects, direct mortality due to oiling in hatchlings, juveniles and adults, and impacts to the skin, blood, salt glands, and digestive and immune systems. Vargo et al. (1986) reported that sea turtles would be at substantial risk if they encountered an oil spill or large amounts of tar in the environment. In a review of available information on debris ingestion, Balazs (1985) reported that tar balls were the second most prevalent type of debris ingested by sea turtles. Physiological experiments showed that sea turtles exposed to petroleum products may suffer inflammatory dermatitis, ventilator disturbance, salt gland dysfunction or failure, red blood cell disturbances, immune response, and digestive disorders (Vargo et al. 1986, Lutcavage et al. 1995).

Natural Threats: A number of threats are common to all sea turtles.[1] Predation is a primary natural threat. While cold stunning is not a major concern for leatherback sea turtles, which can tolerate low water temperatures, it is considered a major natural threat to other sea turtle species. Disease is also a factor in sea turtle survival. Fibropapillomatosis (FP) tumors are a major threat to green turtles in some areas of the world and is particularly associated with degraded coastal habitat. Scientists have also documented FP in populations of loggerhead, olive ridley, and flatback turtles, but reports in green turtles are more common. Large tumors can interfere with feeding and essential behaviors, and tumors on the eyes can cause permanent blindness. FP was first described in green turtles in the Florida Keys in the 1930s. Since then it has been recorded in many green turtle populations around the world. The effects of FP at the population level are not well understood. The sand-borne fungal pathogens *Fusarium falciforme* and *F. keratoplasticum* capable of killing greater than 90 percent of sea turtle embryos they infect, threatening nesting productivity under some conditions. These pathogens can survive on decaying organic matter and embryo mortality rates attributed to fusarium were associated with clay/silt nesting areas compared to sandy areas (Sarmiento-Ramırez et al. 2014).

Climate Change. Conant’s (2009) review describes the potentially extensive impacts of climate change on all aspects of a sea turtle's life cycle, as well as impact the abundance and distribution of prey items. Rising sea level is one of the most certain consequences of climate change (Titus and Narayanan 1995), and will result in increased erosion rates along nesting beaches. This could particularly affect areas with low-lying beaches where sand depth is a limiting factor, as the sea will inundate nesting sites and decrease available nesting habitat (Fish et al. 2005, Baker et al. 2006). The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Baker et al. 2006). On some undeveloped beaches, shoreline migration will have limited effects on the suitability of nesting habitat. The Bruun rule specifies that during a sea level rise, a typical beach profile will maintain its configuration but will be translated landward and upward (Rosati et al. 2013). However, along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels will cause severe effects on nesting females and their eggs. Erosion control structures can result in the permanent loss of dry nesting beach or deter nesting females from reaching suitable nesting sites (Council 1990). Nesting females may deposit eggs seaward of the erosion control structures potentially subjecting them to repeated tidal inundation. Non-native vegetation often out competes native species, is usually less stabilizing, and can lead to increased erosion and degradation of suitable nesting habitat. Exotic vegetation may also form impenetrable root mats that can prevent proper nest cavity excavation, invade and desiccate eggs, or trap hatchlings.

5.1 Leatherback Sea Turtle

Status. The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. It ranges from tropical to subpolar latitudes, worldwide.

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[1] See hyperlink to NMFS information on sea turtles: http://www.nmfs.noaa.gov/pr/species/turtles/threats.htm, updated June 16, 2014

The global population of adult females has declined over 70 percent in less than one generation, from an estimated 115,000 adult females in 1980 to 34,500 adult females in 1995 (Pritchard 1982, Spotila et al. 1996). There may be as many as 34,000 – 94,000 adult leather backs in the North Atlantic, alone (TEWG 2007), but dramatic reductions (> 80 percent) have occurred in several populations in the Pacific, which was once considered the stronghold of the species (Sarti Martinez 2000). The 2013 five year review (NMFS and USFWS 2013b) reports that the East Pacific and Malaysia leatherback populations have collapsed, yet Atlantic populations generally appear to be stable or increasing. Many explanations have been provided to explain the disparate population trends, including fecundity and foraging differences seen in the Pacific, Atlantic, and Indian Oceans. Since the last 5-year review, studies indicate that high reproductive output and consistent and high quality foraging areas in the Atlantic Ocean have contributed to the stable or recovering populations; whereas prey abundance and distribution may be more patchy in the Pacific Ocean, making it difficult for leatherbacks to meet their energetic demands and lowering their reproductive output. Both natural and anthropogenic threats to nesting and marine habitats continue to affect leatherback populations, including the 2004 tsunami in the Indian Ocean, 2010 oil spill in the United States Gulf of Mexico, logging practices, development, and tourism impacts on nesting beaches in several countries.

In 2015, NMFS announced a new program to focus and redouble its efforts to protect some of the species that are currently among the most at risk of extinction in the near future with the goal of reversing their declining trend so that the species will become a candidate for recovery in the future. The leatherback sea turtle is one of the eight species identified for this initiative (NMFS 2015b). These species were identified as among the most at-risk of extinction based on three criteria (1) endangered listing, (2) declining populations, and (3) are considered a recovery priority #1. A priority #1 species is one whose extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction, whose limiting factors and threats are well understood and the needed management actions are known and have a high probability of success, and is a species that is in conflict with construction or other developmental projects or other forms of economic activity.

Life history. Estimates of age at maturity ranges from 5 to 29 years (Spotila et al. 1996, Avens et al. 2009). Females nest every 1 to 7 years. Natal homing, at least within an ocean basin, results in reproductive isolation between five broad geographic regions: eastern and western Pacific, eastern and western Atlantic, and Indian Ocean. Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight (James et al. 2005, Wallace et al. 2006).

Designated critical habitat. On March 23, 1979, leatherback designated critical habitat was identified adjacent to Sandy Point, St. Croix, Virgin Islands from the 183 m isobath to mean high tide level between 17° 42’12” N and 65°50’00” W. This habitat is essential for nesting, which has been increasingly threatened since 1979, when tourism increased significantly, bringing nesting habitat and people into close and frequent proximity; however, studies do not support significant designated critical habitat deterioration. Additional designated critical habitat for the leatherback sea turtle includes approximately 43,798 km2 stretching along the California coast from Point Arena to Point Arguello east of the 3000 m depth contour; and 64,760 km^2 stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 m depth contour. The designated areas comprise approximately 108558 km2 of marine habitat and include waters from the ocean surface down to a maximum depth of 80 m. They were designated specifically because of the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

5.2 Hawksbill Sea Turtle

Status. The hawksbill sea turtle has a sharp, curved, beak-like mouth. It has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical oceans. The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973.

The hawksbill turtle was once abundant in tropical and subtropical regions throughout the world. Over the last century, this species has declined in most areas and stands at only a fraction of its historical abundance. According to the 2013 status review (NMFS and USFWS 2013a), nesting populations in the eastern Pacific, and the Nicaragua nesting population in the western Caribbean appears to have improved. However, the trends and distribution of the species throughout the globe largely is unchanged. Although greatly depleted from historical levels, nesting populations in the Atlantic in general are doing better than in the Indian and Pacific Oceans. In the Atlantic, more population increases have been recorded in the insular Caribbean than along the western Caribbean mainland or the eastern Atlantic. In general, hawksbills are doing better in the Indian Ocean (especially the southwestern and northwestern Indian Ocean) than in the Pacific Ocean. The situation for hawksbills in the Pacific Ocean is particularly dire, despite the fact that it still has more nesting hawksbills than in either the Atlantic or Indian Oceans.

Life history. Hawksbill sea turtles reach sexual maturity at 20 to 40 years of age. Females return to their natal beaches every 2 to 5 years to nest (an average of 3 to 5 times per season). Clutch sizes are large (up to 250 eggs). Sex determination is temperature dependent, with warmer incubation producing more females. Hatchlings migrate to and remain in pelagic habitats until they reach approximately 22 to 25 cm in straight carapace length. As juveniles, they take up residency in coastal waters to forage and grow. As adults, hawksbills use their sharp beak-like mouths to feed on sponges and corals.

Designated critical habitat. NMFS established designated critical habitat for hawksbill sea turtles around Mona and Monito Islands, Puerto Rico. Aspects of these areas that are important for hawksbill sea turtle survival and recovery include important natal development habitat, refuge from predation, shelter between foraging periods, and food for hawksbill sea turtle prey.

5.3 Kemp's Ridley Sea Turtle

Status. The Kemp's ridley is the smallest of all sea turtle species and considered to be the most endangered sea turtle, internationally (Zwinenberg 1977, Groombridge 1982, TEWG 2000). According to the 2015 status review (NMFS and USFWS 2013a), population growth rate (as measured by numbers of nests) stopped abruptly after 2009. Given the recent lower nest numbers, the population is not projected to grow at former rates. An unprecedented mortality in subadult and adult females post-2009 nesting season may have altered the 2009 age structure and momentum of the population, which had a carryover impact on annual nest numbers in 2011-2014. The results indicate the population is not recovering and cannot meet recovery goals unless survival rates improve. The Deep Water Horizon oil spill that occurred at the onset of the 2010 nesting season and exposed Kemp's ridleys to oil in nearshore and offshore habitats may have been a factor in fewer females nesting in subsequent years, however this is still under evaluation. The long-term impacts from the Deep Water Horizon oil spill and response to the spill (e.g., dispersants) to sea turtles are not yet known. Given the Gulf of Mexico is an area of high-density offshore oil exploration and extraction, future oil spills are highly probable and Kemp's ridleys and their habitat may be exposed and injured. Commercial and recreational fisheries continue to pose a substantial threat to the Kemp's ridley despite measures to reduce bycatch. Kemp's ridleys have the highest rate of interaction with fisheries operating in the Gulf of Mexico and Atlantic Ocean than any other species of turtle.

Life history. Adult Kemp's ridley sea turtles have an average straight carapace length of 2.1 ft (65 cm). Females mature at 12 years of age. The average remigration is 2 years. Nesting occurs from April to July in large arribadas, primarily at Rancho Nuevo, Mexico. Females lay an average of 2.5 clutches per season. The annual average clutch size is 97 – 100 eggs per nest. The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately 2 years before returning to nearshore coastal habitats. Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November, but move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops. Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep, although they can also be found in deeper offshore waters. As adults, Kemp's ridleys forage on swimming crabs, fish, jellyfish, mollusks, and tunicates.

Designated critical habitat. Critical habitat has not been designated for this species.

5.4 Loggerhead Sea Turtle

Status. The loggerhead sea turtle is distinguished from other turtles by its large head and powerful jaws. The North Pacific Ocean DPS ranges throughout tropical to temperate waters in the North Pacific. Based on the 2009 status review (Conant et al. 2009), for three of five DPSs with sufficient data (Northwest Atlantic Ocean, South Pacific Ocean, and North Pacific Ocean), analyses indicate a high likelihood of quasi-extinction. Similarly, threat matrix analysis indicated that all other DPSs have the potential for a severe decline in the future.

North Pacific Ocean Loggerhead sea turtle DPS life history. Mean age at first reproduction for female loggerhead sea turtles is 30 years (SD = 5). Females lay an average of three clutches per season. The annual average clutch size is 112 eggs per nest. The average remigration interval is 2.7 years. Nesting occurs primarily on Japanese beaches, where warm, humid sand temperatures incubate the eggs. Temperature determines the sex of the turtle during the middle of the incubation period. Turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone (Kuroshio Extension Bifurcation Region) and later in the neritic zone (i.e., coastal waters) in the eastern and central Pacific. Coastal waters in the eastern and western North Pacific provide important foraging habitat, inter-nesting habitat, and migratory habitat for adult loggerheads.

Northwest Atlantic Ocean Loggerhead sea turtle DPS life history. Mean age at first reproduction for female loggerhead sea turtles is 30 years (SD = 5). Mating occurs in the spring, and eggs are laid throughout the summer. Northwest Atlantic females lay an average of five clutches per season. The annual average clutch size is 115 eggs per nest. The average remigration interval is 3.7 years (Tucker 2010). Nesting occurs primarily on beaches along the Southeastern Coast of the United States, from southern Virginia to Alabama. Additional nesting occurs on beaches throughout the Gulf of Mexico and Caribbean Sea. Temperature determines the sex of the turtle during the middle of the incubation period. Post- hatchling loggerheads from southeast United States nesting beaches may linger for months in waters just off the nesting beach or become transported by ocean currents within the Gulf of Mexico and North Atlantic, where they become associated with Sargassum habitats, driftlines, and other convergence zones.

The juvenile stage is spent first in the oceanic zone (e.g., waters around the Azores, Madeira, Morocco, and the Grand Banks off Newfoundland) and later in the neritic zone (i.e., continental shelf waters) from Cape Cod Bay, Massachusetts, south through Florida, the Caribbean, and the Gulf of Mexico. Neritic stage juveniles often inhabit relatively enclosed, shallow water estuarine habitats with limited ocean access. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd 1988). Adults inhabit shallow water habitats with large expanses of open ocean access, as well as continental shelf waters. Sub-adult and adult loggerheads prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom, coastal habitats.

Northwest Atlantic Ocean Loggerhead sea turtle DPS designated critical habitat. The final designated critical habitat for the Northwest Atlantic Ocean loggerhead DPS within the Atlantic Ocean and the Gulf of Mexico includes 36 occupied marine areas within the range of the Northwest Atlantic Ocean DPS. These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors.

5.5 Green sea turtle

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) and a straight carapace length of greater than 3.3 ft (1 m). It has a circumglobal distribution, occurring throughout nearshore tropical, subtropical, and, to a lesser extent, temperate waters. The species was separated into two listing designations: endangered for breeding populations in Florida and the Pacific coast of Mexico, and threatened in all other areas throughout its range. On August 1, 2012, NMFS found that a petition to identify the Hawaiian population of green turtle as a DPS, and to delist the DPS, may be warranted (77 FR 45571). In April 2016, we removed the range-wide and breeding population listings of the green sea turtle, and in their place, listed 8 DPSs as threatened and 3 DPSs as endangered (81 FR 20057). Among these, only the North Atlantic DPS occurs in waters where EPA has permitting authority.

Life history throughout range. Age at first reproduction for females is 20 - 40 years. They lay an average of three nests per season with an average of 100 eggs per nest. The remigration interval (i.e., return to natal beaches) is 2 – 5 years. Nesting occurs primarily on beaches with intact dune structure, native vegetation, and appropriate incubation temperatures during summer months. After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, although they also eat jellyfish, sponges, and other invertebrate prey.

Status. Once abundant in tropical and subtropical waters, globally, green sea turtles exist at a fraction of their historical abundance, as a result of over-exploitation. The North Atlantic DPS is characterized by geographically widespread nesting with eight sites having high levels of abundance (i.e., <1,000 nesters). Nesting is reported in 16 countries and/or United States Territories at 73 sites. This region is data rich and has some of the longest running studies on nesting and foraging turtles anywhere in the world. All major nesting populations demonstrate long-term increases in abundance. The prevalence of FP has reached epidemic proportions in some parts of the North Atlantic DPS.

The extent to which this will affect the long-term outlook for green turtles in the North Atlantic DPS is unknown and remains a concern, although nesting trends across the DPS continue to increase despite the high incidence of the disease. There are still concerns about future risks, including habitat degradation (particularly coastal development), bycatch in fishing gear, continued turtle and egg harvesting, and climate change.

Designated critical habitat. On September 2, 1998, NMFS designated critical habitat for green sea turtles (63 FR 46694), which include coastal waters surrounding Culebra Island, Puerto Rico. Seagrass beds surrounding Culebra provide important foraging resources for juvenile, subadult, and adult green sea turtles. Additionally, coral reefs surrounding the island provide resting shelter and protection from predators. This area provides important developmental habitat for the species.

6 CORALS

There are currently 22 coral species listed as threatened under the ESA, 16 of which occur in the action area (Table 5). Information from the proposed listings and status reports (ABRT 2005) were used to summarize the status of these species

Table 4: Threatened coral species occurring in the PGP action area

Threatened Corals	Currently Known in These United States Geographic Areas			
	Caribbean Waters: Puerto Rico			
Acropora cervicornis (Staghorn)*and designated critical habitat*	X			
Acropora palmata (Elkhorn) *and designated critical habitat*	X			
Mycetophyllia ferox	X			
Dendrogyra cylindrus	X			
Orbicella annularis	X			
Orbicella faveolata	X			
Orbicella franksi	X			
	Pacific Waters			
	Guam	**Commonwealth of Northern Mariana Islands**	**Pacific Remote Island Areas**	**American Samoa**
Acropora globiceps	X	X	X	X
Acropora jacquelineae				X
Acropora retusa	X		X	X
Acropora rudis				X
Acropora speciosa			X	X
Euphyllia paradivisa				X
Isopora crateriformis				X
Pavona diffluens	X	X		X
Seriatopora aculeata	X			

Life history. The threatened coral species include true stony corals (class Anthozoa, order Scleractinia), the blue coral (class Anthozoa, order Helioporacea), and fire corals (class

Hydrozoa, order Milleporina). All threatened species are reef-building corals, because they secrete massive calcium carbonate skeletons that form the physical structure of coral reefs.

Reef-building coral species are capable of rapid calcification rates because of their symbiotic relationship with single-celled dinoflagellate algae, zooxanthellae, which occur in great numbers within the host coral tissues. Zooxanthellae photosynthesize during the daytime, producing an abundant source of energy for the host coral that enables rapid growth. At night, polyps extend their tentacles to filter-feed on microscopic particles in the water column such as zooplankton, providing additional nutrients for the host coral. In this way, reef-building corals obtain nutrients autotrophically (i.e., via photosynthesis) during the day, and heterotrophically (i.e., via predation) at night.

Most coral species use both sexual and asexual propagation. Sexual reproduction in corals is primarily through gametogenesis (i.e., development of eggs and sperm within the polyps near the base). Some coral species have separate sexes (gonochoric), while others are hermaphroditic. Strategies for fertilization are by either “brooding” or “broadcast spawning” (i.e., internal or external fertilization, respectively). Brooding is relatively more common in the Caribbean, where nearly 50 percent of the species are brooders, compared to less than 20 percent of species in the Indo-Pacific. Asexual reproduction in coral species most commonly involves fragmentation, where colony pieces or fragments are dislodged from larger colonies to establish new colonies, although the budding of new polyps within a colony can also be considered asexual reproduction. In many species of branching corals, fragmentation is a common and sometimes dominant means of propagation.

Reef-building corals do not thrive outside of an area characterized by a fairly narrow mean temperature range (typically 25 °C-30 °C). Two other important factors influencing suitability of habitat are light and water quality.

Threats. Massive mortality events from disease conditions of corals and the keystone grazing urchin *Diadema antillarum* have precipitated widespread and dramatic changes in reef community structure. Large-scale coral bleaching reduces population viability. In addition, continuing coral mortality from periodic acute events such as hurricanes, disease outbreaks, and bleaching events from ocean warming have added to the poor state of coral populations and yielded a remnant coral community with increased dominance by weedy brooding species, decreased overall coral cover, and increased macroalgal cover. Additionally, iron enrichment may predispose the basin to algal growth. Further, coral growth rates in many areas have been declining over decades. Such reductions prevent successful recruitment as a result of reduced density. Finally, climate change is likely to result in the endangerment of many species as a result of temperature increases (and resultant bleaching), sea level rises, and ocean acidification.

Designated critical habitat. On November 26, 2008, NMFS designated critical habitat for elkhorn and staghorn coral. They designated marine habitat in four specific areas: Florida (1,329 square miles), Puerto Rico (1,383 square miles), St. John/St. Thomas (121 square miles), and St. Croix (126 square miles). These areas support the following physical or biological features that are essential to the conservation of the species: substrate of suitable quality and availability to support successful larval settlement and recruitment and reattachment and recruitment of fragments.

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APPENDIX B

COMPREHENSIVE ENVIRONMENTAL BASELINE

The Environmental Baseline is defined as: “past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process” (50 CFR 402.02). The key purpose of the Environmental Baseline is to describe the natural and anthropogenic factors influencing the status and condition of ESA-listed species and designated critical habitat in the action area. Since this is a programmatic consultation on what is primarily a continuing action with a large geographic scope, this Environmental Baseline focuses more generally on the status and trends of the aquatic ecosystems in the U.S. and the consequences of that status for listed resources.

Activities that negatively impact water quality also threaten aquatic species. The deterioration of water quality is a contributing factor that has led to the endangerment of some aquatic species under NMFS jurisdiction. Declines in populations of listed species leave them vulnerable to a multitude of threats. Due to the cumulative effects of reduced abundance, low or highly variable growth capacity, and the loss of essential habitat, these species are less resilient to additional disturbances. In larger populations, stressors that affect only a limited number of individuals could once be tolerated by the species without resulting in population level impacts; in smaller populations, the same stressors are more likely to reduce the likelihood of survival. It is with this understanding of the environmental baseline that we consider the effects of the proposed action, including the likely effect that the PGP will have on endangered and threatened species and their designated critical habitat. There may be direct and indirect effects of activities associated with the proposed PGP in streams, wetlands, rivers, lakes, estuaries, irrigation canals, and drainage systems into, over, and in close proximity to which pesticides are applied. Areas adjacent to or downstream from these jurisdictional areas may be indirectly affected by activities authorized under the PGP.

1 *REGIONS WITHIN THE ACTION AREA*

We identified the following regions and states for inclusion in the Environmental Baseline section of this opinion: Pacific Coast (Washington, Idaho, Oregon, and California); New England (Maine, New Hampshire, Vermont, and Massachusetts); Mid-Atlantic (District of Columbia, Delaware, and Virginia); U.S. Caribbean (Puerto Rico) and U.S. Pacific Islands (excluding Hawaii). These regions/states cover the vast majority of the proposed action area. At the regional level, our baseline assessment focused on the natural and anthropogenic threats affecting the listed species (and their habitats) within the action area for each particular region: Pacific Coast – all listed ESUs and DPSs of Pacific salmon and steelhead, eulachon, Southern DPS green sturgeon, and Southern Resident killer whale; New England – Atlantic salmon, Atlantic sturgeon (5 listed DPSs); Mid-Atlantic - Atlantic sturgeon (5 listed DPSs); Caribbean –

Nassau grouper, elkhorn coral, staghorn coral, lobed star coral, boulder star coral, mountainous star coral, pillar coral, and rough cactus coral; Pacific Islands – all listed Pacific Islands coral species.

While there are some Tribal lands and federal facilities in regions or states not mentioned above, in general these areas are either very small, far removed from listed species or habitat, or not affected by the proposed action. For example, any discharges of pesticide pollutants on Tribal lands in Florida would have to be transported through Everglades or Big Cypress National Parks, where they would be degraded by exposure to sunlight, microbial action and chemical processes. While all areas of overlap between ESA-listed species (and their critical habitat) and the PGP coverage area are evaluated in this opinion, the Environmental Baseline will focus specifically on the aquatic ecosystems in the regions/states (listed above) where the anticipated effects of the proposed action are considered more likely to adversely affect listed species.

The action area for this consultation covers a very large number of individual watersheds and an even larger number of specific water bodies (e.g., lakes, rivers, streams, estuaries). It is, therefore, not practicable to describe the environmental baseline and assess risk for each particular area where the PGP may authorize discharges and activities. Accordingly, this opinion approaches the Environmental Baseline more generally by describing the activities, conditions and stressors which adversely affect ESA-listed species and designated critical habitat. These include natural threats (e.g., parasites and disease, predation and competition, wildland fires), water quality, hydromodification projects, land use changes, dredging, mining, artificial propagation, non-native species, fisheries, vessel traffic, and climate changes. For each of these threats we start with a general overview of the problem, followed by a more focused analysis at the regional and state level for the species listed above, as appropriate and where such data are available.

Our summary of the Environmental Baseline complements the information provided in the Status of Listed Resources section of this opinion, and provides the background necessary to evaluate and interpret information presented in the Effects of the Proposed Action and Cumulative Effects sections to follow. We then evaluate the consequences of EPA's proposed action in combination with the status of the species, environmental baseline and the cumulative effects to determine whether EPA can insure that the likelihood of jeopardy or adverse modification of designated critical habitat will be avoided.

2 NATURAL THREATS

Natural mortality rates for some ESA listed species are already high due to a combination of contributing threats including parasites and/or disease, predation, water quality and quantity, wildland fire, oceanographic features and climatic variability. Natural mortality often varies for a given species depending on life stage or habitat. While species continuously co-evolve and adapt to changes in the natural environment, when combined with, and often compounded by, anthropogenic threats such natural threats can contribute significantly to the decline and endangerment of species.

2.1 Parasites and Disease

Fish disease and parasitic organisms occur naturally in the water. Many fish species are highly susceptible to parasites and disease, particularly during early life stages. Native fish have co-evolved with such organisms and individuals can often carry diseases and parasites at less than lethal levels. However, outbreaks may occur when stress from disease and parasites is compounded by other stressors such as diminished water quality, flows, and crowding (Spence and Hughes 1996, Guillen 2003). At higher than normal water temperatures salmonids may become stressed and lose their resistance to diseases (Spence and Hughes 1996). Consequently, diseased fish become more susceptible to predation and are less able to perform essential functions, such as feeding, swimming, and defending territories (McCullough 1999).

Salmonids are susceptible to numerous bacterial, viral, and fungal diseases. The more common bacterial diseases in New England waters include furunculosis, bacterial kidney disease, enteric redmouth disease, coldwater disease, and vibriosis (Olafesen and Roberts 1993), (Egusa and Kothekar 1992). There are over 30 identified parasites of Atlantic salmon including external parasites (Scott and Scott 1988, Hoffman 1999). Several species sea lice, a marine ectoparasite found in Atlantic and Pacific coastal waters, can cause deadly infestations of farm-grown salmon and may also affect wild salmon. While captive fish in aquaculture have the highest risk for transmission and outbreaks of such diseases, wild fish that must pass near aquaculture facilities are at risk of encountering both parasites and pathogens from hatchery operations. Although substantial progress has been made in recent years to reduce the risks to wild fish, this remains a potential threat.

Parasites also occur in both wild-caught and cultivated Nassau grouper, predominantly in the viscera and gonads. These include encysted larval tapeworms, nematode, isopods, and trematodes (Manter 1947, Thompson and Munro 1978).

Coral diseases are a common and significant threat affecting most or all coral species and regions to some degree, although the scientific understanding of the causes and mechanisms of coral diseases remains very poor. Disease adversely affects various coral life history events by, among other processes, causing adult mortality, reducing sexual and asexual reproductive success, and impairing colony growth. A diseased state results from a complex interplay of factors including the cause or agent (e.g., pathogen, environmental toxicant), the host, and the environment. All coral disease impacts are presumed to be attributable to infectious diseases or to poorly-described genetic defects. Coral disease often produces acute tissue loss. Other manifestations of disease in the broader sense, such as coral bleaching from ocean warming, are discussed under other the anthropogenic threats of ocean warming as a result of global climate change. Increased prevalence and severity of diseases is correlated with increased water temperatures and bleaching, which may correspond to increased virulence of pathogens, decreased resistance of hosts, or both (Bruno et al. 2007, Muller and Woesik 2012, Rogers and Muller 2012). Moreover, the expanding coral disease threat may result from opportunistic pathogens that become damaging only in situations where the host integrity is compromised by physiological stress or immune suppression. Coral resistance to disease can also be diminished by other stressors such as predation and nutrients. White band disease is thought to be the major factor responsible for the rapid loss of Atlantic Acropora due to mass mortalities. Significant population declines of star coral species have been linked to disease impacts, both with and without prior bleaching (Bruckner and Bruckner 2006, Miller et al. 2009). Disease outbreaks can persist for years in a population—star coral colonies suffering from yellow-band in Puerto Rico still manifested similar disease signs four years later (Bruckner and Bruckner 2006). Pillar coral and rough cactus coral are susceptible to extensive impacts and rapid tissue loss from white plague disease (Dustan 1977, Miller et al. 2006). The incidence of coral disease also appears to be expanding geographically in the Indo-Pacific, and there is evidence that corals with massive morphology damage are not recovering from disease events.

Although little is known about the threat of infectious diseases to killer whale populations in the wild, deaths of captive individuals have been attributed to pneumonia, systemic mycosis, other bacterial infections, and mediastinal abscesses (Gaydos et al. 2004). Marine *Brucella*, *Edwardsiella tarda*, and cetacean poxvirus, were detected in wild individuals. Marine *Brucella* and cetacean poxvirus have the potential to cause mortality in calves and marine *Brucella* has induced abortions in bottle-nose dolphins (Miller et al. 1999, Van Bressem et al. 1999). Pathogens identified from other species of toothed whales that are sympatric with the Southern Residents are potentially transmittable to killer whales (Palmer et al. 1991, Gaydos et al. 2004). Several, including porpoise morbillivirus, dolphin morbillivirus, and herpes viruses, are highly virulent and are capable of causing large-scale disease outbreaks in some related species. Killer whales are susceptible to other forms of disease, including Hodgkin’s disease and severe atherosclerosis of the coronary arteries (Roberts Jr et al. 1965, Yonezawa et al. 1989). Tumors and bone fusion have also been recorded (NMFS 2008b). Disease epidemics have never been reported in killer whales in the northeastern Pacific (Gaydos et al. 2004). No severe parasitic infestations have been reported in killer whales in the northeastern Pacific (NMFS 2008b).

2.2 Predation

Predation is a natural and necessary process in properly functioning aquatic ecosystems. In order to survive, species evolve a suite of strategies that allow them to co-exist with the numerous and diverse predators they encounter throughout their life cycle. However, natural predator-prey relationships in aquatic ecosystems have been substantially altered through the impacts of anthropogenic changes, often resulting in increased risk to populations of threatened and endangered species. High rates of predation may jeopardize viability of populations that are already experiencing significantly reduced abundance due to the cumulative effects of multiple stressors.

2.2.1 Salmonids

Salmonids are exposed to high rates of natural predation, during freshwater rearing and migration stages, as well as during ocean migration. Salmon along the U.S. west coast are prey for marine mammals, birds, sharks, and other fishes. In the Pacific Northwest, the increasing size of tern, seal, and sea lion populations in recent decades may have reduced the survival of some salmon ESUs/DPSs. Human barriers commonly aggregate fish, where they are subject to intense predation. Such locations include Ballard Locks in Seattle and the Bonneville Dam (Gustafson et al. 1997). Threatened Puget Sound Chinook adults are preferred prey (up to 78 percent of identified prey) of endangered Southern Resident killer whales during late spring to fall (Hanson et al. 2005, Ford et al. 2010). Several species of seals prey on Atlantic salmon in estuarine and marine areas and could exert a substantial impact on populations which have already been depleted due to other stressors (Cairns and Reddin 2000). Large numbers of fry and juvenile Pacific salmon are eaten by piscivorous birds such. Stream-type juveniles are vulnerable to bird predation in estuaries. Caspian terns and cormorants may be responsible for the mortality of up to 6 percent of the outmigrating stream-type juveniles in the Columbia River basin (Roby et al. 2007). Mergansers and kingfishers are likely the most important predators of Atlantic salmon in freshwater environments (Cairns and Reddin 2000). In estuarine environments, double crested cormorants are considered an important predator of smolts as they transition to life at sea because osmotic stress due to sea water entry likely enhances the predation risk at this life stage (Handeland et al. 1996). Avian predators of adult salmonids include bald eagles and osprey (Pearcy 1997). Overall freshwater fish predators native to Maine pose little threat to the Gulf of Maine DPS (Fay et al. 2006).

2.2.2 Non-salmonid Species

In estuarine and marine environments striped bass, Atlantic cod, pollock, porbeagle shark, Greenland shark, Atlantic halibut, and many other fish species have been recorded as predators of salmon at sea (Hvidsten and Møkkelgjerd 1987, Mills 1989, and Mills 1993 all cited in Fay, 2006). The primary fish predators in estuaries are probably adult salmonids or juvenile salmonids which emigrate at older and larger sizes than others (Beamish et al. 1992, Beamish and Neville 1995).

The impact of natural predation on sturgeon at various life stages is unknown. The presence of bony scutes is an effective adaptation for minimizing predation of sturgeon greater than 25 mm total length (Gadomski and Parsley 2005). Documented predators of sturgeon include sea lampreys, gar, striped bass, common carp, northern pikeminnow, channel catfish, smallmouth bass, walleye, grey seal, fallfish and sea lion (Scott and Crossman 1973, Dadswell et al. 1984, Kynard and Horgan 2002, Gadomski and Parsley 2005). Predation by non-native catfish species may also have an impact on early life stages of several Atlantic sturgeon DPSs. Pinnepeds are known predators of Southern DPS green sturgeon and populations of both Eastern DPS Steller and California sea lions have increased in recent decades (Caretta et al. 2009, NMFS 2013).

Predation of North American green sturgeon by white sharks has also been documented off Central California (Klimley 1985).

Large numbers of predators commonly congregate at eulachon spawning runs (Willson et al. 2006) and was identified as a moderate threat to eulachon in the Fraser River and mainland British Columbia rivers, and a low severity threat to eulachon in the Columbia and Klamath rivers. Information on predation on Nassau grouper is lacking. Sharks were reported to attack Nassau groupers at spawning aggregations in the Virgin Islands, and there is one report of cannibalism in this species (Olsen and LaPlace 1979 cited in NMFS, 2013). Although there is currently no legal directed fishery for Nassau grouper in the U.S. and possession is prohibited, they are still caught and released as bycatch in some fisheries. Predators can have important direct and indirect impacts on coral colonies. Predation on some coral genera by many corallivorous species of fish and invertebrates (e.g., snails and seastars) is a chronic threat that has been identified for most coral life stages. Prior to settlement and metamorphosis, coral larvae experience considerable mortality (up to 90 percent or more) from predation or other factors (Goreau et al. 1981). Because newly settled corals barely protrude above the substrate, juveniles need to reach a certain size to reduce damage or mortality from impacts such as grazing, sediment burial, and algal overgrowth (Bak and Elgershuizen 1976, Sammarco 1985). Predation of coral colonies can increase the likelihood of the colonies being infected by disease, and likewise diseased colonies may be more likely to be preyed upon. Predation impacts are typically greatest when population abundances are low as, in most cases, coral predators have not been subject to the same degrees of disturbance mortality and their broad diet breadth has allowed them to persist at high levels despite decreases in coral prey (FR 79 53852). Coral exposure to predation is naturally moderated by presence of predators of the corallivores. For example, corallivorous reef fish prey on corals, and piscivorous reef fish and sharks prey on the corallivores; thus, high abundances of piscivorous reef fish and sharks moderate coral predation.

Crown-of-thorns seastar can reduce living coral cover to less than one percent during outbreaks, dramatically changing coral community structure, promoting algal colonization, and affecting fish population dynamics (FR 79 53852).

The most important predators on Atlantic *Acropora* spp. are fireworm and muricid snail. Although these predators rarely kill entire colonies, there are several possible mechanisms of indirect impact. Because they prey on the growing tips (including the apical polyps), especially of *A. cervicornis*, growth of the colony may be arrested for prolonged periods of time. Another important coral predator is the gastropod, *Coralliophila abbreviata* which feeds on a wide range of corals, but seems to be particularly damaging to *Acropora* spp. (Baums et al. 2003) . Several species of damselfish establish algal nursery gardens within branching *Acropora* spp. (Itzkowitz 1978, Sammarco and Williams 1982). Although not predators in the strict sense, damselfish nip off living coral tissue, thus denuding the skeleton to make a place for their algal gardens. As with other predators, it is likely that the impacts of damselfish are proportionally greater when population abundances of *Acropora* are already reduced due to other stressors.

2.3 Wildland Fire

Wildland fires that are allowed to burn naturally in riparian or upland areas may benefit or harm aquatic species, depending on the degree of departure from natural fire regimes. Fire is one of the dominant habitat-forming processes in mountain streams (Bisson et al. 2003). The patchy, mosaic pattern burned by fires provides a refuge for those fish and invertebrates that leave a burning area or simply spares some fish that were in a different location at the time of the fire (Murphy 2000). Although most fires are small in size, large size fires increase the chances of adverse effects on aquatic species. Large fires that burn near the shores of streams and rivers can have biologically significant short-term effects. These include increased water temperatures, ash, nutrients, pH, sediment, toxic chemicals, and loss of large woody debris (Buchwalter et al. 2004, Rinne 2004). Such fires can result in fish kills and the indirect effects of displacement as fish are forced to swim downstream to avoid poor water quality conditions (Gresswell 1999, Rinne 2004). Small fires or fires that burn entirely in upland areas also cause ash to enter rivers and increase smoke in the atmosphere, contributing to ammonia concentrations in rivers as the smoke adsorbs into the water (Gresswell 1999). The presence of ash can have indirect effects on aquatic species depending on the quantity deposited into the water. All ESA-listed salmonids rely on macroinvertebrates as a food source for at least a portion of their life histories. When small amounts of ash enter the water, there are usually no noticeable changes to the macroinvertebrate community or water quality (Bowman and Minshall 2000). When significant amounts of ash are deposited into rivers, the macroinvertebrate community density and composition may be moderately to drastically reduced for a full year, with milder long-term effects lasting 10 years or more (Minshall et al. 2001, Buchwalter et al. 2004). Larger fires can also indirectly affect fish by altering water quality. Ash and smoke contribute to elevated ammonium, nitrate, phosphorous, potassium, and pH, which can remain elevated for up to four months after forest fires (Buchwalter et al. 2003). Within the action area for this opinion, wildland fires of the size and proximity to aquatic ecosystems that may result in adverse effects on listed species are concentrated in the Pacific Coast region.

2.4 Oceanographic Features and Climatic Variability

Oceanographic conditions and natural climatic variability may affect Pacific salmonids within the action area. There is evidence that Pacific salmon abundance may have fluctuated for centuries as a consequence of dynamic oceanographic conditions (Beamish and Bouillon 1993, Finney et al. 2002, Beamish et al. 2009). Sediment cores reconstructed for 2,200-year records have shown that Northeastern Pacific fish stocks have historically been regulated by these climate regimes (Finney et al. 2002). The long-term pattern of the Aleutian low pressure system corresponds with historical trends in salmon catches, copepod production, and other climatic indices, indicating that climate and the marine environment play an important role in salmon production. Pacific salmon abundance and corresponding worldwide catches tend to be large during naturally-occurring periods of strong Aleutian low pressure causing stormier winters and upwelling, positive Pacific decadal oscillation , and an above average Pacific circulation index

(Beamish et al. 2009). Periods of increasing Aleutian low pressure correspond with periods of high pink and chum salmon production and low coho and Chinook salmon production (Beamish et al. 2009). The abundance and distribution of salmon and zooplankton also relate to shifts in North Pacific atmospheric and oceanic climate (Francis and Hare 1994). Over the past century, regime shifts have occurred as a result of the North Pacific's natural climate regime. Reversals in the prevailing polarity of the Pacific Decadal Oscillation occurred around 1925, 1947, 1977, and 1989 (Mantua et al. 1997, Hare and Mantua 2000). The reversals in 1947 and 1977 correspond to dramatic shifts in salmon production regimes in the North Pacific Ocean (Mantua et al. 1997). Poor environmental conditions for salmon survival and growth may be more prevalent with projected increases in ocean warming and acidification. Anthropogenic climate change (discussed in more detail below) may exacerbate the effects that natural oceanographic conditions and climatic variability have on listed species, although the synergistic effects of these combined stressors is largely unknown at this time.

3 ANTHROPOGENIC THREATS

The quality of the biophysical components within aquatic ecosystems is affected by human activities conducted within and around coastal waters, estuarine and riparian zones, as well as those conducted more remotely in the upland portion of the watershed. Industrial activities can result in discharge of pollutants, changes in water temperature and levels of dissolved oxygen, and the addition of nutrients. In addition, forestry and agricultural practices can result in erosion, run-off of fertilizers, herbicides, insecticides or other chemicals, nutrient enrichment and alteration of water flow. Chemicals such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later consumed by benthic feeders, such as macroinvertebrates, and then work their way higher into the food web (e.g., to sturgeon and sea turtles). Some of these compounds may affect physiological processes and impede a fish's ability to withstand stress, while simultaneously increasing the stress of the surrounding environment by reducing dissolved oxygen, altering pH, and altering other physical properties of the water body. Coastal and riparian areas are also heavily impacted by development and urbanization resulting in storm water discharges, non-point source pollution and erosion. Section 2.1 *Status of Aquatic Ecosystem Health* describes the health status and trends of the U.S. coastal zone, rivers, streams and wetlands in the geographic areas covered by the PGP that overlap with ESA-listed species under NMFS jurisdiction. Section 1.2.2 focuses specifically on the effects of pesticides on aquatic ecosystems as is relevant to the proposed action in this opinion. Sections 2.3 through 2.8 describe other anthropogenic stressors and threats that result in both direct and indirect adverse effects on listed species and their critical habitats within the action area. These include hydromodification projects (dams, channelization, and water diversion), dredging, mining, population growth and land use changes, artificial propagation, non-native species introductions, direct harvest and bycatch, vessel related stressors (strikes, noise, harassment), and climate change.

3.1 Status of Aquatic Ecosystem Health

This section describes the current status and recent health trends of aquatic ecosystems within the action area. EPA sampling results (USEPA 2015) are summarized by region for the following biological, chemical, and physical indicators: 1) Biological – benthic macroinvertebrates; 2) Chemical – phosphorous, nitrogen, ecological fish tissue contaminants, sediment contaminants, sediment toxicity, and pesticides; and 3) Physical – dissolved oxygen, salinity, water clarity, pH, and Chlorophyll a. Cumulatively, these key indicators provide us with an overall picture of the ecological condition of aquatic ecosystems. Different thresholds, based on published references and the best professional judgment of regional experts, are used to evaluate each region as "good," "fair," or "poor" for each water quality indicator. EPA rates overall water quality from results of the five key indicators using the following guidelines: "poor" – two or more component indicators are rated poor; "fair" - one indicator is rated poor, or two or more are rated fair; "good" - no indicators are rated poor, and a maximum of one is rated fair.

The benthic macroinvertebrates (e.g., worms, mollusks, and crustaceans) that inhabit the bottom substrates of aquatic ecosystems are an important food source for a wide variety of fish, mammals, and birds. Benthic communities serve as reliable biological indicators of environmental quality because they are sensitive to chemical contamination, dissolved oxygen stresses, salinity fluctuations, and sediment disturbances. A good benthic index rating means that benthic habitats contain a wide variety of species, including low proportions of pollution-tolerant species and high proportions of pollution-sensitive species. A poor benthic index rating indicates that benthic communities are less diverse than expected and are populated by more pollution-tolerant species and fewer pollution-sensitive species than expected.

Chemical and physical components are measured as indicators of key stressors that have the potential to degrade biological integrity. Some of these are naturally occurring and others result only from human activities, but most come from both sources. EPA evaluates overall water quality based on the following primary indicators: surface nutrient enrichment—dissolved inorganic nitrogen and dissolved inorganic phosphorus concentrations; algae biomass—surface chlorophyll a concentration; and potential adverse effects of eutrophication—water clarity and bottom dissolved oxygen levels (USEPA 2015). Contaminants, including some pesticides, PCBs and mercury, also contribute to ecological degradation. Many contaminants adsorb onto suspended particles and accumulate in areas where sediments are deposited and may adversely affect sediment-dwelling organisms. As other organisms eat contaminated sediment-dwellers the contaminants can accumulate in organisms and potentially become concentrated throughout the food web.

3.1.1 Northeast Region (Maine to Virginia)

A wide variety of coastal environments are found in the Northeast region including rocky coasts, drowned river valleys, estuaries, salt marshes, and city harbors. The Northeast is the most populous coastal region in the U.S.. In 2010, the region was home to 54.2 million people, representing about a third of the nation's total coastal population (USEPA 2015). The population in this area has increased by ten million residents (~ 23 percent) since 1970. The coast from Cape

Cod to the Chesapeake Bay consists of larger watersheds that are drained by major riverine systems that empty into relatively shallow and poorly flushed estuaries. These estuaries are more susceptible to the pressures of a highly populated and industrialized coastal region.

A total of 238 sites were sampled to assess approximately 10,700 square miles of Northeast coastal waters. Figure 1 shows a summary of findings from the EPA's National Coastal Condition Assessment Report for the Northeast Region (USEPA 2015). Biological quality is rated as good in 62 percent of the Northeast coast region based on the benthic index. Poor biological conditions occur in 27 percent of the coastal area. About 11 percent of the region reported missing results, due primarily to difficulties in collecting benthic samples along the rocky coast north of Cape Cod. Based on the water quality index, 44 percent of the Northeast coast is in good condition, 49 percent is rated fair, and 6 percent is rated poor.

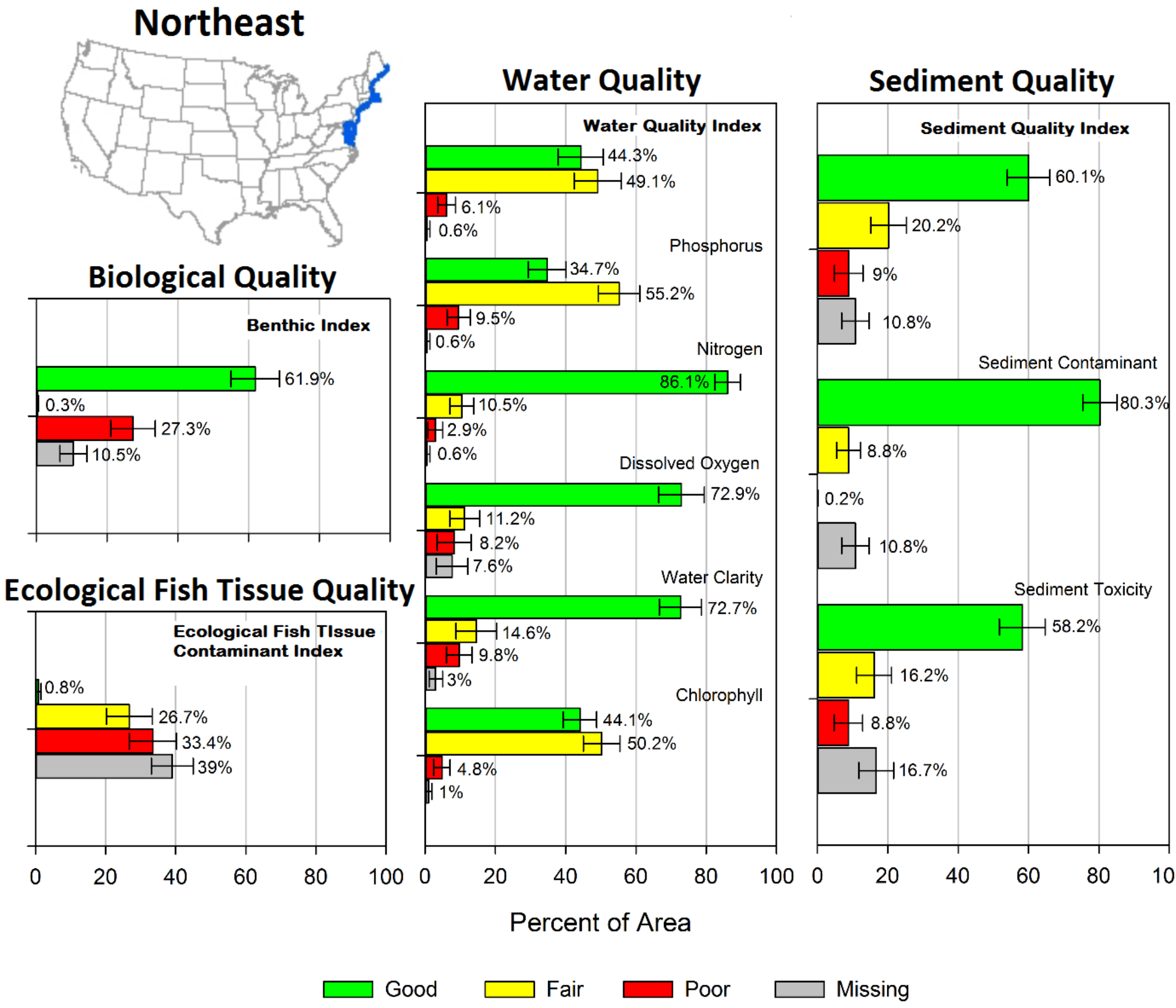

Figure 1. National Coastal Condition Assessment 2010 Report findings for the Northeast Region. Bars show the percentage of coastal area within a condition class for a given indicator (n = 238 sites sampled). Error bars represent 95 percent confidence levels (USEPA 2015).

Based on the sediment quality index, 60 percent of the Northeast coastal area sampled is in good condition, 20 percent is in fair condition, and 9 percent is in poor condition (11 percent were reported "missing"). Compared to ecological risk-based thresholds for fish tissue contamination, less than 1 percent of the Northeast coast is rated as good, 27 percent is rated fair, and 33 percent is rated poor. Researchers were unable to evaluate fish tissue for 39 percent of the region, including almost the entire Acadian Province, because target species were not caught for analysis. The contaminants that most often exceed the thresholds for a "poor" rating in the assessed areas of the Northeast coast are selenium, mercury, arsenic, and, in a small proportion of the area, total PCBs.

New Hampshire

New Hampshire conducted site specific water quality assessments on 42 percent of rivers, 81 percent of aquatic estuarine waters, and 85 percent of ocean waters within the state. Results reported in the New Hampshire 2012 Surface Water Quality Report indicate that approximately 0.8 percent of freshwater rivers and stream mileage is fully supportive of aquatic life, 26.0 percent is not supportive, and 73.2 percent could not be assessed due to insufficient information (NHDES 2012). In estuarine waters, approximately 0.8 percent of the square mileage is fully supportive of aquatic life, 91.9 percent is not supportive and 7.2 percent could not be assessed due to insufficient information. Twenty-six percent of estuarine waters fully met the water quality standards, 54 percent were impaired, and 19 percent could not be assessed due to insufficient information. In ocean waters, approximately 94.1 percent of the square mileage is fully supportive of aquatic life, 0.0 percent is not supportive and 5.9 percent could not be assessed due to insufficient information (NHDES 2012). Fifty-six percent of ocean waters fully met the water quality standards, 29 percent were impaired, and 15 percent could not be assessed due to insufficient information. All of New Hampshire waters are impaired by mercury contamination in fish tissue, with the source being atmospheric deposition. All of New Hampshire's bays and estuaries are impaired by dioxins and PCBs. The top five reasons for impairment in New Hampshire rivers for 2012 were: mercury (16,962 acres), pH (3,821 acres), E coli (1,306 acres), dissolved oxygen (688 acres), and aluminum (563 acres) (NHDES 2012). The top five reasons for impairment in New Hampshire estuaries for 2012 were: mercury (18 acres), dioxin (18 acres), PCBs (18 acres), estuarine bioassessments (15 acres), and nitrogen (14 acres). The top five reasons for impairment in New Hampshire ocean waters for 2012 were: PCBs (81 acres), mercury (81 acres), dioxin (81 acres), Enterococcus (0.5 acres), and fecal coliform (0.5 acres). Besides atmospheric deposition, sources of impairment in New Hampshire include forced drainage pumping, waterfowl, domestic wastes, combined sewer overflows, animal feeding operations, municipal sources, and other unknown sources (NHDES 2012).

Violation rates among EPA- permitted pollutant sources are relatively low in New Hampshire. A total of 386 (1.7 percent) of 23,192 permitted facilities are in violation of their permits, and only 58 (0.25 percent) of these violations are classified as a significant noncompliance. Of the 254 NPDES permits in New Hampshire, 28 currently have effluent violations and five of these are classified as significant noncompliance.

Massachusetts

In 2012, Massachusetts assessed the condition of 2,816 miles (28 percent) of the state's rivers and streams and found 63 percent to be impaired[1]. Four out of the top five impairment causes for rivers and streams in Massachusetts are attributed to pathogens and nutrients. The probable sources for these impaired waters include unknown sources, municipal discharges and unspecified urban stormwater. The distribution of impairment causes and probable sources suggest that eutrophication is a factor in Massachusetts rivers and stream impairments. PCBs in fish tissue from legacy sediment contamination is identified as a contributing factor in 14 percent of assessed river or stream miles. Both invasive species and atmospheric mercury deposition are

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[1] Massachusetts 2014 Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=MA

major contributors to impairments of lakes, reservoirs and ponds. Nearly the entire spatial area of Massachusetts' bays and estuaries were assessed (98 percent of 248 square miles), with 87 percent found to be impaired. Fecal coliform contamination from municipal discharges impair the entire extent of assessed bays and estuaries. PCBs in fish tissue are also a significant factor, occurring in 36 percent of assessed waters. The impairment classification "other cause" is identified in 27 percent of estuaries and bays. This reporting category is used for dissolved gases, floating debris and foam, leachate, stormwater pollutants, and many other uncommon causes lumped together. Among sources for pollutants, stormwater was a major factor for Massachusetts estuaries and bays as three of the top five identified sources of impairments are discharges from municipal separate storm sewer systems (53 percent of impaired area), wet weather discharges (27 percent) and unspecified urban stormwater (25 percent). Among the 29,788 discharge-permitted facilities located in Massachusetts, 956 (3 percent) are in violation, with 115 (0.39 percent) of these violations classified as a significant noncompliance. NPDES permits are held by 833 of these facilities. Effluent violations are identified at 77 of these facilities, with 33 violations classified as in significant noncompliance.

The Remaining East Coast

In 2014, the District of Columbia assessed the condition of 98.5 percent of its 39 miles of rivers and streams and 99 percent of its 6 square miles of bays and estuaries[2]. All waters assessed were found to be impaired by PCBs. By impairment group, pesticides accounted for the most causes for impairment for 303(d) listed waters assessed in D.C. The following pesticides were identified as causes for impairment in D.C. rivers/streams and bays/estuaries: heptachlor epoxide (21.9 miles), dieldrin (21.9 miles), chlordane (21.1 miles), DDT (19.4 miles), DDD (16.2 miles), and DDE (16.2 miles). Out of 2,729 facilities with pollutant-source permits in D.C., 48 permits (1.8 percent) are in violation, with three classified as significant noncompliance. Among the twenty-eight NPDES permits in D.C., two had effluent violations (7 percent), but none of the effluent violations were classified as a significant noncompliance.

The remaining East coast portion of the action area is very small. It includes Tribal and federal lands within 24 subwatersheds distributed among Maine, Vermont, Connecticut, and Delaware. Although 13 of these are in Maine, few river and stream aquatic impairments are reported in this state (8 out of 250 total assessed water bodies are impaired). Impairment causes in Maine are identified as low dissolved oxygen and dioxins. Microbial pollution of rivers and streams are indicated as major impairment causes in Vermont, Connecticut and Delaware, accounting for nearly 60 percent of the impaired river and stream miles among these states (EPA Water Quality Assessment and TMDL Information, https://iaspub.epa.gov/waters10/attains_index.home). Mercury, arsenic pollution and "unknown" are also among the top impairment causes for rivers and streams in these states. None of the 35 federally operated permitted facilities in Delaware and Vermont or the six facilities on Tribal land in Connecticut have permit violations (NMFS

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[2] District of Columbia 2014 Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=DC

2015a). The 9 facilities located in Maine include 5 with violations, 4 of which are classified as a significant noncompliance. There are no NPDES permits for sub-watersheds of Maine or Vermont within the action area. The single NPDES permitted facility in the Delaware portion of the action area is currently in compliance with its permit.

3.1.2 West Coast Region

The West Coast region contains 410 estuaries, bays, and sub-estuaries that cover a total area of 2,200 square miles (USEPA 2015). More than 60 percent of this area consists of three large estuarine systems—the San Francisco Estuary, Columbia River Estuary, and Puget Sound (including the Strait of Juan de Fuca). Sub-estuary systems associated with these large systems make up another 27 percent of the West Coast. The remaining West Coast water bodies, combined, compose only 12 percent of the total coastal area of the region.

The majority of the population in the West Coast states of California, Oregon, and Washington lives in coastal counties. In 2010, approximately 40 million people lived in these coastal counties, representing 19 percent of the U.S. population residing in coastal watershed counties and 63 percent of the total population of West Coast states (U.S. Census Bureau, http://www.census.gov/2010census/). Between 1970 and 2010, the population in the coastal watershed counties of the West Coast region almost doubled, growing from 22 million to 39 million people.

A total of 134 sites were sampled to characterize the condition of West Coast waters. Figure 2 shows a summary of findings from the EPA's National Coastal Condition Assessment Report for the west Coast Region (USEPA 2015).

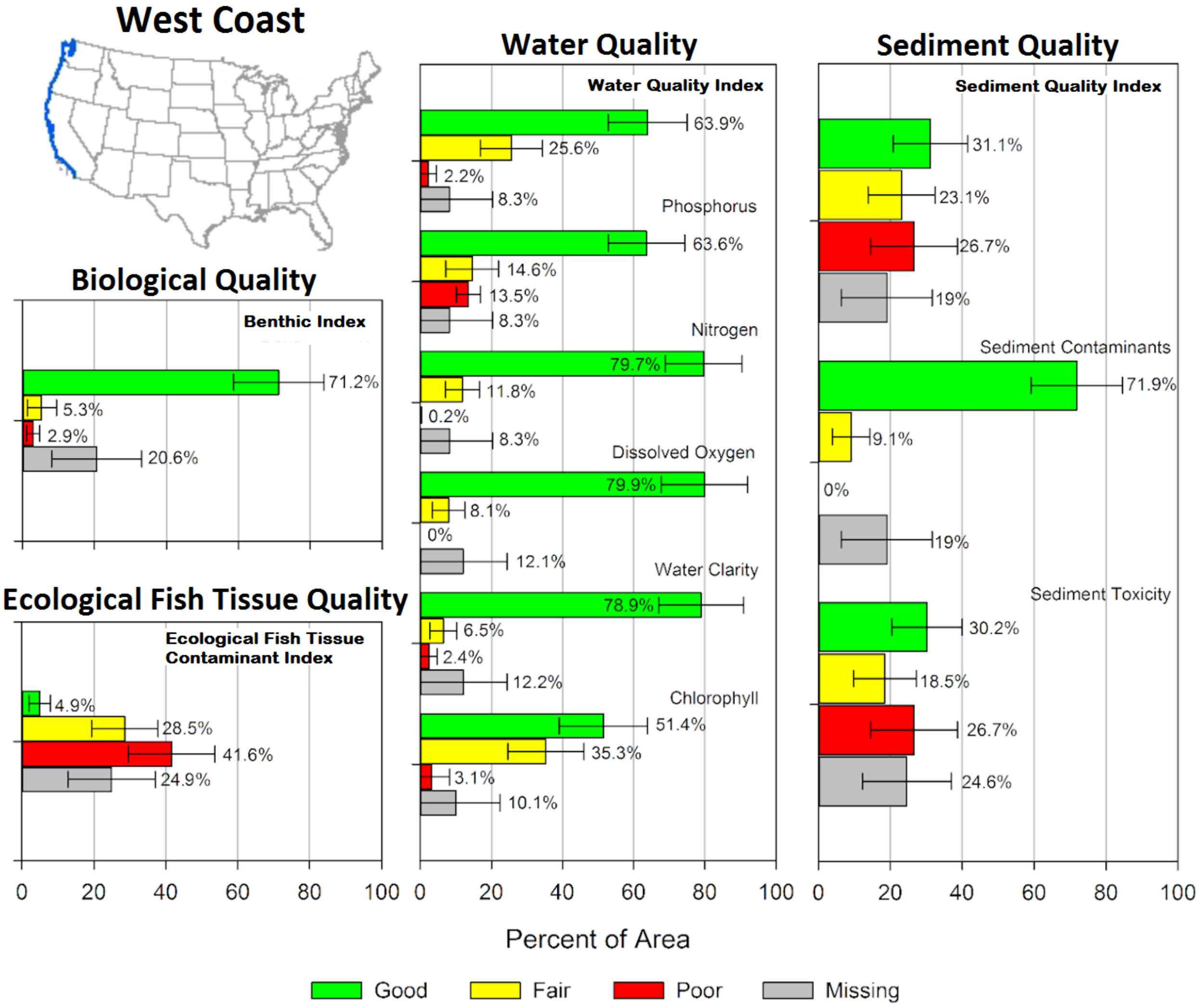

Figure 2. National Coastal Condition Assessment 2010 Report findings for the West Coast Region. Bars show the percentage of coastal area within a condition class for a given indicator (n = 238 sites sampled). Error bars represent 95 percent confidence levels (USEPA 2015).

Biological quality is rated good in 71 percent of West Coast waters, based on the benthic index. Fair biological quality occurs in 5 percent of these waters, and poor biological quality occurs in 3 percent (data are missing for an additional 21 percent of waters due to difficulty obtaining samples). Based on the water quality index, 64 percent of waters in the West Coast region are in good condition, 26 percent are rated fair, and 2 percent are rated poor (USEPA 2015).

Based on the sediment quality index, 31 percent of West Coast waters sampled are in good condition, 23 percent in fair condition, and 27 percent in poor condition (data missing for 19 percent of waters sampled) (USEPA 2015). Based on the ecological fish tissue contaminant index, 42 percent of West Coast waters are in poor condition, 29 percent in fair condition, and 5 percent in good condition (data missing for 25 percent of waters sampled). The contaminants that most often exceed the thresholds for “poor” condition are selenium, mercury, arsenic, and, in a very small proportion of the area, hexachlorobenzene (USEPA 2015).

Washington

Subwatersheds associated with Washington State federal lands where PGP eligible activities may occur (e.g., Department of Defense, Bureau of Land Management, Bureau of Reclamation) or Tribal lands, are distributed throughout the state and along the coast line. Information from the 2008 state water quality assessment report for the entire state was used to infer conditions within the action area. For the 2008 reporting year, the state of Washington assessed 1,997 miles of rivers and streams, 434,530 acres of lakes, reservoirs, and ponds, and 376 square miles of ocean and near coastal waters (Washington 2008 Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=WA). Among assessed waters, 80 percent of rivers and streams, 68 percent of lakes, reservoirs, and ponds, and 53 percent of ocean and near coastal waters were impaired. Temperature (39 percent of assessed waters) and fecal coliform (32 percent of assessed waters) are prominent causes of impairments. These are followed by low dissolved oxygen (19 percent), pH (9 percent), and instream flow impairments (2 percent). Ocean and near coastal impairment causes include fecal coliform in 17 percent of assessed waters, followed by low dissolved oxygen in 12 percent of these waters. The remaining contributors are invasive exotic species, sediment toxicity, and PCBs.

Among the 485 facilities located within Washington's Tribal lands, 67 are in violation of their permits, with 7 of these violations classified as a significant noncompliance (NMFS 2015a). There are 349 NPDES permits within the action area, but only two of these facilities have effluent violations. There are no violations reported for the 11 EPA permitted facilities within the watersheds associated with federally operated facilities in Washington. Three of these permits are NPDES permits.

Oregon

The area covered by subwatersheds within Tribal lands in Oregon where EPA has permitting authority account for only 1.5 percent of the action area. Direct examination of these areas using EPA's geospatial databases from 2006 indicate that 80 percent of the 376 km of rivers and streams assessed are impaired by elevated iron (NMFS 2015a). While the source of the iron is not identified, iron contamination can result from acid mine drainage. Eleven out of the 13 assessed lakes, reservoirs, and ponds in subwatersheds associated with these lands are impaired, with causes listed as temperature and fecal coliform bacteria. This amounts to impairment of 93 percent of the assessed area.

California

EPA also has permitting authority for Tribal lands in California. The subwatersheds associated with these lands account for about 6 percent of the total action area, but are dispersed widely and make up a very small fraction of the watersheds within the state. As such, we did not make generalizations about water quality in these areas based on the 2010 statewide water quality assessment report. Rather, information for the relevant watersheds was extracted from EPA Geospatial databases and analyzed separately. Seventy nine percent of the assessed rivers and streams within these Tribal land subwatersheds are impaired by nutrients, aluminum, arsenic, temperature, and chlordane (NMFS 2015a). Stressor sources are attributed to unknown sources, municipal point discharges, agriculture, natural background, and loss of riparian habitat. High impairment rates (93 percent) are also found for assessed lakes, reservoirs and ponds within the action area in California (NMFS 2015a). The predominant impairment for these waters is arsenic, affecting 45 percent of assessed waters, while mercury is a factor in about 9 percent of assessed waters. Arsenic is also the identified cause of impairment in 97 percent of assessed bays and estuaries (NMFS 2015a). Among the 204 facilities located in the California action area, a total of 25 facilities are in violation of their NPDES, Clean Air Act, or Resource Conservation and Recovery Act permit, with 2 of these violations classified as a significant noncompliance. The single NPDES permit listed among these permits is in compliance (NMFS 2015a).

3.1.3 Puerto Rico

Since the listed species under NMFS jurisdiction in Puerto Rico are strictly marine and do not occur in freshwaters or wetlands, this discussion will focus on water quality conditions reported for coastal shoreline and saltwater habitats. In 2014, Puerto Rico assessed the condition of 390 out of 550 miles of coastal shoreline (70.9 percent) and all 8.7 square miles of the surrounding bays and estuaries. The findings indicate that 77 percent of the coastline and 100 percent of the assessed estuaries and bays are impaired[3]. TMDLs are needed in 100 percent of coastal areas sampled but none have been completed. TMDLs are needed in 58.6 percent of bay/estuary areas sampled but are completed for less than 2 percent of assessed areas. Pathogens (e.g., fecal coliform, total coliform, Enterococcus) and pathogen sources dominate the impairment profiles for all three types of assessed waters These include onsite waste water systems, agriculture, concentrated animal feed operations, major municipal point sources, and urban runoff. Coastline impairment causes include pH, turbidity and Enterococcus bacteria. Many of these impairments are attributed to sewage and urban-related stormwater runoff. Rates of noncompliance among EPA-permitted pollution sources are fairly high. Among the 10,077 facilities located in Puerto Rico, 59 percent were in violation of at least one permit in 2012, and nearly all were classified as significant noncompliance. There are 522 facilities with NPDES permits and 84 (16 percent) of these were classified as in significant violation of permit effluent limits as of 2012.

3.1.4 Pacific Islands

The EPA has NPDES permitting authority in the Pacific islands of Guam, the Northern Marianas, and American Samoa. Because the listed species under NMFS jurisdiction in these areas are strictly marine and do not occur in freshwaters or wetlands, this discussion will focus on water quality conditions reported for coastal shoreline and saltwater habitats.

The population of American Samoa was 55,519 in 2010. Factors such as population density, inadequate land-use permitting, and increased production of solid waste and sewage, have detrimentally impacted water quality in streams and coastal waters of this U.S. territory. The

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[3] Puerto Rico Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_index.control?p_area=PR#total_assessed_waters

total surface area of American Samoa is very small, only 76.1 sq. miles, which is divided into 41 watersheds with an average size of 1.8 sq. miles. Water quality monitoring, along with coral and fish benthic monitoring, covers 34 of the 41 watersheds, which includes areas populated by more than 95 percent of the total population of American Samoa. For the goal Protect and Enhance Ecosystems (Aquatic Life), of the 45.1 shoreline miles (out of 149.5 total) assessed in 2012-2013, 15.5 miles were found to be fully supporting, 12.8 miles were found to be partially supporting, and 16.8 miles were found to be not supporting (Tuitele et al. 2014). For the goal to Protect and Enhance Public Health, all 7.9 shoreline miles assessed in 2012-2013 for fish consumption were found to be not supporting. Eighty four percent of American Samoa's coastline was assessed in 2010 and 60 percent of the assessed waters were found to be impaired. Enterococcus is identified as causing impairments along 50 percent of the coastline evaluated, while 26 percent of assessed coastline had nonpoint source pollutants contributing to impairments. Of the 5.7 km^2 of reef flats assessed in 2010, 76 percent were fully supporting and 24 percent were not supporting the goal of Protect and Enhance Ecosystems (Tuitele et al. 2014). The major stressors identified were PCBs, metals (mercury), pathogen indicators, and other undetermined stressors (Tuitele et al. 2014). The major sources of impairment included sanitary sewer overflows and animal feed operations, each implicated for 50 percent of the waters assessed. Multiple nonpoint sources were identified as a stressor source for 26 percent of assessed waters, while contaminated sediments contributed to impairments in 6 percent of assessed waters. Among the 204 facilities with pollutant permits, a total of 21 (10.3 percent) facilities were in violation, with 17 of these violations classified as a significant noncompliance. Of the six facilities with NDPES permits, two have violated effluent limits, one of which is considered to be in significant noncompliance.

Guam assessed 3 percent of its 915 acres of bays/estuaries and 14 percent of its 117 miles of coastline in 2010[4]. Impairments are identified in 42 percent of assessed bays and estuaries and the entire extent of assessed coastline. PCBs levels in fish tissue was the cause of impairment in 33 percent of assessed bays and estuaries, followed by antimony, dieldrin, tetrachloroethylene, and trichloroethylene, each listed as causing impairments to 6 percent of assessed waters. Enterococcus bacteria is the cause of impairment in nearly all of Guam's coastal shoreline waters (96 percent), while PCB contamination is a minor contributor to impairment of the coastal shoreline (4 percent). Sources of impairment causes have not been identified for Guam. Among the 403 NPDES, Clean Air Act, or Resource Conservation and Recovery Act EPA-permitted facilities located in Guam, a total of 23 (5.7 percent) facilities are in violation, with 13 of these violations classified as a significant noncompliance. NPDES permits are held by 19 facilities, six of which have effluent violations classified as significant noncompliance.

In the Northern Marianas, 36 percent of the 235.5 miles of assessed shoreline were found to be impaired in 2014[5]. Phosphate is listed as a cause for all impaired areas. Other causes identified

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[4] Guam 2010 Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=GU

[5] N. Mariana Islands Water Quality Assessment Report, https://iaspub.epa.gov/waters10/attains_state.control?p_state=CN

among the impaired stretches of shoreline include microbiological contamination from Enterococcus bacteria (22 percent), dissolved oxygen saturation levels (16 percent), and mercury in fish tissue (1 percent). The presence of Enterococci bacteria was implicated for the impairment of 32.2 miles of Saipan’s, 17.8 miles of Rota’s, and 24.3 miles of Tinian’s shoreline for recreational uses. In addition 15 percent of the assessed waters had impaired biological assemblages. Sources of impairments included sediments (15 percent), unknown sources (13 percent), on-site septic treatment systems (12 percent), urban runoff (12 percent), and livestock operations (7 percent). We did not find any NPDES permitted facilities in the Northern Marianas.

3.2 Baseline Pesticide Detections in Aquatic Environments

Pesticide detections for the environmental baseline are addressed as reported in the U.S. Geological Survey (USGS) National Water-Quality Assessment Program’s (NAWQA) national assessment (Gilliom 2006). This approach was chosen because the NAWQA reports provide the same level of analysis for each geographic area. In addition, given the lack of uniform reporting standards and large action area for this opinion, it is not feasible to present a comprehensive basin-specific analysis of pesticide detections.

Over half a billion pounds of herbicides, insecticides, and fungicides were used annually from 1992 to 2011 to increase crop production and reduce insect-borne disease (Stone et al. 2014) During any given year, more than 400 different types of pesticides are used in agricultural and urban settings. The distributions of the most prevalent pesticides in streams and groundwater correlate with land use patterns and associated present or past pesticide use (Gilliom 2006). When pesticides are released into the environment they frequently end up as contaminants in aquatic environments. Depending on their physical properties, some are rapidly transformed via chemical, photochemical, and biologically mediated reactions into other compounds known as degradates. These degradates may become as prevalent as the parent pesticides depending on their rate of formation and their relative persistence. Another dimension of pesticides and their degradates in the aquatic environment is their simultaneous occurrence as mixtures (Gilliom 2006). Mixtures result from the use of different pesticides for multiple purposes within a watershed or groundwater recharge area. Pesticides generally occur more often in natural water bodies as mixtures than as individual compounds. Fish exposed to multiple pesticides at once may also experience additive and synergistic effects. If the effects on a biological endpoint from concurrent exposure to multiple pesticides can be predicted by adding the potency of the pesticides involved, the effects are said to be additive. If, however, the response to a mixture leads to a greater than expected effect on the endpoint, and the pesticides within the mixture enhance the toxicity of one another, the effects are characterized as synergistic. These effects are of particular concern when the pesticides share a mode of action.

From 1992 to 2001, the USGS sampled water from 186 stream sites, bed sediment samples from 1,052 stream sites, and fish from 700 stream sites across the continental U.S. Pesticide concentrations were detected in streams and groundwater within most areas sampled with substantial agricultural or urban land uses. NAWQA results detected at least one pesticide or degradate in more than 90 percent of water samples, more than 80 percent of fish samples, and more than 50 percent of bed sediment samples from streams in watersheds with agricultural, urban, and mixed land use (Gilliom 2006). Compounds commonly detected included 11 agriculture-use herbicides and the atrazine degradate deethylatrazine; 7 urban-use herbicides; and 6 insecticides used in both agricultural and urban areas. Mixtures of pesticides were detected more often in streams than in ground water and at relatively similar frequencies in streams draining areas of agricultural, urban, and mixed land use. Water from streams in these developed land use settings had detections of two or more pesticides or degradates more than 90 percent of the time, five or more pesticides or degradates about 70 percent of the time, and 10 or more pesticides or degradates about 20 percent of the time (Gilliom 2006). NAWQA analysis of all detections indicates that more than 6,000 unique mixtures of 5 pesticides were detected in agricultural streams (Gilliom 2006). The number of unique mixtures varied with land use. More than half of all agricultural streams and more than three-quarters of all urban streams sampled had concentrations of pesticides in water that exceeded one or more benchmarks for aquatic life. Exceedance of an aquatic life benchmark level indicates a strong probability that aquatic species are being adversely affected. However, aquatic species may also be affected at levels below benchmark criteria. In agricultural streams, most concentrations that exceeded an aquatic life benchmark involved chlorpyrifos (21 percent), azinphos methyl (19 percent), atrazine (18 percent), DDE (16 percent), and alachlor (15 percent) (Gilliom 2006). Organochlorine pesticides that were discontinued 15 to 30 years ago still exceeded benchmarks for aquatic life and fish-eating wildlife in bed sediment or fish tissue samples from many streams.

Stone et al. (2014) compared pesticide levels for streams and rivers across the conterminous U.S. for the decade 2002−2011 with previously reported findings from the decade of 1992−2001. Overall, the proportions of assessed streams with one or more pesticides that exceeded an aquatic life benchmark were very similar between the two decades for agricultural (69 percent during 1992−2001 compared to 61 percent during 2002−2011) and mixed-land-use streams (45 percent compared to 46 percent). Urban streams, in contrast, increased from 53 percent during 1992−2011 to 90 percent during 2002−2011, largely because of fipronil and dichlorvos. Agricultural use of synthetic organic herbicides, insecticides, and fungicides in the continental U.S. had a peak in the mid-1990s, followed by a decline to a low in the mid-2000s (Stone et al. 2014). During the late-2000s, overall pesticide use steadily increased, largely because of the rapid adoption of genetically modified crops and the increased use of glyphosate. The herbicides that were assessed by USGS represent a decreasing proportion of total use from 1992 to 2011 because glyphosate was not previously included in the national monitoring network.

3.2.1 ESA Section 7 Consultations

EPA has consulted with NMFS under Section 7(a)(2) of the ESA on the registration of several pesticides on the West Coast (NMFS Pesticide Consultations with EPA, http://www.nmfs.noaa.gov/pr/consultation/pesticides.htm). In a 2008 biological opinion NMFS concluded that current use of chlorpyrifos, diazinon, and malathion is likely to jeopardize the continued existence of 27 listed salmonid ESUs/DPSs. In 2009, NMFS further determined that the current use of carbaryl and carbofuran is likely to jeopardize the continued existence of 22 ESUs/DPSs; and the current use of methomyl is likely to jeopardize the continued existence of 18 ESUs/DPSs of listed salmonids. In 2010 NMFS issued a biological opinion that concluded pesticide products containing azinphos methyl, disulfoton, fenamiphos, methamidophos, or methyl parathion are not likely to jeopardize the continuing existence of any listed Pacific salmon or destroy or adversely modify designated critical habitat. NMFS also concluded that the effects of products containing bensulide, dimethoate, ethoprop, methidathion, naled, phorate, or phosmet are likely to jeopardize the continued existence of some listed Pacific salmonids and to destroy or adversely modify designated habitat of some listed salmonids. In 2011, NMFS issued a biological opinion on the effects of four herbicides and two fungicides. NMFS concluded that products containing 2,4-D are likely to jeopardize the existence of all listed salmonids, and adversely modify or destroy the critical habitat of some of these ESUs and DPSs. Products containing chlorothalonil or diuron were also likely to adversely modify or destroy critical habitat, but not likely to jeopardize listed salmonids. NMFS also concluded that products containing captan, linuron, or triclopyr BEE do not jeopardize the continued existence of any ESUs/DPSs of listed Pacific salmonids or adversely modify designated critical habitat. In 2012 NMFS issued an opinion on oryzalin, pendimethalin, and trifluralin that concluded each of these chemicals are likely to jeopardize the continued existence of some listed Pacific salmonids, and adversely modify designated critical habitat of some listed salmonids. Also in 2012, NMFS concluded EPA’s proposed registration of thiobencarb, an herbicide authorized for use in California only on rice, is not likely to jeopardize the continued existence or adversely modify the designated critical habitat of listed Pacific salmonid species. Finally, in 2015 NMFS concluded that the EPAs proposed registration of the pesticide active ingredient diflubenzuron is likely to jeopardize the continued existence of 23 ESA-listed Pacific salmonid species and is likely to destroy or adversely modify designated critical habitat of 23 listed Pacific salmonids. Also in this opinion, NMFS found that the active ingredients fenbutatin oxide and propargite are each likely to jeopardize the continued existence and likely to destroy or adversely modify designated critical habitat of 21 ESA-listed Pacific salmonid species.

3.3 Hydromodification

Hydromodification is generally defined as a change in natural channel form, watershed hydrologic processes and runoff characteristics (i.e., interception, infiltration, overland flow, interflow and groundwater flow) associated with alterations in stream and rivers flows and sediment transport due to anthropogenic activities. Such changes often result in negative impacts to water quality, quantity, and aquatic habitats.

3.3.1 Dams

While dams provide valuable services to the public, such as recreation, flood control, and hydropower, they also have detrimental impacts on aquatic ecosystems. Dams can have profound effects on anadromous species by impeding access to spawning and foraging habitat and altering natural river hydrology and geomorphology, water temperature regimes, and sediment and debris transport processes (Pejchar and Warner 2001, Wheaton et al. 2004). The loss of historic habitat ultimately affects anadromous fish in two ways: 1) it forces fish to spawn in sub-optimal habitats that can lead to reduced reproductive success and recruitment, and 2) it reduces the carrying capacity (physically) of these species and affects the overall health of the ecosystem (Patrick 2005). Additionally, a substantial number of juvenile salmonids are killed and injured during downstream migrations. Physical injury and direct mortality occurs as juveniles pass through turbines, bypasses, and spillways. Indirect effects of passage through all routes may include disorientation, stress, delay in passage, exposure to high concentrations of dissolved gases, elevated water temperatures, and increased predation.

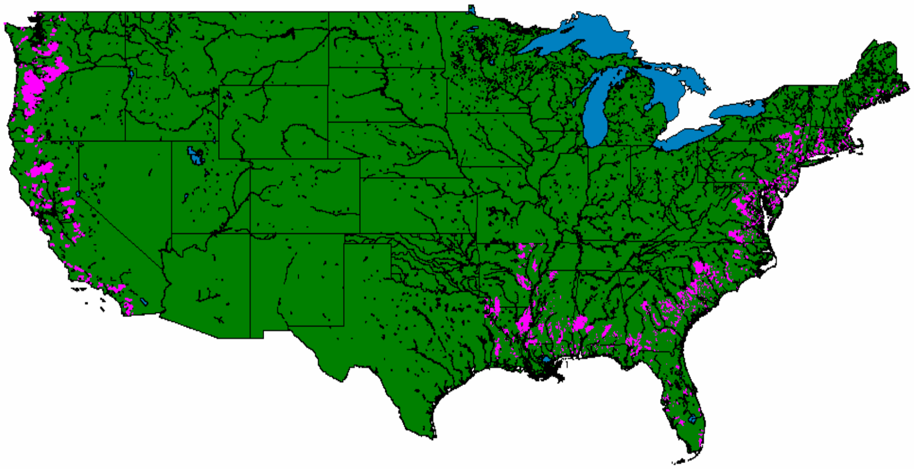


Figure 3. Map of River and Lake Habitat Impeded by Dams (Denoted in Purple) for the Continental U.S. (modified from Patrick 2005).

Nationwide, nearly 44,000 miles of river and lake habitat are blocked by terminal dams (those lowest in the watershed), which includes the area between the terminal dam and the next upstream impediment. This loss of habitat represents approximately 8.5 percent and 4.7 percent of the total riverine miles available (637,525 miles) along the Atlantic/Gulf Coast and Pacific Coast, respectively (Patrick 2005). Based on a non-random sample of dams affecting the largest areas (east and west coast) with diadromous fish runs, nearly 30 percent of diadromous fish habitat is blocked by terminal dams that have no fish passage (Patrick 2005).

The final rule listing Southern DPS green sturgeon indicates that the principle factor for the decline of this DPS is the reduction of spawning to a limited area, due largely to impassable barriers on the Sacramento River (Keswick Dam) and the Feather River (Oroville Dam) (71 FR 17757; April 7, 2006).

Comparative analyses of historic and contemporary hydrologic and thermal regimes indicate that aquatic habitats in the Sacramento, Yuba, and Feather rivers are different than they were before dam construction (NMFS 2015b). However, the impact of these changes on Southern DPS green sturgeon spawning and recruitment is not fully understood. (Mora et al. 2009) suggest that flow regulation has had mixed effects on habitat suitability. In the Sacramento River the removal of Red Bluff Diversion Dam as a barrier to migration has increased the use of upstream spawning habitat by Southern DPS green sturgeon. Modeling studies predict that Southern DPS green sturgeon would use additional areas on the Sacramento River in the absence of impassable dams (Mora et al. 2009). This modeling work also found that suitable spawning habitat historically existed on portions of the San Joaquin, lower Feather, American, and Yuba rivers, much of which is currently inaccessible to green sturgeon due to the presence of barriers. Flood bypass systems along the Sacramento River pose a challenge to Southern DPS green sturgeon during spawning migrations. Green sturgeon are particularly affected at the Yolo and Sutter bypasses and by Tisdale and Fremont weirs (Thomas et al. 2013).

3.3.2 Pacific Northwest Dams

There are more than 400 dams in the Pacific Northwest, ranging from mega dams that store large amounts of water to small diversion dams for irrigation (Panel on Economic Environmental and Social Outcomes of Dam Removal 2001). Every major tributary of the Columbia River, except the Salmon River, is totally or partially regulated by dams and diversions. More than 150 dams are major hydroelectric projects which provide a significant source of power to the region. Of these, 18 dams are located on the mainstem Columbia River and its major tributary, the Snake River. Development of the Pacific Northwest regional hydroelectric power system, dating to the early 20th century, has had profound effects on ecosystems within the Columbia River Basin, particularly the survival of anadromous salmonids (Williams et al. 1999). Approximately 80 percent of historical spawning and rearing habitat of Snake River fall-run Chinook salmon is now inaccessible due to dams. The Snake River spring/summer run has been limited to the Salmon, Grande Ronde, Imnaha, and Tuscanon rivers. Dams have cut off access to the majority of Snake River Chinook salmon spawning habitat. The Sunbeam Dam on the Salmon River is believed to have limited the range of Snake River sockeye salmon as well. Non-federal hydropower facilities on Columbia River tributaries have also partially or completely blocked higher elevation spawning (NMFS 2015b).

The Puget Sound region, which includes the San Juan Islands and south to Olympia is the second largest estuary in the U.S. and is fed by over 10,000 rivers and streams. More than 20 dams occur within this region’s rivers and overlap with the distribution of salmonids. Dams were built on the Cedar, Nisqually, White, Elwha, Skokomish, Skagit, and several other rivers in the early 1900s to supply urban areas with water, prevent downstream flooding, allow for floodplain activities (like agriculture or development), and to power local timber mills (Ruckelshaus and McClure 2007).

Compared to other parts of the Northwest Region, the Oregon-Washington-Northern California coastal drainages are less impacted by dams and still have several remaining free flowing rivers.. Dams in the coastal streams of Washington permanently block only about 30 miles of salmon habitat (Palmisano et al. 1993 cited in NMFS, 2015). In the past, temporary splash dams were constructed throughout the region to transport logs out of mountainous reaches. Thousands of splash dams were constructed across the Northwest in the late 1800s and early 1900s. While these dams typically only temporarily blocked salmon habitat, in some cases dams remained long enough to wipe out entire salmon runs. The effects of the channel scouring and loss of channel complexity from splash dams also resulted in the long-term loss of salmon habitat (Salmonids 1996)

Several hydromodification projects in the Pacific Northwest have been designed to improve the productivity of listed salmonids. Improvements include flow augmentation to enhance water flows through the lower Snake and Columbia Rivers; providing stable outflows at Hells Canyon Dam during the fall Chinook salmon spawning season and maintaining these flows as minimums throughout the incubation period to enhance survival of incubating fall-run Chinook salmon; and reduced summer temperatures and enhanced summer flow in the lower Snake River (Corps et al. 2007, Appendix 1 cited in NMFS, 2008). Providing suitable water temperatures for over-summer rearing within the Snake River reservoirs allows the expression of productive “yearling” life history strategy that was previously unavailable to Snake River Fall-run Chinook salmon. The mainstem Federal Columbia River Power System corridor has also improved safe passage through the hydrosystem for juvenile steelhead and yearling Chinook salmon with the construction and operation of surface bypass routes at Lower Granite, Ice Harbor, and Bonneville dams and other configuration improvements. For salmon, with a stream-type juvenile life history, projects that have protected or restored riparian areas and breached or lowered dikes and levees in the tidally influenced zone of the estuary have improved the function of the juvenile migration corridor. The Federal Columbia River Power System action agencies recently implemented 18 estuary habitat projects that removed passage barriers to increase fish access to high quality habitat. The Army Corps estimates that hydropower configuration and operational improvements implemented from 2000 to 2006 resulted in an 11.3 percent increase in survival of yearling juvenile Lower Columbia River Chinook salmon from populations that pass Bonneville Dam.

Obstructed fish passage and degraded habitat caused by dams is considered the greatest impediment to self-sustaining anadromous fish populations in Maine (NRC 2004). Gulf of Maine DPS Atlantic salmon are not well adapted to the artificially created and maintained impoundments resulting from dam construction (NRC 2004). Other aquatic species that thrive in impounded riverine habitat have proliferated and significantly altered the prey resources available to salmon, as well as the abundance and species composition of salmon competitors and predators. The National Inventory of Dams Program lists 639 dams (over four feet high) in Maine, over half of which are located within the range of the Gulf of Maine DPS (USACOE National Inventory of Dams Program, http://nid.usace.army.mil/cm_apex/f?p=838:12). The larger hydroelectric dams and storage projects within the Gulf of Maine DPS are primarily located in the Penobscot, Kennebec, and Androscoggin watersheds. Gulf of Maine DPS salmon habitat is also degraded as a result of bypassed reaches of natural river channels that re-route river flows through forebays or penstocks. Many smaller dams still remain on smaller rivers and streams within Gulf of Maine DPS range.

3.3.3 East Coast Dams

The prevalence of dams throughout East Coast rivers means that all Atlantic sturgeon life stages generally occur downstream of dams, leaving them vulnerable to perturbations of natural river conditions. Atlantic sturgeon spawning sites remain unknown for the majority of rivers in their range. However, they have been observed spawning hundreds of miles upstream in Southern non-tidal rivers that are unobstructed by dams, suggesting that dams may prevent them from reaching preferred spawning areas. Observations of Atlantic sturgeon spawning immediately below dams, further suggests that they are unable to reach their preferred spawning habitat upriver. Overall, 91 percent of historic Atlantic sturgeon habitat seems to be accessible, but the quality of the remaining portions of habitat as spawning and nursery grounds is unknown, therefore estimates of percentages of availability do not necessarily equate to functionality (ASSRT 2007). Access to 50 percent or more of historical sturgeon spawning habitat have been eliminated or restricted. Thus, dams may one of the primary causes of the extirpation of several Atlantic sturgeon subpopulations.

Due to their upriver locations, most dams in the Chesapeake Bay watershed have large freshwater tailways (unobstructed habitat downstream of the dam). Several dams within the Atlantic sturgeon historic range have been removed or naturally breached.Sturgeon appear unable to use some fishways (e.g., ladders) but have been transported in fish lifts (Kynard 1998). Data on the effects of the fish lift at the Holyoke Hydroelectric Project on the Connecticut River suggest that fish lifts that successfully attract other anadromous species (i.e., shad, salmon etc.) do a poor job of attracting sturgeon: attraction and lifting efficiencies for shortnose sturgeon at the Holyoke Project are estimated around 11 percent (ASSRT 2007). Despite decades of effort, fish passage infrastructure retrofitted at hydroelectric dams has largely failed to restore diadromous fish to historical spawning habitat (Brown et al. 2013). While improvements to fish passage are often required when hydroelectric dams go through Federal Energy Regulatory Commission relicensing, the relicensing process occurs infrequently, with some licenses lasting up to 50 years. Over 95 percent of dams on the eastern seaboard are not hydroelectric facilities and are thus not subject to continual relicensing or fish passage improvement measures (ASMFC 2008).

3.3.4 Water Diversions

Like many regions throughout the world, the U.S. is experiencing increasing demand for fresh, clean water. Increasing population growth and agricultural needs frequently conflict with water availability. The twentieth century saw increased dam construction, increased irrigation practices for agriculture, increased recreational use of waterbodies, and increased use of waterways for waste disposal, both sanitary and industrial. Water use in the western U.S. presents a particular concern because the western states are characterized by low precipitation and extended periods of draught. Moreover, agricultural uses dominate the water needs in these states (Anderson and

Woosley 2008). Although the western states contain the headwaters of some of the continent's major river systems, these water sources have been utilized to the point that there are few undeveloped resources to draw upon to satisfy new demands or to restore depleted rivers and aquifers (USACE and CBI 2012). Groundwater has become an increasingly important source of water as surface water resources have been depleted. Water remains a finite resource, however, and there are consequences to pumping ground water including depleting aquifer storage, supplying poorer quality water to wells, diminishing flow to springs and streams, and land subsidence (Anderson and Woosley 2008).

The amount and extent of water withdrawals or diversions for agriculture impacts streams and their inhabitants by reducing water flow/velocity and dissolved oxygen levels, which can have negative effects on listed species and their designated critical habitat. Water diversions and withdrawals for agricultural irrigation or other purposes can directly impact fish populations by constraining available spawning and rearing habitat. Adequate water quantity and quality are critical to all salmonid life stages, especially adult migration and spawning, fry emergence, and smolt emigration. Low flow events may delay salmonid migration or lengthen fish presence in a particular water body until favorable flow conditions permit fish migration along the migratory corridor or into the open ocean. Survival of eggs, fry, and juveniles are also mediated by streamflow. Water withdrawals may dewater redds thus reducing egg survival. During summer and winter, the two periods of low flow annually, juvenile salmon survival is directly related to discharge, with better survival in years with higher flows during these two seasons (Gibson 1993, Ghent and Hanna 1999). Summer water withdrawals have the potential to limit carrying capacity and reduce parr survival.

Other potential detrimental impacts of water diversions include increases in nutrient loading, sediments (from bank erosion), and water temperature. Flow management, in combination with the effects of climate change (i.e., droughts), has further decreased the delivery of suspended particulate matter and fine sediment to estuaries. Low river flows may constrain conditions necessary for important salmonid refuge habitat (shade, woody debris, overhanging vegetation), making fish more vulnerable to predation, elevated temperatures, crowding, and disease. In addition, some listed fish species have been shown to be susceptible to entrainment through unscreened diversion pipes. Although many diversion pipes are now screend, the effectiveness of screening for green sturgeon requires further study given that screen criteria were designed to reduce salmon entrainment and impingement. Thousands of diversions exist in the Sacramento River and Delta that could potentially entrain Southern DPS green sturgeon (Mussen et al. 2014). By the early 1900s, agricultural opportunities within the Columbia River basin began increasing rapidly with the creation of more irrigation canals and the passage of the Reclamation Act of 1902. Today, agriculture represents the largest water user within the basin (>90 percent). Approximately 6 percent of the annual flow from the Columbia River is diverted for the irrigation of over seven million acres of croplands (Hinck et al. 2004). The vast majority of these agricultural lands are located along the lower Columbia River, the Willamette, Yakima, Hood, and Snake rivers, and the Columbia Plateau.

In general, the southern basins in California have a warmer and drier climate while the more northern, coastal-influenced basins are cooler and wetter. About 75 percent of the runoff occurs in basins in the northern third of the state (north of Sacramento), while 80 percent of the demand occurs in the southern two-thirds of the state. Two major water diversion projects meet these demands—the federal Central Valley Project and the California State Water Project. Combined these two water storage and transport systems irrigate about four million acres of farmland and deliver drinking water to roughly 22 million residents.

Water withdrawal may also impact Gulf of Maine DPS Atlantic salmon habitat in the main stem areas of the Penobscot, Kennebec, and Androscoggin Rivers including headwater areas and tributaries of these watersheds (Fay et al. 2006). There are a variety of consumptive water uses in these large watersheds including municipal water supplies, snow making, mills, golf course and agricultural irrigation, and industrial cooling. Increased levels of agricultural irrigation have been occurring throughout the range of the Gulf of Maine DPS for several years. Approximately 6,000 acres of blueberries are irrigated annually with water withdrawn from Pleasant, Narraguagus, and Machias river watersheds (Fay et al. 2006).

3.3.5 Dredging

Riverine, nearshore, and offshore coastal areas are often dredged to support commercial shipping, recreational boating, construction of infrastructure, and marine mining. Dredging in spawning and nursery grounds modifies habitat quality, and limits the extent of available habitat in some rivers where anadromous fish habitat has already been impacted by the presence of dams. Negative indirect effects of dredging include changes in dissolved oxygen and salinity gradients in and around dredged channels ((Jenkins et al. 1993, Secor and Niklitschek 2001, Campbell and Goodman 2004). Dredging operations may also pose risks to anadromous fish species by destroying or adversely modifying benthic feeding areas, disrupting spawning migrations, and filling spawning habitat with resuspended fine sediments. As benthic omnivores, sturgeon in particular may be sensitive to modifications of the benthos which affect the quality, quantity and availability of prey species.

Dredging and filling impact important habitat features of Atlantic sturgeon as they disturb benthic fauna, eliminate deep holes, and alter rock substrates (Smith and Clugston 1997). (Hatin et al. 2007) reported avoidance behavior by Atlantic sturgeon during dredging operations. Dredging operations are also capable of destroying macroalgal beds that may be used as Nassau grouper nursery areas. The eulachon biological review team identified dredging as a low to moderate threat to the species in the Fraser and Columbia rivers, and a low threat in mainland British Columbia rivers due to less dredging activity there (FR 75 13012). They noted that dredging during eulachon spawning was particularly detrimental, as eggs associated with benthic substrates are likely to be destroyed. In addition to indirect impacts, hydraulic dredging can directly harm listed fish species by lethally entraining fish up through the dredge drag-arms and impeller pumps. Atlantic sturgeon have been reported as taken in hydraulic pipeline and bucketand-barge operations (Moser and Ross 1995), mechanical dredges (i.e., clamshell) (Hastings 1983), and hopper dredges (Dickerson 2006).

Dredging and filling activities can adversely affect colonies of reef-building organisms by burying them, releasing contaminants such as hydrocarbons into the water column, reducing light penetration through the water, and increasing the level of suspended particles in the water column. Corals are sensitive to even slight reductions in light penetration or increases in suspended particulates, and the adverse effects of such activities lead to a loss of productive coral colonies. Among corals, Atlantic Acropora species are considered to be particularly environmentally sensitive, requiring relatively clear, well-circulated water (Jaap 1989). Acropora spp. are almost entirely dependent upon sunlight for nourishment compared to massive, boulder-shaped species in the region, with these latter types of corals more dependent on zooplankton (Porter 1976). Thus, Acropora are considered more susceptible to increases in water turbidity and reductions in water clarity that can result from dredging operations.

3.4 Mining

Mining operations can negatively impact aquatic ecosystems and decrease the viability of threatened and endangered fish populations. The effect of mining in a stream or reach depends upon the rate of harvest and the natural rate of replenishment, as well as flood and precipitation conditions during or after the mining operations. Extraction methods such as suction dredging, hydraulic mining, and strip mining may cause water pollution problems and increased levels of harmful contaminants. Metal contamination reduces the biological productivity within a basin. Metal contamination can result in fish kills at high levels or sublethal effects at low levels, including reduced feeding, activity level, and growth. Sand and gravel mined from riverbeds (gravel bars and floodplains) may result in substantial changes in channel elevation and patterns, in-stream sediment loads, and in-stream habitat conditions. In some cases, in-stream or floodplain mining has resulted in large-scale river avulsions.

California has a long history of mining that dates back to the Gold Rush of the mid-1800s. The Sacramento Basin and the San Francisco Bay watershed are two of the most heavily impacted basins from mining activities. The Iron Metal Mine in the Sacramento Basin releases large quantities of copper, zinc, and lead into the Keswick Reservoir below Shasta Dam (Cain et al. 2000). Methyl mercury contamination remains a persistent problem within San Francisco Bay (Conaway et al. 2003). Many of the streams and river reaches in the Pacific Northwest are impaired from mining. Metal mining (zinc, copper, lead, silver, and gold) peaked in Washington state between 1940 and 1970 (Palmisano et al. 1993 cited in NMFS, 2015). Several abandoned and former mining sites are designated as Superfund cleanup areas (Benke and Cushing 2011). An estimated 200 abandoned mines within the Columbia River Basin pose a potential hazard to the environment due elevated levels of lead and other trace metals (Quigley 1997 cited in Hinck, 2004).

3.5 Population Growth, Development and Land Use Changes

The 2010 Census reported 308.7 million people in the U.S., a 9.7 percent increase from the 2000 Census population of 281.4 million (U.S. Census Bureau, www.census.gov). From 2000 to 2010, regional growth was much faster in the South and West (14.3 and 13.8 percent, respectively) than in the Midwest (3.9 percent) and Northeast (3.2 percent). Puerto Rico's population declined by 2.2 percent from 2000 to 2010. Several coastal states within the action area experienced faster growth than the nation as a whole including Oregon (12 percent), Washington (14.1 percent), Delaware (14.5 percent), and Virginia (13.0 percent). Population trends by state and decade from 1980 to 2010 are shown in Figure 4. Some of the highest population densities in the U.S. are found in coastal counties within the action area, particularly in central and southern California, Washington, and Massachusetts through New Jersey.

Many stream and riparian areas within the action area have been degraded by the effects of land and water use resulting from urbanization, road construction, forest management, agriculture, mining, transportation, and water development. Development activities have contributed to many interrelated factors causing the decline of listed anadromous fish species considered in this opinion. These include reduced in- and off-channel habitat, restricted lateral channel movement, increased flow velocities, increased erosion, decreased cover, reduced prey sources, increased contaminants, increased water temperatures, degraded water quality, and decreased water quantity.

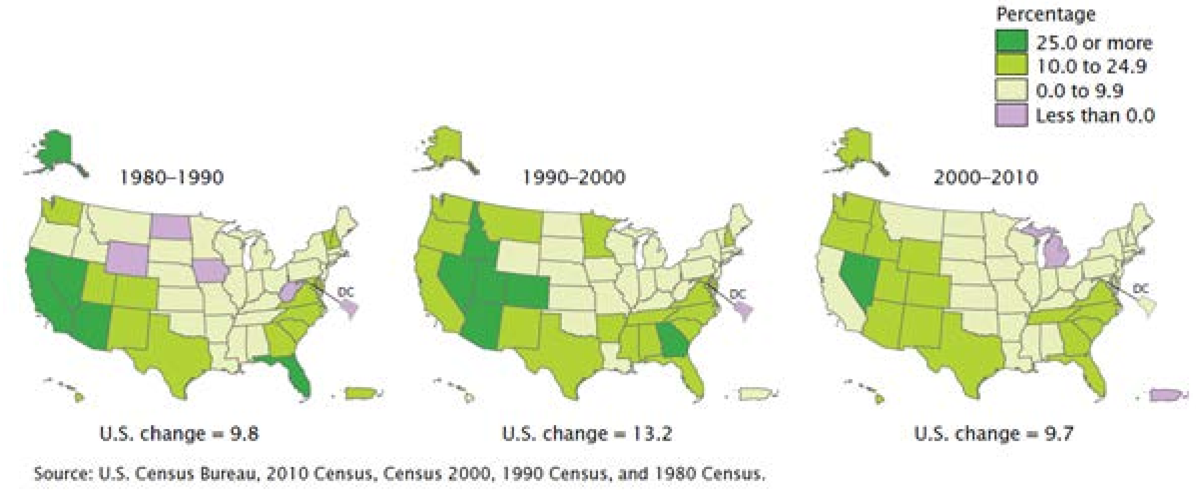
Urbanization and increased human population density within a watershed result in changes in stream habitat, water chemistry, and the biota (plants and animals) that live there. The most obvious effect of urbanization is the loss of natural vegetation which results in an increase in impervious cover and dramatic changes to the natural hydrology of urban and suburban streams. Urbanization generally results in land clearing, soil compaction, modification and/or loss of riparian buffers, and modifications to natural drainage features. The increased impervious cover in urban areas leads to increased volumes of runoff, increased peak flows and flow duration, and greater stream velocity during storm events. Runoff from urban areas also contains chemical pollutants from vehicles and roads, industrial sources, and residential sources. Urban runoff is typically warmer than receiving waters and can significantly increase temperatures in small urban streams. Wastewater treatment plants replace septic systems, resulting in point discharges of nutrients and other contaminants not removed in the processing. Additionally, some cities have combined sewer/stormwater overflows and older systems may discharge untreated sewage following heavy rainstorms. These urban nonpoint and point source discharges affect the water quality and quantity in basin surface waters. Dikes and levees constructed to protect infrastructure and agriculture have isolated floodplains from their river channels and restricted fish access. The many miles of roads and rail lines that parallel streams with the action area have degraded stream bank conditions and decreased floodplain connectivity by adding fill to floodplains. Culvert and bridge stream crossings have similar effects and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

3.5.1 USGS Land Cover Trends Project

The USGS Land Cover Trends Project (http://landcovertrends.usgs.gov/) was a research project focused on understanding the rates, trends, causes, and consequences of contemporary U.S. land use and land cover change. The project spanned from 1999 to 2011, producing statistical and geographic summaries of land cover change using time series land cover data. The project was designed to document the types and rates, causes, and consequences of land cover change from 1973 to 2000 within 84 ecoregions, as defined by EPA, that span the conterminous U.S.. Research objectives of this project were as follows:

- Develop a comprehensive methodology using sampling, change analysis techniques, and Landsat Multispectral Scanner and Thematic Mapper data for estimating regional land cover change.
- Characterize the spatial and temporal characteristics of conterminous U.S. land cover change for five periods from 1973-2000 (1973, 1980, 1986, 1992, and 2000).
- Document the regional driving forces and consequences of change.
- Prepare a national synthesis of land cover change.

For this opinion we summarized the results of the Land Cover Trends Project for project areas that overlap with PGP coverage. The Northeastern coastal zone covers approximately 37,158 km2 in eight states (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey). Primary land-cover classes are forests and developed land which account for more than 70 percent of the ecoregion. Water, wetlands, and agriculture are secondary land covers classes found in smaller, less frequent concentrations in the Northeast coastal zone. Developed land increased an estimated 4 percent (1,510 km2) from 1973 to 2000, to approximately 27 percent of the ecoregion’s area. Much of the new development came from forest loss, with a decrease of 3.7 percent (1,361 km2) during this same time period. Agricultural land-cover decreased by 0.8 percent. Other land cover changes in the Northeastern coastal zone from 1973 to 2000 included slight decreases in wetlands and slight increases in mechanically disturbed lands and mining.



Source: U.S. Census Bureau, 2010 Census, Census 2000, 1990 Census, and 1980 Census.

Figure 4. Percentage Change in Population by State and Decade from 1980 to 2010 (Source: U.S. Census Bureau)

The Puget lowland ecoregion is located in western Washington State and covers an area of approximately 17,541 km² (Omernik 1987). Puget Sound is in the center of the ecoregion, which is bordered on the west by the Olympic Mountains and on the east by the Cascade Mountains. The dominant land-cover class in 2000 for Puget lowland was forest (48.4 percent), followed by developed (19.3 percent), agriculture (10.6 percent), and water (10.6 percent). Puget lowland experienced one of the highest percentages of land use change of any ecoregion nationwide from 1973 to 2000. The largest net change for any land-cover class between 1973 and 2000 was the loss of 1,767 km² of forest, which is 10 percent of the land area of the ecoregion. Agriculture decreased by 0.7 percent during this period, while developed land increased by 6.7 percent or 1,186 km².

The Willamette Valley ecoregion covers approximately 14,400 km² and includes the Willamette River watershed, with headwaters in the Cascades draining northward into the Columbia River near the ecoregion’s northern boundary in Washington State (Omernik 1987). The dominant land-cover class in 2000 for Willamette Valley was agriculture (45.1 percent), followed by forest/woodland (33.5 percent), developed/urban (12.6 percent), and mechanically disturbed (4.0 percent). The largest net change for any land-cover class between 1973 and 2000 was the loss of 597 km² (-4.1 percent) of forest, followed by the loss of 320 km² of agricultural land. Most of the land use increases were for development (+3.1 percent) and mechanically disturbed land (+2.8 percent).

The Central California Valley ecoregion is an elongated basin extending approximately 650 km north to south through central California (Omernik 1987). The ecoregion is bound by the Sierra Nevada mountain range to the east and the Coast Range to the west. Agriculture land cover, which accounted for more than 70 percent of the ecoregion area, remained relatively stable from 1973 to 2000 with a net increase of 357 km² or 0.8 percent . The largest change in any one land cover class between 1973 and 2000 was a 3.9 percent loss (1,777 km²) of grasslands and shrublands in the ecoregion. Developed lands increased in cover from 6.5 percent to 9.0 percent of the total ecoregion area during this time frame.

3.6 Artificial Propagation

Each year approximately 380 million hatchery salmon and steelhead are released by government agencies on the Pacific coast and in New England (Kostow 2009). The introduction of hatchery produced fish can be a major cause of ecological perturbation in wild salmonid populations. Potential adverse effects of hatchery practices include: loss of genetic variability within and among populations (Hard et al. 1992, Reisenbichler 1997); disease transfer; increased competition for food, habitat, or mates; increased predation; altered migration; and the displacement of natural fish (Steward and Bjornn 1990 cited in NMFS, 2015, Hard et al. 1992, Fresh 1997). Recent research has demonstrated that the ecological effects of hatchery programs may significantly reduce wild population productivity and abundance even where genetic risks do not occur (Kostow 2009). Long-term domestication has eroded the fitness of hatchery reared fish in the wild and has reduced the productivity of wild stocks where significant numbers of hatchery fish spawn with wild fish.

Hatchery practices are cited as one of the key factors contributing to large reductions in salmonid populations in the Pacific Northwest over the past several decades, and remain a continuing threat to the recovery of many listed ESUs and DPSs. Hatcheries have been used for more than 100 years in the Pacific Northwest to produce fish for harvest and replace natural production lost to dam construction. Hatcheries have only minimally been used to protect and rebuild naturally produced salmonid populations. Hatchery contribution to naturally-spawning fish remains high for a number of Columbia River salmon populations, and it is likely that many returning unmarked adults are the progeny of hatchery-origin parents, especially where large hatchery programs operate (NWFSC 2015). For many populations the proportion of hatchery origin fish exceeds recovery goal criteria set for primary and contributing populations (Good et al. 2005, NWFSC 2015).

The Pacific Northwest Hatchery Reform Project was established in 2000. In their 2015 report to Congress the project's independent scientific review panel concluded that the widespread use of artificial propagation programs has contributed to the overall decline of wild salmonid populations. The states of Oregon and Washington have initiated a comprehensive program of hatchery and associated harvest reforms designed to manage hatchery broodstocks to achieve proper genetic integration with, or segregation from, natural populations, and to minimize adverse ecological interactions between hatchery and natural origin fish[6].

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[6] (WDFW, http://wdfw.wa.gov/hatcheries/esa.html; ODFW, http://www.dfw.state.or.us/fish/HGMP/final.asp).

Atlantic salmon have been stocked in at least 26 rivers in Maine from 1871 to 2003. Over 106 million fry and parr and over 18 million smolts have been stocked during this period (Fay et al. 2006). Currently there are two federal hatcheries that spawn and rear progeny of anadromous, captive reared Atlantic salmon, and four permanent feeding/rearing stations that raise progeny of captive reared and domestic broodstock obtained from the federal hatcheries for recovery and restoration stocking.

3.6.1 Non-native Species

When non-native plants and animals are introduced into habitats where they do not naturally occur they can have significant impacts on ecosystems and native fauna and flora. Non-native species can be introduced through infested stock for aquaculture and fishery enhancement, ballast water discharge, and from the pet and recreational fishing industries. Non-native species can reduce native species abundance and distribution, and reduce local biodiversity by out-competing native species for food and habitat. They may also displace food items preferred by native predators, disrupting the natural food web. The introduction of non-native species is considered one of the primary threats to ESA-listed species (Wilcove and Chen 1998). Non-native species were cited as a contributing cause in the extinction of 27 species and 13 subspecies of North American fishes over the past 100 years (Miller et al. 1989).

The introduction of invasive blue and flathead catfish along the Atlantic coast has the potential to adversely affect ongoing anadromous fish restoration programs and native fish conservation efforts, including Atlantic sturgeon restoration in mid-Atlantic and south Atlantic river basins (Brown et al. 2005, , J. Kahn, NMFS OPR, pers. comm. to R. Salz NMFS OPR, June 2016). Recent studies suggest that invasive species may reduce prey resources for Southern DPS green sturgeon. Green sturgeon may have difficulty feeding in substrate that has been invaded by Japanese eelgrass, which negatively impacts habitat for burrowing shrimp a common sturgeon prey item (Mary Moser, NMFS, pers. comm., June 18, 2015 cited in NMFS, 2015). Similarly, the invasive isopod (*U. pugettensis*) could also impact blue mud shrimp, another green sturgeon prey item (Olaf Langness, WDFW, and Brett Dumbauld, USDA-ARS, pers. comm. May 22, 2013 cited in NMFS, 2015).

Natural predator-prey relationships in aquatic ecosystems in Maine have been substantially altered by non-native species interactions. Several non-native fish species have been stocked throughout the range of Gulf of Maine DPS of Atlantic salmon. Those that are known to prey upon Atlantic salmon include smallmouth bass, largemouth bass, chain pickerel, northern pike, rainbow trout, brown trout, splake, yellow perch, and white perch (van den Ende 1993 cited in Fay, 2006, Baum 1997). Yellow perch, white perch, and chain pickerel were historically native to Maine, although their range has been expanded by stocking and subsequent colonization. Dams create slow water habitat that is preferred by chain pickerel and concentrate emigrating smolts in these head ponds by slowing migration speeds (McMenemy and Kynard 1988, Spicer et al. 1995). Brown trout, capable of consuming large numbers of stocked Atlantic salmon fry, have contributed to the decline of several native salmonid populations in North America (Alexander 1977, Alexander 1979, Taylor et al. 1984 all cited in Fay, 2006 #2827, Moyle 1976).

Introduction of non-native species on the West Coast has resulted in increased salmonid predation in many river and estuarine systems. Native resident salmonid populations have also been affected by releases of non-native hatchery reared salmonids (See 1.2.7 Artificial Propagation). The introduced northern pikeminnow is a significant predator of yearling juvenile Chinook migrants. Chinook salmon represented 29 percent of northern pikeminnow prey in lower Columbia reservoirs, 49 percent in the lower Snake River, and 64 percent downstream of Bonneville Dam (Friesen and Ward 1999). An ongoing northern pikeminnow management program has been in place since 1990 to reduce predation-related juvenile salmonid mortality. The rapid expansion of pikeminnow populations in the Pacific Northwest is believed to have been facilitated by alterations in habitat conditions (particularly increased water temperatures) that favor this species (Brown et al. 1994).

Predation of invasive lionfish on small reef fish and early life stages is a general concern throughout the Caribbean and could have an impact on Nassau grouper populations (Albins and Hixon 2008).

3.7 Fisheries

Commercial, recreational, and subsistence fisheries can result in substantial detrimental impacts on populations of ESA listed species. Past fisheries contributed to the steady decline in the population abundance of many ESA listed anadromous fish species. Although directed fishing for the species covered in this opinion is prohibited under the ESA, many are still caught as a result of ongoing fishing operations targeting other species (i.e., “bycatch”). Bycatch occurs when fishing operations interact with marine mammals, sea turtles, fish species, corals, sponges, or seabirds that are not the target species for commercial sale.

3.7.1 Directed Harvest

While directed fisheries for Atlantic salmon in the U.S. are at present illegal, impacts from past fisheries are an important factor contributing to the present low abundance of the Gulf of Maine DPS. The most complete records of commercial harvest of Atlantic salmon in the U.S. are for the Penobscot River, although historical records also mention commercial salmon fisheries in the Dennys, Androscoggin and Kennebec rivers (Kendall 1935, Beland et al. 1982, Beland 1984 all cited in Fay, 2006, Stolte 1981) reported that nearly 200 pound nets were operating in Penobscot Bay in 1872. A record commercial catch of 200,000 pounds of salmon was recorded for the Penobscot River in 1888. By 1898, landings had declined to 53,000 pounds and continued to decline in the following decades. The directed commercial fishery for Atlantic salmon in the Penobscot was eliminated by the Atlantic Sea Run Salmon Commission after the 1948 season when commercial harvest was reduced to only 40 fish. Directed fisheries for Atlantic salmon were further regulated by the adoption of the Atlantic Salmon Fishery Management Plan in 1987 which prohibits possession of Atlantic salmon in the U.S. Exclusive Economic Zone (NEFMC, http://www.nefmc.org/management-plans/atlantic-salmon).

The West Greenland fishery is one of the last directed Atlantic salmon commercial fisheries in the Northwest Atlantic. Greenland implemented a 45 mt quota for this fishery for 2015-2017. The West Greenland fishery is a mixed stock fishery and genetic analysis on captures from 2002 to 2004 indicate that Maine-origin salmon contribute between 0.1 and 0.8 percent to this fishery (ICES 2006). Based upon historic tag returns, the commercial fisheries of Newfoundland and Labrador historically intercepted far greater numbers of Maine-origin salmon than the West Greenland fishery (Baum 1997). A small commercial salmon fishery occurs off St. Pierre et Miquelon, a French territory south of Newfoundland. Historically, the fishery was very limited (2 to 3 mt per year). Genetic analysis on 134 samples collected in 2004 indicate that all samples originated from North American salmon, with roughly 2 percent of U.S. origin, presumably from the Gulf of Maine DPS.

Sport fishing for Atlantic salmon in Maine dates back to the mid-1800s. Recreational harvest regulations were not very restrictive through the 1970s. Increasingly restrictive regulations on the recreational harvest of Maine Atlantic salmon began in the 1980s as run sizes decreased notably. In 1995 regulations were promulgated for catch and release fishing only (i.e., zero harvest) of sea run Atlantic salmon throughout the state (Fay et al. 2006). By 2000, directed recreational fishing for sea run Atlantic salmon in Maine was prohibited. Illegal harvest (“poaching”) of Maine Atlantic salmon has been reported (MASTF 1997 cited in Fay, 2006) but the level of this activity and the impact on the Gulf of Maine DPS has not been quantified.

During the mid-1800s, an estimated 10 to 16 million adult salmonids entered the Columbia River each year. Large annual harvests of returning adult salmon and steelhead during the late 1800s, ranging from 20 million to 40 million pounds, significantly reduced population productivity (ODFW 2002). The largest known harvest of Chinook salmon occurred in 1883 when Columbia River canneries processed 43 million pounds (Lichatowich and Lichatowich 2001). Commercial landings declined steadily from the 1920s to a low in 1993 when just over one million pounds of Chinook salmon were harvested (ODFW 2002). Harvest levels increased to 2.8 million pounds by the early 2000s, but almost half the harvest was hatchery produced fish. In the early 2000’s, commercial harvest by tribal fisheries in the Columbia River ranged from between 25,000 and 110,000 fish. Recreational catches in both ocean and river fisheries have ranged from about 140,000 to 150,000 individuals over the same time frame. Non-Indian fisheries in the lower Columbia River are limited to a harvest rate of 1 percent. Treaty Indian fisheries are limited to a harvest rate of 5 percent to 7 percent, depending on the run size of upriver Snake River sockeye stocks. Snake River steelhead were historically taken in tribal and non-tribal gillnet fisheries, and in recreational fisheries in the mainstem Columbia River and its tributaries. In the 1970s, retention of steelhead in non-tribal commercial fisheries was prohibited, and in the mid 1980s tributary recreational fisheries in Washington adopted mark-selective regulations. Steelhead are still harvested in tribal fisheries and in mainstem recreational fisheries. Columbia River chum salmon were historically abundant and subject to substantial harvest until the 1950s (Johnson 1997). Illegal high seas driftnet fishing also likely contributed to past declines in Pacific salmon abundance although the extent of this activity is largely unknown.

Many grouper species are highly susceptible to overfishing, whether intentionally or as bycatch, due to a combination of life history traits including large size, late maturity, and tendency to form large spawning aggregations. Puerto Rico had significant commercial landings of Nassau grouper from the 1950s through the 1970s with fishermen targeting spawning aggregations (Schärer 2007). Landings subsequently dropped to negligible levels before the species was fully protected (in Commonwealth and federal waters) in 2004 (Sadovy 1997) (Matos-Caraballo 1997). Nassau grouper were considered “commercially extinct” in Puerto Rico by 1990 (Sadovy 1997); although the species still appeared in landings reports where it averaged approximately 11,000 pounds per year from 1994-2006.

Commercial harvest of eulachon in the Columbia and Fraser rivers was identified as a “low to moderate” threat by the Southern DPS eulachon biological review team. Current harvest levels are orders of magnitude lower than historic harvest levels, and a relatively small number of vessels still operate in this fishery. However, it is possible that even a small harvest of the remaining stock may slow recovery (75 FR 13012). Commercial fishing for eulachon is allowed in the Pacific Ocean, Columbia River, Sandy River, Umpqua River, and Cowlitz River. Commercial fishing in the Columbia River is managed according to the joint Washington and Oregon Eulachon Management Plan (WDFW and ODFW 2001). Under this plan, three eulachon harvest levels can be authorized based on the strength of the prior years’ run, resultant juvenile production estimates, and ocean productivity indices.

In the final listing rule, past and present commercial and recreational fishing, as well as poaching, were recognized as factors that pose a threat to the Southern DPS green sturgeon (71 FR 17757). Current regulations prohibit retention of green sturgeon in California, Oregon, and Washington state fisheries and in federal fisheries in the U.S. and Canada. These regulations apply to the range of both Southern and Northern DPS green sturgeon to address the possibility of capture of the threatened Southern DPS throughout the coast. Estimates based on past encounters suggest that Washington commercial fisheries outside of the lower Columbia River annually encounter 311 Southern DPS green sturgeon (pers. comm. with Kirt Hughes, WDFW January 30, 2015 cited in NMFS 2015c). An estimated 271 Southern DPS green sturgeon are annually encountered in lower Columbia River commercial fisheries (NMFS 2008a). Prior to the recreational retention limit, as many as 553 (1985) green sturgeon were harvested by anglers fishing in the lower Columbia River. A small number of green sturgeon (≤10) are still annually retained in this fishery due to misidentification or poaching.

Harvest records indicate that fisheries for sturgeon were conducted in every major coastal river along the Atlantic coast at one time, with fishing effort concentrated during spawning migrations (Smith 1985). Approximately 3,350 mt (7.4 million lbs) of sturgeon (Atlantic and shortnose combined) were landed in 1890 (Smith and Clugston 1997). The sturgeon fishery during the early years (1870 to 1920) was concentrated in the Delaware River and Chesapeake Bay systems. During the 1970s and 1980s sturgeon fishing effort shifted to the South Atlantic which accounted for nearly 80 percent of total U.S. landings (64 mt). By 1990 sturgeon landings were prohibited in Pennsylvania, District of Columbia, Virginia, South Carolina, Florida, and waters managed by the Potomac River Fisheries Commission. From 1990 through 1996 sturgeon fishing effort shifted to the Hudson River (annual average 49 mt) and coastal areas off New York and New Jersey (Smith and Clugston 1997). By 1996, closures of the Atlantic sturgeon fishery had been instituted in all Atlantic Coast states except for Rhode Island, Connecticut, Delaware, Maryland, and Georgia, all of which adopted a seven-foot minimum size limit. Poaching of Atlantic sturgeon continues and is a potentially significant threat to the species, but the present extent and magnitude of such activity is largely unknown.

3.7.2 Bycatch

Commercial bycatch is not thought to be a major source of mortality for Gulf of Maine DPS Atlantic salmon. Beland (1984 cited in Fay, 2006) reported that fewer than 100 salmon per year were caught incidental to other commercial fisheries in the coastal waters of Maine. A more recent study found that bycatch of Maine Atlantic salmon in herring fisheries is not a significant mortality source (ICES 2004). Commercial fisheries for white sucker, alewife, and American eel conducted in state waters also have the potential to incidentally catch Atlantic salmon.

Recreational angling occurs for many freshwater fish species throughout the range of the Gulf of Maine DPS Atlantic salmon. As a result Atlantic salmon can be incidentally caught (and released) by anglers targeting other species such as striped bass or trout. The potential also exists for anglers to misidentify juvenile Atlantic salmon as brook trout, brown trout, or landlocked salmon. A maximum length for landlocked salmon and brown trout (25 inches) has been adopted in Maine in an attempt to avoid the accidental harvest of sea-run Atlantic salmon due to misidentification.

Fisheries directed at unlisted Pacific salmonid populations, hatchery produced fish, and other species have caused adverse impacts to threatened and endangered salmonid populations. Incidental harvest rates for listed Pacific salmon and steelhead vary considerably depending on the particular ESU/DPS and population units. Bycatch represents one of the major threats to recovery as incidental harvest rates still remain as high as 50 percent-70 percent for some populations (NWFSC 2015). Freshwater fishery impacts on naturally-produced salmon have been markedly reduced in recent years through implementation of mark-selective fisheries (NWFSC 2015).

Take of Southern DPS green sturgeon in federal fisheries was prohibited as a result of the ESA 4(d) protective regulations issued in 2010 (75 FR 30714; June 2, 2010). Green sturgeon are occasionally encountered as bycatch in Pacific groundfish fisheries (Al-Humaidhi 2011), although the impact of these fisheries on green sturgeon populations is estimated to be small (NMFS 2012). (NMFS 2012) estimates between 86 and 289 Southern DPS green sturgeon are annually encountered as bycatch in the state-regulated California halibut bottom trawl fishery.

Approximately 50 to 250 green sturgeon are encountered annually by recreational anglers in the lower Columbia River (NMFS 2015c), of which 86 percent are expected to be Southern DPS green sturgeon based on the higher range estimate of Israel (Israel et al. 2009). In Washington, recreational fisheries outside of the Columbia River may encounter up to 64 Southern DPS green sturgeon annually (Kirt Hughes, WDFW, pers. comm., January 30, 2015 cited in NMFS, 2015). Southern DPS green sturgeon are also captured and released by California recreational anglers. Based on self-reported catch card data, an average of 193 green sturgeon were caught and released annually by California anglers from 2007-2013 (green sturgeon 5-year review). Recreational catch and release can potentially result in indirect effects on green sturgeon, including reduced fitness and increased vulnerability to predation. However, the magnitude and impact of these effects on Southern DPS green sturgeon are not well studied.

Directed harvest of Atlantic sturgeon is prohibited by the ESA. However, sturgeon are taken incidentally in fisheries targeting other species in rivers, estuaries, and marine waters along the east coast, and are probably targeted by poachers throughout their range (Collins et al. 1996) (ASSRT 2007). Commercial fishery bycatch is a significant threat to the viability of listed sturgeon species and populations. Bycatch could have a substantial impact on the status of Atlantic sturgeon, especially in rivers or estuaries that do not currently support a large subpopulation (< 300 spawning adults per year). Reported mortality rates of sturgeon (Atlantic and shortnose) captured in inshore and riverine fisheries range from 8 percent to 20 percent (Collins et al. 1996) (Bahn et al. 2012).

Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. Atlantic sturgeon originating from the five DPSs considered in this consultation are at risk of bycatch-related mortality in fisheries operating in the action area and beyond. Sturgeon are benthic feeders and as a result they are generally captured near the seabed unless they are actively migrating (Moser and Ross 1995). Atlantic sturgeon are particularly vulnerable to being caught in commercial gill nets, therefore fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch and bycatch mortality. An estimated 1,385 individual Atlantic sturgeon were killed annually from 1989-2000 as a result of bycatch in offshore gill net fisheries operating from Maine through North Carolina (Stein et al. 2004b). Sturgeon are also taken in trawl fisheries, though recorded captures and mortality rates are thought to be low.

From 2001-2006 an estimated 649 Atlantic sturgeon were killed annually in offshore gill net and otter trawl fisheries From 2006-2010 an estimated 3,118 Atlantic sturgeon were captured annually in Northeast fisheries, resulting in approximately 391 mortalities (Miller and Shepherd 2011).

3.8 Vessel Related Stressors

Both large and small vessels can adversely affect listed species within the action area. The detrimental effects of vessel traffic can be both direct (i.e., ship strikes) and indirect (i.e., noise, harassment, displacement, avoidance).

Atlantic sturgeon are susceptible to vessel collisions. The Atlantic Sturgeon Status Review Team (ASSRT 2007) determined Atlantic sturgeon in the Delaware River are at a moderately high risk of extinction because of ship strikes, and sturgeon in the James River are at a moderate risk from ship strikes. Balazik (Balazik et al. 2012) estimated up to 80 sturgeon were killed between 2007 and 2010 in these two river systems. Ship strikes may also be threatening Atlantic sturgeon populations in the Hudson River where large ships move from the river mouth to ports upstream through narrow shipping channels. The channels are dredged to the approximate depth of the ships, usually leaving less than 6 feet of clearance between the bottom of ships and the river bottom. Any aquatic life along the bottom is sucked through the large propellers of these ships. Large sturgeon are most often killed by ship strikes because their size means they are unable to pass through ship propellers without making contact. Green sturgeon may also be susceptible to ship strikes but there is no data available indicating that this is a major source of mortality.

Collisions with ships are also one of the primary threats to marine mammals, particularly large whales. While interactions between killer whales and ships are known to occur, large migratory cetaceans including blue, fin, humpback, right, and gray whales are considered the most vulnerable to ship strikes, particularly along migratory routes that span thousands of miles. Only one killer whale ship strike was recorded the NMFS national large whale ship strike database from 1975-2002 (Jensen et al. 2004).

While ship strikes may be rare for this species, killer whales are likely more susceptible to other vessel related effects including noise and harassment. Reduced feeding behavior has been reported when vessels are present (Lusseau et al. 2009). However, there is insufficient data available to quantify the reduction in feeding for individual whales or to evaluate the cumulative behavioral effects of vessel traffic on killer whales. Commercial and recreational whale watching was identified as a “high severity” and “high likelihood” threat in the listing determination of Southern Resident killer whales and cited as a factor that could potentially affect recovery of this DPS. Other vessel traffic (not targeting killer whales) was identified as a “medium severity” and “high likelihood” threat. Current voluntary guidelines are in place regarding vessel activity around killer whales, but a vessel monitoring program has documented persistent violations of these guidelines for many years (Koski 2010 cited in NMFS, 2011). In 2009 NMFS proposed regulations under the ESA and MMPA to prohibit vessels from approaching killer whales within 200 yards, parking in the path of whales in inland waters of Washington State, and entering a conservation area during a defined season (74 FR 37674). NMFS has coordinated with the U.S. Coast Guard, Washington Department of Fish and Wildlife, and the Canadian Department of Fisheries and Oceans to evaluate the need for regulations or areas with vessel restrictions as described in the Southern Resident Killer Whales Recovery Plan.

3.9 Global Climate Change

The Intergovernmental Panel on Climate Change estimates that average global land and sea surface temperature has increased by 0.85°C (± 0.2) since the late 1800s, with most of the change occurring since the mid-1900s (IPCC 2013). This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley and Berner 2001). The Intergovernmental Panel on Climate Change estimates that the last 30 years were likely the warmest 30-year period of the last 1,400 years, and that global mean surface temperature change will likely increase in the range of 0.3 to 0.7°C by 2033.

Global climate change stressors, including consequent changes in land use, are major drivers of ecosystem alterations (Rahel and Olden 2008) (Bellard et al. 2012). Climate change is projected to have substantial direct effects on individuals, populations, species, and the community structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (McCarty 2001, IPCC 2007, 2013). Increasing atmospheric temperatures have already contributed to changes in the quality of freshwater, coastal, and marine ecosystems and to the decline of endangered and threatened species populations (Mantua et al. 1997, Karl 2009) (Littell et al. 2009 cited in NMFS, 2015). All species discussed in this opinion are currently or are likely to be impacted by the direct and indirect effects of global climatic change.

Warming water temperatures attributed to climate change can have significant effects on survival, reproduction, and growth rates of aquatic organisms (Bellard et al. 2012). For example, warmer water temperatures have been identified as a factor in the decline and disappearance of mussel and barnacle beds in the Northwest (Harley 2011). Increasing surface water temperatures can cause the latitudinal distribution of freshwater and marine fish species to change as species move northward (Hiddink and Ter Hofstede 2008) (Britton et al. 2010). Cold water fish species and their habitat will begin to be displaced by warm water species (Hiddink and Ter Hofstede 2008, Britton et al. 2010). Fish species are expected to shift latitudes and depths in the water column, and the increasing temperatures may also result in expedited life cycles and decreased growth (Perry et al. 2005). Shifts in migration timing of pink salmon (*Oncorhynchus gorbuscha*), which may lead to high pre-spawning mortality, have already been connected to warmer water temperatures (Taylor 2008) . Climate-mediated changes in the global distribution and abundance of marine species are expected to reduce the productivity of the oceans by affecting keystone prey species in marine ecosystems such as phytoplankton, krill, and cephalopods. For example, climate change may reduce recruitment in krill by degrading the quality of areas used for reproduction (Walther et al. 2002).

Climate change will extend growing seasons and spatial extent of arable land in temperate and northern biomes. This would be accompanied by changes land use and pesticide application patterns to control pests (Kattwinkel et al. 2011). However modeling results indicate that predictions of mean trends in pesticide fate and transport is complicated by case specific and location specific conditions (Gagnon et al. 2016). Hellmann et al. (2008) described the consequences for climate change on the effectiveness of management strategies for invasive species. Such species are expected become more vigorous in areas where they had previously been limited by cold or ice cover. Increased vigor would make making mechanical control less effective and pesticide use likely. Some plant species may become more tolerant of herbicides due to elevated CO2. Pesticide fate and transport, toxicities, degradation rates, and the effectiveness of biocontrol agents are expected to change with changing temperature and water regimes, driven largely by effects on rates in organism metabolism and abiotic reactions (Bloomfield et al. 2006, Schiedek et al. 2007, Noyes et al. 2009).

Warmer water also stimulates biological processes which can lead to environmental hypoxia. Oxygen depletion in aquatic ecosystems can result in anaerobic metabolism increasing, thus leading to an increase in metals and other pollutants being released into the water column (Staudinger et al. 2012). In addition to these changes, climate change may affect agriculture and other land development as rainfall and temperature patterns shift. Aquatic nuisance species invasions are also likely to change over time as oceans warm and ecosystems become less resilient to disturbances. If water temperatures warm in marine ecosystems, native species may shift poleward to cooler habitats, opening ecological niches that can be occupied by invasive species introduced via ships' ballast water or other sources (Ruiz et al. 1999, Philippart et al. 2011). Invasive species that are better adapted to warmer water temperatures could outcompete native species that are physiologically geared towards lower water temperatures. This scenario of native species displacement is currently occurring along central and northern California (Lockwood and Somero 2011).

Climate change is also expected to impact the timing and intensity of stream seasonal flows (Staudinger et al. 2012). Warmer temperatures are expected to reduce snow accumulation and increase stream flows during the winter, cause spring snowmelt to occur earlier in the year, and reduce summer stream flows in rivers that depend on snow melt. As a result, seasonal stream flow timing will likely shift significantly in sensitive watersheds (Littell et al. 2009 cited in NMFS, 2015). Warmer temperatures may also have the effect of increasing water use in agriculture, both for existing fields and the establishment of new ones in once unprofitable areas (ISAB 2007 cited in NMFS, 2015). This means that streams, rivers, and lakes will experience additional withdrawal of water for irrigation and increasing contaminant loads from returning effluent. Changes in stream flow due to use changes and seasonal run-off patterns may alter predator-prey interactions and change species assemblages in aquatic habitats.

Over the past 200 years, the oceans have absorbed about half of the CO2 produced by fossil fuel burning and other human activities. This increase in CO2 has led to a reduction of the pH of surface seawater of 0.1 units, equivalent to a 30 percent increase in the concentration of hydrogen ions in the ocean. If global emissions of CO2 from human activities continue to increase at current rates, the average pH of the oceans is projected to fall by 0.5 units by the year 2100 (Raven et al. 2005). Although the scale of acidification changes would vary regionally, the resulting pH could be lower than the oceans have experienced over at least the past 420,000 years and the rate of change is probably one hundred times greater than the oceans have experienced at any time over that time interval. Acidification poses a significant threat to oceans because many major biological functions respond negatively to increased acidity of seawater. Ocean acidification, as a result of increased atmospheric CO2, can interfere with fertilization, larval development, settlement success, and secretion of skeletons(Albright et al. 2010). Photosynthesis, respiration rate, growth rates, calcification rates, reproduction, and recruitment may be negatively impacted by increased ocean acidity (Raven et al. 2005). Marine species have already experienced stress related to the impacts of rising temperature. Corals, in particular, demonstrate extreme sensitivity to even small temperature increases. When sea temperatures increase beyond a coral's limit the coral "bleaches" by expelling the symbiotic organisms that not only give coral its color, but provide food for the coral through their photosynthetic capabilities. Bleaching events have steadily increased in frequency since the 1980s (Hoegh-Guldberg 2010). Kroeker Kroeker et al. (2010) reviewed 139 studies that quantified the effects of ocean acidification on aquatic life. Their analysis determined that the effects were variable depending on species, but effects were generally negative, with calcification being one of the most sensitive processes.

In summary, the direct effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, ocean acidity, patterns of precipitation, and sea level. Indirect effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. Climate change is most likely to have its most pronounced effects on species whose populations are already in tenuous positions (Williams et al. 2008).

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