IEc

Economic Analysis of the Impacts of Designating Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon

Final | September 28, 2009

prepared for:

National Marine Fisheries Service

Southwest Region

501 West Ocean Blvd.

Long Beach, CA 90802-4213

prepared by:

Industrial Economics, Incorporated

2067 Massachusetts Avenue

Cambridge, MA 02140

INDUSTRIAL ECONOMICS, INCORPORATED

IEc

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

The purpose of this report is to identify and analyze the potential economic impacts associated with the designation of critical habitat for the Southern Distinct Population Segment (DPS) of North American green sturgeon (hereafter, "green sturgeon"). The analysis examines the potential impacts of restricting or modifying specific land or water uses or activities to avoid adverse modification or destruction of critical habitat.

The assessment and findings provided in this report inform the analysis of the economic impacts of designating each area considered for designation as critical habitat for the Southern DPS. A separate Biological Report was prepared to analyze the biological conservation benefits of designating critical habitat within each area. To determine which areas to designate as critical habitat, the biological conservation benefits of designation were weighed against the economic impacts and other relevant impacts (i.e., impacts to national security and tribal lands) of designation. This weighing process and analysis was documented in the ESA 4(b)(2) report to support NMFS' final critical habitat designation.

APPROACH

This analysis examines the state of the world with and without the designation of critical habitat for the green sturgeon. The "without critical habitat" scenario represents the baseline for the analysis, considering habitat protections already afforded green sturgeon under its Federal listing or under other Federal, State, and local regulations, including protections afforded green sturgeon from other listed species, such as West Coast salmon and steelhead, delta smelt, and marine mammal species. The "with critical habitat" scenario attempts to describe the incremental impacts associated specifically with the designation of critical habitat for the green sturgeon. This analysis does provide an overview of costs that may be considered coextensive with the listing of green sturgeon and other baseline protections. The focus of the analysis, however, is determining the increment of costs that is attributable to critical habitat.

To quantify the economic impacts of modifications to land and water uses that result from critical habitat designation, the analysis employs the following five steps:

- Define the geographic study area for the analysis, and identify the units within the study area to be analyzed for purposes of this designation. The proposed rule to designate critical habitat analyzes how each of these units meets the definition of critical habitat set forth in Section 3 of the Endangered Species Act (ESA).
- Identify potentially affected economic activities (e.g., dredging projects).
- Estimate the baseline level of protection afforded green sturgeon by unit and activity type.
- For each economic activity, establish the existing/expected level of economic activity that may be affected by green sturgeon conservation efforts in each critical habitat unit.
- Estimate potential economic impacts of green sturgeon conservation efforts by economic activity type and sum these impacts by unit.

These steps are described in greater detail in Section 1.

RESULTS

Because a large degree of uncertainty exists with regard to future actions likely to be undertaken specifically for the benefit of green sturgeon and its habitat, this analysis presents a range of possible impacts. This range is based on low-end and high-end impact scenarios developed for five activities where future management is highly uncertain: bottom-trawl fisheries, tidal/wave energy projects, liquefied natural gas terminals, desalination plants, and restoration projects. These scenarios are discussed further in Section 3. Section 4 of the analysis describes three activity categories for which data limitations precluded a quantitative assessment of economic effects, including: aquaculture, commercial shipping, and non-native species management.

In the low-end scenario, annualized impacts by unit vary from $0 to $36.0 million (discounted at seven percent), with the unit containing coastal Alaskan waters northwest of Yakutat Bay incurring the highest impacts. In the high-end scenario, annualized impacts by unit vary from $0 to $310 million (discounted at seven percent), also with the unit containing coastal Alaskan waters northwest of Yakutat Bay incurring the highest impacts. Impacts for all units are presented in Exhibits ES-1 and ES-2.

In addition to the above impacts, based on the consultation history for completed consultations that included green sturgeon to date (2006-2009), this analysis forecasts a future rate of section 7 consultation for the green sturgeon. On average, it forecasts 12 formal consultations, 67 informal consultations, and 8 technical assistance efforts per year for green sturgeon. The additional administrative effort associated with these consultations is estimated to be approximately $251,000 per year.

We note that although the focus of this analysis is on the incremental effects of the rule, due to uncertainties with regard to future management actions associated with green sturgeon critical habitat, it was difficult to exclude potential impacts that may already occur under the baseline. Thus, the analysis includes some costs which would have occurred under the baseline regardless of this rule, including those that may have occurred following the listing of the species. Appendix E tests the sensitivity of the assumptions in this analysis about the degree to which green sturgeon, as opposed to other listed salmonids, drive the costs in particular areas where habitats overlap.

EXHIBIT ES-1. SUMMARY OF ANNUALIZED IMPACTS BY UNIT* (DISCOUNTED AT 7 PERCENT)

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS	
		LOW	HIGH
1	Elkhorn Slough, CA	$220,000	$220,000
2	Upper Sacramento River	$3,900,000	$3,900,000
3	Lower Sacramento River	$4,700,000	$4,700,000
4	Yolo Bypass	$550,000	$550,000
5	Sutter Bypass	$13,000	$13,000
6	Lower Feather River	$2,000,000	$2,000,000
7	Lower Yuba River	$600,000	$610,000
8	Sacramento-San Joaquin Delta	$2,700,000	$2,800,000
9	Suisun Bay	$150,000	$200,000
10	San Pablo Bay	$320,000	$4,100,000
11	San Francisco Bay	$970,000	$1,100,000
12	Tomales Bay	$120,000	$270,000
13	Noyo Harbor	$23,000	$23,000
14	Eel River	$16,000	$16,000
15	Humboldt Bay	$14,000	$14,000
16	Klamath River	$8,900	$8,900
17	Rogue River	$2,100	$2,100
18	Coos Bay	$73,000	$16,000,000
19	Winchester Bay	$12,000	$12,000
20	Siuslaw River	$8,600	$8,600
21	Alsea River	$9,300	$9,300
22	Yaquina River	$3,300	$3,300
23	Tillamook Bay	$16,000	$16,000
24a	Lower Columbia River Estuary	$710,000	$20,000,000
24b	Lower Columbia River	$2,300,000	$2,300,000

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS	
		LOW	HIGH
25	Willapa Bay	$110,000	$110,000
26	Grays Harbor	$31,000	$31,000
27	Puget Sound	$3,000,000	$3,000,000
28	US/Mexico Border to Monterey Bay	$1,300,000	$190,000,000
29	Monterey Bay to San Francisco Bay	$200,000	$8,400,000
30	San Francisco Bay to Humboldt Bay	$520,000	$1,200,000
31	Humboldt Bay to Coos Bay	$710,000	$1,400,000
32	Coos Bay to Winchester Bay	$220,000	$550,000
33	Winchester Bay to Columbia R. Estuary	$460,000	$890,000
34	Columbia River Estuary to Willapa Bay	$540,000	$2,700,000
35	Willapa Bay to Grays Harbor	$0	$0
36	Grays Harbor to US/Canada Border	$470,000	$2,100,000
37	Strait of Juan de Fuca	$220,000	$220,000
38	Alaska/Canada Border to Yakutat Bay	$270,000	$270,000
39	Coastal Alaska Waters northwest of Yakutat Bay	$36,000,000	$310,000,000
40	Nehalem Bay	$300	$300
	Total	**$64,000,000**	**$578,000,000**

*Note: Sections 2 through 5 of the report present results of the analysis in more detail. Unit 40 Nehalem Bay is presented at the end of the table because it is a new specific area considered in the final rule. The Columbia River Units are labeled 25a and 25b to reflect that they were originally considered as one specific area, but then divided into two units based on the public comments.

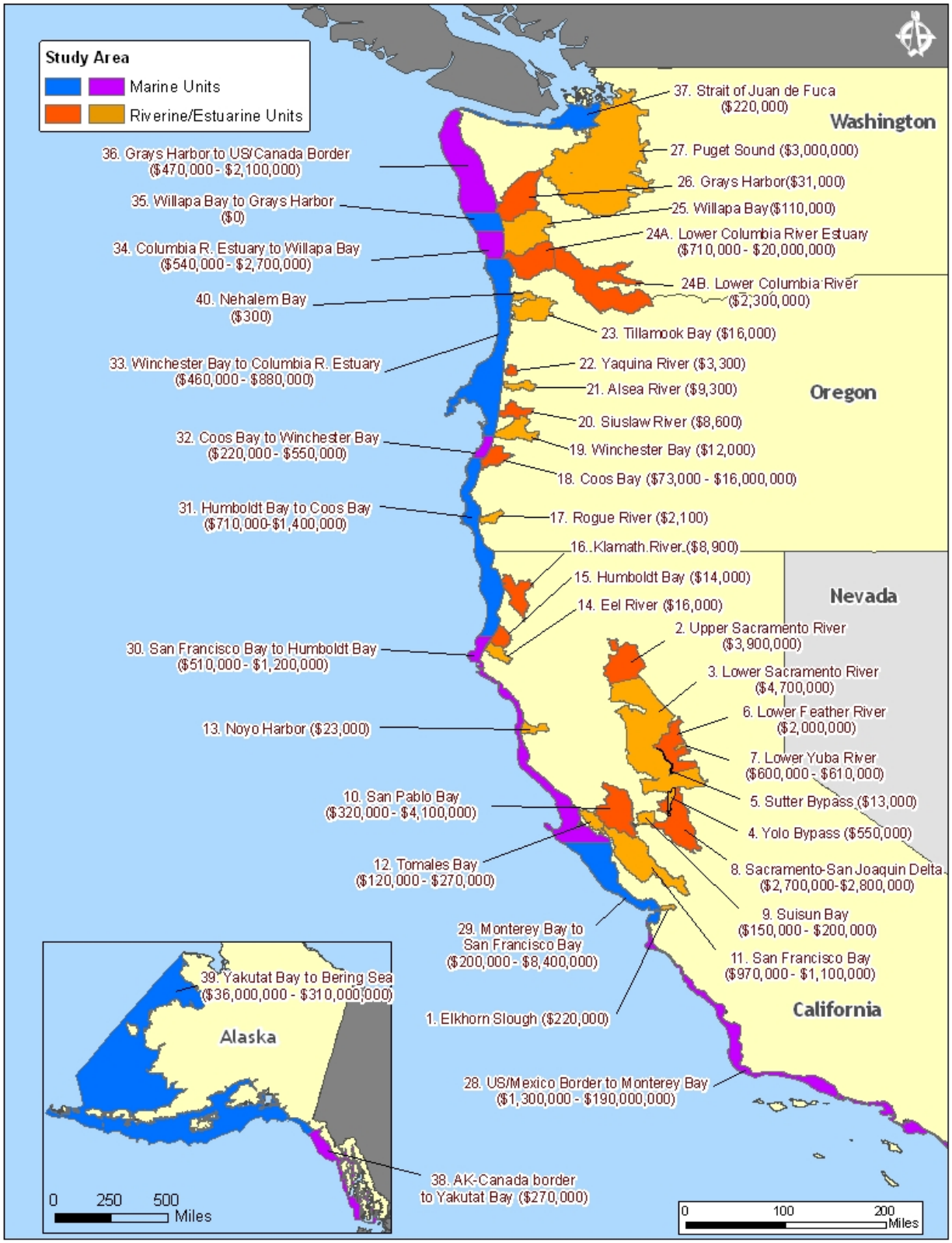
EXHIBIT ES-2. SUMMARY OF ANNUALIZED IMPACTS BY UNIT* (DISCOUNTED AT 3 PERCENT)

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS	
		LOW	HIGH
1	Elkhorn Slough, CA	$220,000	$220,000
2	Upper Sacramento River	$3,900,000	$3,900,000
3	Lower Sacramento River	$4,700,000	$4,700,000
4	Yolo Bypass	$550,000	$550,000
5	Sutter Bypass	$13,000	$13,000
6	Lower Feather River	$2,000,000	$2,000,000
7	Lower Yuba River	$600,000	$610,000
8	Sacramento-San Joaquin Delta	$2,700,000	$2,800,000
9	Suisun Bay	$150,000	$200,000
10	San Pablo Bay	$310,000	$4,100,000

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS	
		LOW	HIGH
11	San Francisco Bay	$940,000	$1,100,000
12	Tomales Bay	$120,000	$270,000
13	Noyo Harbor	$23,000	$23,000
14	Eel River	$15,000	$15,000
15	Humboldt Bay	$13,000	$13,000
16	Klamath River	$8,900	$8,900
17	Rogue River	$2,100	$2,100
18	Coos Bay	$72,000	$16,000,000
19	Winchester Bay	$12,000	$12,000
20	Siuslaw River	$8,600	$8,600
21	Alsea River	$9,300	$9,300
22	Yaquina River	$3,000	$3,000
23	Tillamook Bay	$15,000	$15,000
24a	Lower Columbia River Estuary	$710,000	$20,000,000
24b	Lower Columbia River	$2,300,000	$2,300,000
25	Willapa Bay	$110,000	$110,000
26	Grays Harbor	$29,000	$29,000
27	Puget Sound	$3,000,000	$3,000,000
28	US/Mexico Border to Monterey Bay	$1,300,000	$190,000,000
29	Monterey Bay to San Francisco Bay	$190,000	$8,300,000
30	San Francisco Bay to Humboldt Bay	$520,000	$1,200,000
31	Humboldt Bay to Coos Bay	$700,000	$1,400,000
32	Coos Bay to Winchester Bay	$220,000	$550,000
33	Winchester Bay to Columbia R. Estuary	$460,000	$890,000
34	Columbia River Estuary to Willapa Bay	$540,000	$2,700,000
35	Willapa Bay to Grays Harbor	$0	$0
36	Grays Harbor to US/Canada Border	$470,000	$2,100,000
37	Strait of Juan de Fuca	$220,000	$220,000
38	Alaska/Canada Border to Yakutat Bay	$270,000	$270,000
39	Coastal Alaska Waters northwest of Yakutat Bay	$36,000,000	$310,000,000
40	Nehalem Bay	$300	$300
	Total	**$64,000,000**	**$578,000,000**

*Note: Sections 2 through 5 of the report present results of the analysis in more detail. Unit 40 Nehalem Bay is presented at the end of the table because it is a new specific area considered in the final rule. The Columbia River Units are labeled 25a and 25b to reflect that they were originally considered as one specific area, but then divided into two units based on the public comments.

EXHIBIT ES-3. GEOGRAPHIC DISTRIBUTION OF ANNUALIZED IMPACTS BY UNIT



SECTION 1 | FRAMEWORK FOR THE ANALYSIS

1.1 INTRODUCTION

The purpose of this report is to identify and analyze the potential economic impacts associated with the designation of critical habitat for the Southern Distinct Population Segment (DPS) of North American green sturgeon (hereafter, "green sturgeon"). The analysis examines the potential impacts of restricting or modifying specific land or water uses or activities to avoid adverse modification or destruction of critical habitat. This chapter presents the framework applied to analyze the economic impacts of critical habitat designation.

1.2 GENERAL FRAMEWORK FOR THE ECONOMIC ANALYSIS

Similar to its analysis of critical habitat designation for West Coast salmon and steelhead, National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) is applying a cost-effectiveness framework to support the designation of critical habitat for the green sturgeon. This framework supports the section 4(b)(2) decision-making process by allowing NMFS to compare an estimate of the "benefits of exclusion" against an indicator of the biological "benefits of inclusion" for any particular area.[1] For this analysis, the cost-effectiveness framework has been modified, given the short and limited history of NMFS' experience in managing green sturgeon and the general uncertainty about specific management actions likely to be undertaken. This economic analysis addresses the "benefits of exclusion" portion of the weighing process, while the Biological Report and the ESA section 4(b)2 Report address and compare our results to the "benefits of inclusion" for each particular area considered. These other reports also present more detailed information regarding presence of green sturgeon as well as presence of identified primary constituent elements (PCEs) of the proposed critical habitat units.

1.2.1 BENEFIT-COST ANALYSIS AND COST-EFFECTIVENESS ANALYSIS

When economic activities have biological effects or other consequences for conservation, analyses of the impacts of regulating those activities can take a number of approaches. Two possible approaches are benefit-cost analysis and cost-effectiveness analysis. Each of these approaches has strong scientific support as well as support from the Office of

[1] National Marine Fisheries Service, Northwest Fisheries Science Center. August 2005. Final Economic Analysis of Critical Habitat Designation for 12 West Coast Salmon and Steelhead ESUs. Section 1.2.1 of this report is a reduced form discussion of the framework discussion provided in the West Coast salmon critical habitat analysis by the Northwest Fisheries Science Center.

Management and Budget (OMB) through its guidelines on regulatory analysis.[2] Each also has well known drawbacks, both theoretical and practical, as discussed in the following section in the context of critical habitat designation.

Benefit-cost analysis (BCA) is the first choice for analyzing the consequences of a regulatory action such as critical habitat designation.[3] BCA is a well-established procedure for assessing the "best" course or scale of action, where "best" is that course which maximizes net benefits.[4] Because BCA assesses the value of an activity in net benefit terms, it requires that a single metric, most commonly dollars, be used to gauge both benefits and costs. Although the data and economic models necessary to estimate costs may be difficult or costly to gather and develop, expressing costs in dollars is straightforward for most regulatory actions. This is often the case for critical habitat designation, which has direct impacts on activities carried out, funded, or permitted by the Federal government. However, as discussed below, a large degree of uncertainty exists with regard to potential economic impacts of critical habitat designation for the green sturgeon. (Conceptually, the "benefits of exclusion," which is the language used in section 4(b)(2) of the Endangered Species Act (ESA), are identical to the "costs of inclusion," and so estimates of these costs could be used in a benefit-cost framework.)

However, assessing the benefits of critical habitat designation in a BCA framework is straightforward in principle but much more difficult in practice. To the extent that the critical habitat provisions of the ESA increase the protections afforded the green sturgeon and its habitat, they produce real benefits to the species. In principle, these benefits can be measured first by a biological metric, and then by a dollar metric. A biological metric could take the form of the expected decrease in extinction risk, increase in number of spawners, increase in the annual population growth rate, and so forth. A BCA would then use this metric to assess the state of the species with and without critical habitat designation. This assessment would reveal the biological impact of designation, quantified in terms of the metric. However, the available data are insufficient to quantify the benefits of designating critical habitat for green sturgeon, particularly with respect to discrete geographical areas.

Recognizing the difficulty of estimating economic values in cases like this one, OMB has recently acknowledged cost-effectiveness analysis (CEA) as an appropriate alternative to BCA:

> Cost-effectiveness analysis can provide a rigorous way to identify options that achieve the most effective use of the resources available without requiring monetization of all of [the] relevant benefits or costs. Generally, cost-effectiveness analysis is designed to compare a set of regulatory actions with the same primary outcome (e.g., an increase in

[2] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[3] Ibid.

[4] Zerbe, R., and D. Dively, 1994. Benefit Cost Analysis in Theory and Practice, New York: HarperCollins.

the acres of wetlands protected) or multiple outcomes that can be integrated into a single numerical index (e.g., units of health improvement).[5]

Ideally, CEA quantifies both the benefits and costs of a regulatory action but uses different metrics for each. A common application of this method is to health care strategies, where the benefits of a strategy are quantified in terms of lives saved, additional years of survival, or some other quantitative, health-related measure.

In principle, conducting a CEA of critical habitat designation proceeds along the same lines identified above for BCA, except that the last step of assigning economic (dollar) values to biological benefits is not taken. Different configurations of critical habitat could be gauged by both metrics, with the cost-effectiveness (ratio of units of biological benefits to monetized cost) evaluated in each case. If alternatives have the same level of biological benefits, the most cost-effective is the one with the highest ratio of biological benefits to cost (either in the form of monetized costs or some other cost metric or cost ranking).

Standard CEA presumes that benefits and costs can be measured with a cardinal or even continuous measure. For critical habitat designations in general, however, constructing such a measure for biological benefits is problematic. Although protecting habitat for green sturgeon is likely to have benefits, it is not yet possible to quantify the benefits reliably with a single biological metric given the state of the science. In addition, NOAA has limited experience in managing green sturgeon, and there is general uncertainty about specific management actions likely to be undertaken on behalf of this species. Thus, applying CEA in its standard form is not possible.

The alternative form of CEA being applied to the green sturgeon analysis is one that develops an ordinal measure of the benefits of critical habitat designation. Although it is difficult to monetize or quantify benefits of critical habitat designation, it is possible to differentiate among habitat areas based on their estimated relative need for special management. For example, habitat areas can be rated as having a high, medium, or low biological value. The output (a qualitative ordinal ranking) may better reflect the state of the science for the geographic scale considered here than a quantified output, and can be done with available information.

Individual habitat areas can be assessed using both their biological evaluation and economic impact assessments, so that areas with high conservation value and lower economic impacts have a higher priority for designation, and areas with a low conservation value and higher economic impacts have a higher priority for exclusion. Again, these analyses are discussed in the Biological Report and the ESA section 4(b)(2) report for this rule.

By proceeding in order of these priorities (either in terms of inclusion or exclusion), the proposed critical habitat will minimize, or at least (in practice) reduce, the overall economic cost of achieving any given level of conservation. This form of CEA has two

[5] *Ibid*.

limitations, one of which it shares with the standard form of CEA. First, because CEA does not evaluate benefits and costs in the same metric, the analysis cannot assess whether a given change has benefits that, in monetary terms, are greater than costs. Although this analysis arrives at estimated economic impacts on a cost per unit basis, a large degree of uncertainty exists with regard to these costs. However, because the biological values are classified into high, medium, and low values, the coarseness of the available cost information should suffice to produce an effective tool for balancing costs and benefits. A second limitation of the modified form of CEA is the inability to discern variation in benefits among those areas assigned the same conservation value (i.e., the same ordinal ranking). A likely outcome is that using the modified CEA will lead to an outcome with higher expected costs of achieving any given level of conservation than one produced with standard CEA or BCA. This limitation, however, should be compared to the greater feasibility of the modified CEA.

1.3 IMPACTS THAT ARE THE FOCUS OF THIS ANALYSIS

This analysis examines the state of the world with and without the designation of critical habitat for the green sturgeon. The "without critical habitat" scenario represents the baseline for the analysis, considering habitat protections already afforded green sturgeon under its Federal listing or under other Federal, State, and local regulations, including protections afforded green sturgeon resulting from protections afforded other listed species, such as West Coast salmon and steelhead, delta smelt, and marine mammal species. The "with critical habitat" scenario attempts to describe the incremental impacts associated specifically with the proposed designation of critical habitat for the green sturgeon.[6] This analysis does provide an overview of costs that may be considered coextensive with the listing of green sturgeon and other baseline protections. The focus of the analysis, however, is determining the increment of costs that is attributable to critical habitat.

The social welfare impacts of critical habitat designation generally reflect “opportunity costs” associated with the commitment of resources required to accomplish species and habitat conservation. For example, if a set of activities that may take place on a parcel of land are limited as a result of the designation or the presence of the species, and thus the market value of that land is reduced, this reduction in value represents one measure of opportunity cost. Similarly, the costs incurred by a Federal action agency to consult with NMFS under section 7 represent opportunity costs related to green sturgeon conservation, as the time and effort associated with those consultations would have been spent on other endeavors absent the listing of the species or critical habitat designation.

[6] We note that although the focus of this analysis is on the incremental effects of the rule, due to uncertainties with regard to future management actions associated with green sturgeon critical habitat, it was difficult to exclude potential impacts that may already occur under the baseline. Thus, the analysis includes some costs which would have occurred under the baseline regardless of this rule. As such, this analysis analyzes impacts associated with the conservation of green sturgeon critical habitat (i.e., green sturgeon conservation impacts), some of which may overlap with impacts resulting from baseline protections.

At the guidance of the Office of Management and Budget (OMB) and in compliance with Executive Order 12866, "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be affected by a regulatory action. Economists generally characterize opportunity costs in terms of changes in producer and consumer surpluses (i.e., social welfare impacts) in affected markets.[7]

1.3.1 BASELINE FOR THE ECONOMIC ANALYSIS

The first step in the economic analysis is to identify the baseline level of protection afforded the green sturgeon and its habitat. This section provides a description of the methodology used to identify baseline conditions and incremental impacts stemming from the proposed designation of critical habitat for the green sturgeon.[8]

The baseline for this analysis is the existing state of regulation prior to the designation of critical habitat that provides protection to the species under the ESA and other Federal, State and local laws and guidelines. The baseline includes the protections of sections 7, 9, and 10 of the ESA, and economic impacts resulting from these protections to the extent that they are expected to occur absent the designation of critical habitat for the species, including protections afforded green sturgeon from protections afforded other listed species, such as West Coast salmon and steelhead, delta smelt, and marine mammal species.

> Section 7 of the Act, absent critical habitat designation, requires Federal agencies to consult with NMFS to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species. The portion of the administrative costs of consultations under the jeopardy standard, along with the impacts of project modifications resulting from consideration of this standard, are considered baseline impacts.
>
> Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[9] The economic impacts associated with this section manifest themselves in sections 7 and 10.
>
> Under section 10(a)(1)(B) of the Act, an entity (e.g., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for a listed animal species in order to meet the conditions for issuance of an incidental take permit

[7] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see: Gramlich, Edward M., A Guide to Benefit-Cost Analysis (2nd Ed.), Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, Guidelines for Preparing Economic Analyses, EPA 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

[8] See Footnote 6.

[9] 16 U.S.C. 1532.

in connection with the development and management of a property.[10] The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately minimized and mitigated. The development and implementation of HCPs is considered a baseline protection for the species and habitat unless the HCP is determined to be precipitated by the designation of critical habitat, or the designation influences stipulated conservation efforts under HCPs.

The protection of listed species and habitat is not limited to the Act. Other Federal agencies, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction. If compliance with the Clean Water Act or State environmental quality laws, for example, protects habitat for the species, such protective efforts are considered to be baseline protections and costs associated with these efforts are not quantified as impacts of critical habitat designation. As noted above, where uncertainty exists as to whether particular costs would have already occurred under the baseline, this analysis conservatively includes those costs. Many of the relevant existing regulations are discussed in Appendix B.

1.3.2 TYPES OF ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION

The purpose of the analysis is to determine the impacts on land uses and activities from the proposed designation of critical habitat that are above and beyond those impacts due to existing or planned conservation efforts being undertaken due to other Federal, State, and local regulations or guidelines. [11]

When critical habitat is designated, section 7 requires Federal agencies to ensure that their actions will not result in the destruction or adverse modification of critical habitat (in addition to ensuring that the actions are not likely to jeopardize the continued existence of the species). The added administrative costs of including consideration of critical habitat in section 7 consultations and the additional impacts of implementing project modifications to protect critical habitat are the direct result of the designation of critical habitat. These costs are not in the baseline, and are considered incremental impacts of the rulemaking.

Incremental impacts may include the direct costs associated with additional effort for future consultations, reinitiated consultations, new consultations occurring specifically because of the designation, and additional project modifications that would not have been required to avoid jeopardizing the continued existence of the species. Additionally, incremental impacts may include indirect impacts resulting from reaction to the potential designation of critical habitat (e.g., developing habitat conservation plans (HCPs) in an effort to avoid designation of critical habitat), triggering of additional requirements under State or local laws intended to protect sensitive habitat, and uncertainty and perceptional effects on markets. The nature of these impacts is described in greater detail below.

[10] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at http://endangered.fws.gov/hcp/.

[11] See Footnote 6.

Direct Impacts

The direct incremental impacts of critical habitat designation stem from the consideration of the potential for destruction or adverse modification of critical habitat during section 7 consultations. The two categories of direct incremental impacts of critical habitat designation are: 1) the administrative costs of conducting section 7 consultation; and 2) implementation of any project modifications requested by NMFS through section 7 consultation to avoid or minimize potential destruction or adverse modification of critical habitat.

Administrative Section 7 Consultation Costs

Parties involved in section 7 consultations for green sturgeon include NMFS, a Federal action agency (the Federal action, such as a permit or other authorization, provides the "Federal nexus" requiring consultation), and in some cases, a private entity involved in the project or land use activity. The Federal action agency serves as the liaison with NMFS. While consultations are required for activities that involve a Federal nexus and may jeopardize the continued existence of the species regardless of whether critical habitat is designated, the designation may increase the effort for consultations where the project or activity in question may adversely modify critical habitat. Administrative efforts for consultation may therefore result in both baseline and incremental impacts.

The geographic scope of the green sturgeon critical habitat and the nature of the available data preclude unit-by-unit accounting of these costs. First, a single consultation can cover more than one project. While the majority of consultations cover a single project, the exceptions are important. For example, programmatic consultations determine how a type or types of project, not the projects themselves, can be modified to ensure they comply with section 7. As a result, these consultations can cover large numbers of projects. While programmatic consultations are likely to be more costly, the cost per project is likely to be significantly lower than the per-project cost for non-programmatic consultations. For that reason, applying a constant per-project cost estimate would significantly inflate the estimated level of consultation cost. Moreover, when multi-project consultations occur, they are likely to cover a wide geography. This makes it difficult to attribute those consultation costs to a particular area such as a single unit. Due to the sparse consultation history for this species and uncertainties regarding the specific location, type, and frequency of future consultations, the current analysis does not project total administrative costs associated with this designation.

For contextual purposes, Exhibit 1-1 presents generalized per-consultation administrative costs of consultations. In general, three different scenarios associated with the designation of critical habitat may trigger incremental administrative consultation costs:

- **Additional effort to address adverse modification in a new consultation** - New consultations taking place after critical habitat designation may require additional effort to address critical habitat issues above and beyond the listing issues. In this case, only the additional administrative effort required to consider critical habitat is considered an incremental impact of the designation.

- **Re-initiation of consultation to address adverse modification -** Consultations that have already been completed on a project or activity may require re-initiation to address critical habitat. In this case, the costs of re-initiating the consultation, including all associated administrative and project modification costs are considered incremental impacts of the designation.
- **Incremental consultation resulting entirely from critical habitat designation -** Critical habitat designation may trigger additional consultations that may not occur absent the designation (e.g., for an activity for which adverse modification may be an issue, while jeopardy is not, or consultations resulting from the new information about the potential presence of the species provided by the designation). Such consultations may, for example, be triggered in critical habitat areas that are not occupied by the species. All associated administrative and project modification costs of incremental consultations are considered incremental impacts of the designation.

The administrative costs of these consultations vary depending on the specifics of the project. One way to address this variability is to show a range of possible costs of consultation. Exhibit 1-1 provides estimated consultation costs representing effort required for all types of consultation, including those that consider both adverse modification and jeopardy. To estimate the fractions of the total administrative consultation costs that are baseline and incremental, the following assumptions were applied:

- Costs associated with an incremental consultation (one occurring because of the designation of critical habitat) would be attributed wholly to critical habitat;
- Incremental costs of a re-initiation of a consultation because of the critical habitat designation are assumed to be approximately half the cost of the original consultation that considered only jeopardy. This assumes that re-initiations are less time-consuming as the groundwork for the project has already been considered in terms of its effect on the species;
- Efficiencies exist when considering both jeopardy and adverse modification at the same time (e.g., in staff time saved for project review and report writing), and therefore incremental administrative costs of considering adverse modification in consultations that will already be required to consider jeopardy result in the least incremental effort of these three consultation categories, roughly half that of a re-initiation.

Importantly, the estimated costs represent the midpoint of a potential range of impacts to account for variability regarding levels of effort of specific consultations.

EXHIBIT 1-1. EXAMPLE RANGE OF ADMINISTRATIVE CONSULTATIONS COSTS (PER CONSULTATION), $2007

INCREMENTAL ADMINISTRATIVE COSTS OF CONSULTATION ($2007)					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
INCREMENTAL CONSULTATION RESULTING ENTIRELY FROM CRITICAL HABITAT DESGINATION					
Technical Assistance	$530	n/a	$1,050	n/a	$1,500
Informal	$2,300	$2,900	$2,050	$2,000	$9,500
Formal	$5,150	$5,800	$3,500	$4,800	$19,500
Programmatic	$15,500	$13,000	n/a	$5,600	$34,100
RE-INITIATION OF CONSULTATION TO ADDRESS ADVERSE MODIFICATION					
Technical Assistance	$265	n/a	$525	n/a	$750
Informal	$1,150	$1,450	$1,030	$1,000	$4,750
Formal	$2,580	$2,900	$1,750	$2,400	$9,750
Programmatic	$7,750	$6,480	n/a	$2,800	$17,000
ADDITIONAL EFFORT TO ADDRESS ADVERSE MODIFICATION IN A NEW CONSULTATION					
Technical Assistance	$133	n/a	$263	n/a	$375
Informal	$575	$725	$513	$500	$2,380
Formal	$1,290	$1,450	$875	$1,200	$4,880
Programmatic	$3,880	$3,240	n/a	$1,400	$8,510

Source: IEc analysis of full administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2007, and a review of consultation records from several Fish and Wildlife Service field offices across the country conducted in 2002.
Notes:
1. Totals may not sum due to rounding.
2. Estimates reflect average hourly time required by staff.

Based on the consultation history for completed consultations that included green sturgeon to date (2006-2009), this analysis forecasts a future rate of section 7 consultation for the green sturgeon. On average, it forecasts 12 formal consultations, 67 informal consultations, and 8 technical assistance efforts per year. The additional, incremental administrative effort associated with these consultations is estimated at approximately $251,000 per year.

Section 7 Project Modification Impacts

Section 7 consultation considering critical habitat may also result in additional project modification recommendations specifically addressing potential destruction or adverse modification of critical habitat. For consultations that consider jeopardy and adverse modification, and for re-initiations of past consultations to consider critical habitat, the economic impacts of project modifications undertaken to avoid or minimize adverse modification are considered incremental impacts of critical habitat designation. For consultations that are forecast to occur specifically because of the designation

(incremental consultations), impacts of all associated project modifications are assumed to be incremental impacts of the designation.

Indirect Impacts

The designation of critical habitat may, under certain circumstances, affect actions that do not have a Federal nexus and thus are not subject to the provisions of section 7 of the Act. Indirect impacts are those unintended changes in economic behavior that may occur outside of the Act, through other Federal, State, local, or private actions that are caused by the designation of critical habitat. This section identifies common types of indirect impacts that may be associated with the designation of critical habitat. Importantly, these types of impacts are not always considered incremental. If these types of conservation efforts and economic effects would occur regardless of critical habitat designation, they are appropriately considered baseline impacts.

Habitat Conservation Plans

Under section 10 of the Act, landowners seeking an incidental take permit may develop an HCP to counterbalance the potential harmful effects that an otherwise lawful activity may have on a species. The purpose of the habitat conservation planning process is to ensure that the effects of incidental take are adequately minimized and mitigated. Thus, HCPs are developed to ensure compliance with section 9 of the Act and to meet the requirements of section 10 of the Act.

Application for an incidental take permit and completion of an HCP is not required or necessarily recommended by NMFS as a result of a critical habitat designation. In certain situations, however, the new information provided by the proposed critical habitat rule may prompt a landowner to apply for an incidental take permit. For example, a landowner may have been previously unaware of the potential presence of the species on his or her property, and expeditious completion of an HCP may offer the landowner regulatory relief in the form of exclusion from the final critical habitat designation. In this case, the effort involved in creating the HCP and undertaking associated conservation actions is considered an incremental effect of designation.

Other State and Local Laws

Under certain circumstances, critical habitat designation may provide new information to a State or local government about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under other State or local laws. In cases where these impacts would not have been triggered absent critical habitat designation, they are considered indirect, incremental impacts of the designation.

Additional Indirect Impacts

In addition to the indirect effects noted above, project proponents, land managers and landowners may face additional indirect impacts, including the following:

> **Time Delays -** Both public and private entities may experience incremental delays for projects and other activities due to requirements associated with the need to reinitiate the section 7 consultation process and/or compliance with

other laws triggered by the designation. To the extent that delays result from the designation, they are considered indirect, incremental impacts of the designation.

Regulatory Uncertainty - NMFS conducts each section 7 consultation on a case-by-case basis and issues a biological opinion on formal consultations based on species-specific and site-specific information. As a result, government agencies and affiliated private parties who consult with NMFS under section 7 may face uncertainty concerning whether project modifications will be recommended by NMFS and what the nature of these modifications will be. This uncertainty may diminish as consultations are completed and additional information becomes available on the effects of critical habitat on specific activities. Where information suggests that regulatory uncertainty stemming from the designation may affect a project or economic behavior, associated impacts are considered indirect, incremental impacts of the designation.

Stigma - In some cases, the public may perceive that critical habitat designation may result in limitations on private property uses above and beyond those associated with anticipated project modifications or regulatory uncertainty. Public attitudes about the limits or restrictions that critical habitat may impose can cause real economic effects, regardless of whether such limits are actually imposed. All else equal, a property that is designated as critical habitat may have a lower market value than an identical property that is not within the boundaries of critical habitat due to perceived limitations or restrictions. As the public becomes aware of the true regulatory burden imposed by critical habitat, the impact of the designation on property markets may decrease. To the extent that potential stigma effects on markets are probable and identifiable, these impacts are considered indirect, incremental impacts of the designation.

These potential impacts are not explicitly addressed in this analysis, but were considered during the development of cost estimates.

1.4 APPROACH TO ANALYSIS OF GREEN STURGEON

To quantify the economic impacts of modifications to land and water uses that result from critical habitat designation, the analysis employs the following five steps:

1. Define the geographic study area for the analysis, and identify the units within the study area to be analyzed for purposes of this designation. The proposed rule to designate critical habitat analyzes how each of these units meets the definition of critical habitat set forth in Section 3 of the ESA.
2. Identify potentially affected economic activities (e.g., in-stream construction projects).
3. Estimate the baseline level of protection afforded green sturgeon by unit and activity type.

4. For each economic activity, establish the existing/expected level of economic activity that may be affected by green sturgeon conservation efforts in each critical habitat unit.
5. Estimate potential economic impacts of green sturgeon management on activities, and sum by unit.

These steps are described in greater detail below.

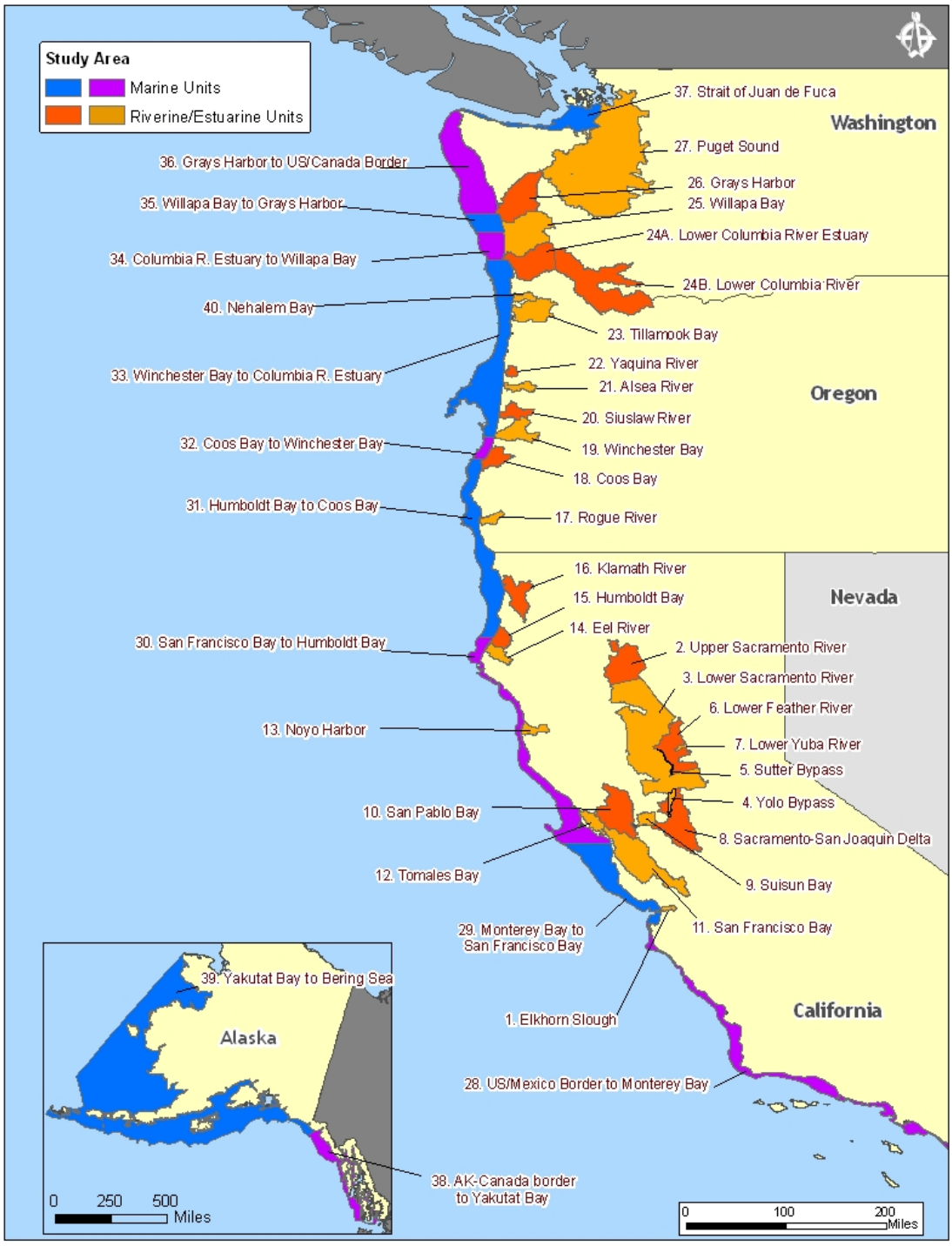
1.4.1 DEFINE GEOGRAPHIC STUDY AREA

The area critical habitat study area spans an area from the California-Mexico border to the Bering Sea in Alaska, and includes a number of inland rivers and estuaries. NMFS has divided the area into 41 units to be considered for critical habitat designation (hereafter, "study area"), as shown in Exhibit 1-2. The proposed rule to designate critical habitat for green sturgeon analyzes how each of these areas meets the definition of critical habitat.

While NMFS provided study area boundaries for coastal study units, IEc applied a watershed-based approach to determine the area of potential effects of green sturgeon critical habitat for estuarine and riverine units. To define the watershed areas potentially affected by green sturgeon critical habitat, this analyses uses a standard watershed unit, as mapped by the U.S. Geological Service and described by ten-digit, fifth-field hydrologic unit codes (referred to in this report as HUC5s, or simply "watersheds") in Oregon an d Washington, and fourth-field hydrologic unit codes for Alaska. For California, the analysis uses the California hydrologic sub-areas (HSAs), which are approximately equivalent to USGS HUC5s, to define the study unit boundaries.[12] Note that while individual watersheds are used to define the bounds of the study units, these watersheds are combined to report economic impacts by study unit.

[12] Note that where multiple critical habitat river or estuary units intersect a single HUC5, IEc used professional judgment to assign the HUC to the most relevant study unit. The Yolo and Sutter Bypass units lie wholly within watersheds assigned to the Sacramento River units. As such, these units were carved out of those watersheds and not assigned a separate HUC5 unit, as shown in Exhibit 1-2.

EXHIBIT 1-2. STUDY AREA FOR ECONOMIC ANALYSIS OF PROPOSED GREEN STURGEON CRITICAL HABITAT



1.4.2 IDENTIFY POTENTIALLY AFFECTED ECONOMIC ACTIVITIES

NMFS identified 15 categories of economic activity as potentially requiring modification to avoid destruction or adverse modification of green sturgeon critical habitat. These "activities" include the operation of some facilities, such as water diversions, where modifications may be required as a result of this designation. The following are the economic activities assessed in this analysis:

- Dredging
- In-water construction
- NPDES permit activities and activities resulting in non-point source pollution
- Agriculture
- Bottom trawl fisheries
- Dams
- Water diversions
- Restoration
- Commercial shipping
- Power plants
- Desalination plants
- Tidal/wave energy projects
- Liquefied natural gas (LNG) projects
- Aquaculture
- Non-native species management

Using GIS and other spatial analysis, this analysis first assesses the level of current and expected economic activity for each affected industry in each unit. The analysis then scales this level of activity to the number of projects expected to be affected annually by green sturgeon critical habitat designation (e.g., the number of proposed tidal/wave energy projects or dredging projects).

1.4.3 ESTIMATE THE BASELINE LEVEL OF PROTECTION AFFORDED GREEN STURGEON BY UNIT AND ACTIVITY TYPE

After the critical habitat rule goes into effect, activities affecting green sturgeon may require modification to avoid destruction or adverse modification of critical habitat. This analysis aims to understand the economic impacts of avoiding adverse impacts to green sturgeon critical habitat over and above other baseline protections that may already be in place.[13] Because of the close relationship in terms of management requirements under the

[13] See Footnote 6.

ESA between green sturgeon and other listed threatened and endangered species, protections for these species may provide the strongest baseline protections to green sturgeon within critical habitat areas. The following sections provide additional detail regarding baseline protections that are provided by these species to green sturgeon. In addition, a number of regulations, laws, and initiatives have been created specifically to address human-induced impacts on anadromous species. These are summarized in Appendix B.

Salmon and Steelhead Species

Riverine green sturgeon habitat largely overlaps listed West Coast salmon and steelhead species habitat. The riverine areas also largely overlap designated critical habitat areas for West Coast salmon and steelhead species, as shown in Exhibit 1-3. While the habitat area affected by the proposed rule supports numerous other listed species, salmon and steelhead are most closely related in terms of threats and habitat management requirements.

Because of the high visibility and regional importance of salmon and steelhead species, numerous protections have already been undertaken on behalf of these species. For example, a critical habitat analysis for salmon and steelhead examined nearly 1,100 consultation actions over three years, or approximately 370 actions annually for salmon and steelhead species. These actions were authorized, funded, or carried out by nearly 30 Federal agencies in addition to NMFS.[14] In another example, the California Habitat Restoration Project Database, a database created in 1999 to capture and maintain data about habitat restoration projects in California benefiting anadromous fish, currently contains nearly 3,000 projects, of which 2,400 are completed and 600 are ongoing.[15] As described above, a number of other initiatives have been undertaken to address human-induced impacts on anadromous species, many of which are summarized in Appendix B.

It is worth noting that every consultation of the approximately 49 completed formal consultations that address impacts on green sturgeon through May 2009 also address impacts to one or more listed salmon and/or steelhead species. Formal consultation actions were most common in California (28 consultations) and Oregon (18 consultations), with just a few in Washington (3 consultations). As presented in Exhibit 1-4, many of the consultations that included green sturgeon addressed multiple salmon species.

[14] NMFS, Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs, Long Beach, CA, August 2005.

[15] Fish barrier data is available from the Calfish program, a cooperative effort headed by CDFG Wildlife and Habitat Data Analysis Branch and CDFG NCNCR Information Services Branch. Accessed at http://www.calfish.org/ on August 21, 2007.

EXHIBIT 1-3. OVERLAP OF CRITICAL HABITAT STUDY AREAS FOR GREEN STURGEON WITH HABITAT FOR WEST COAST SALMON AND STEELHEAD

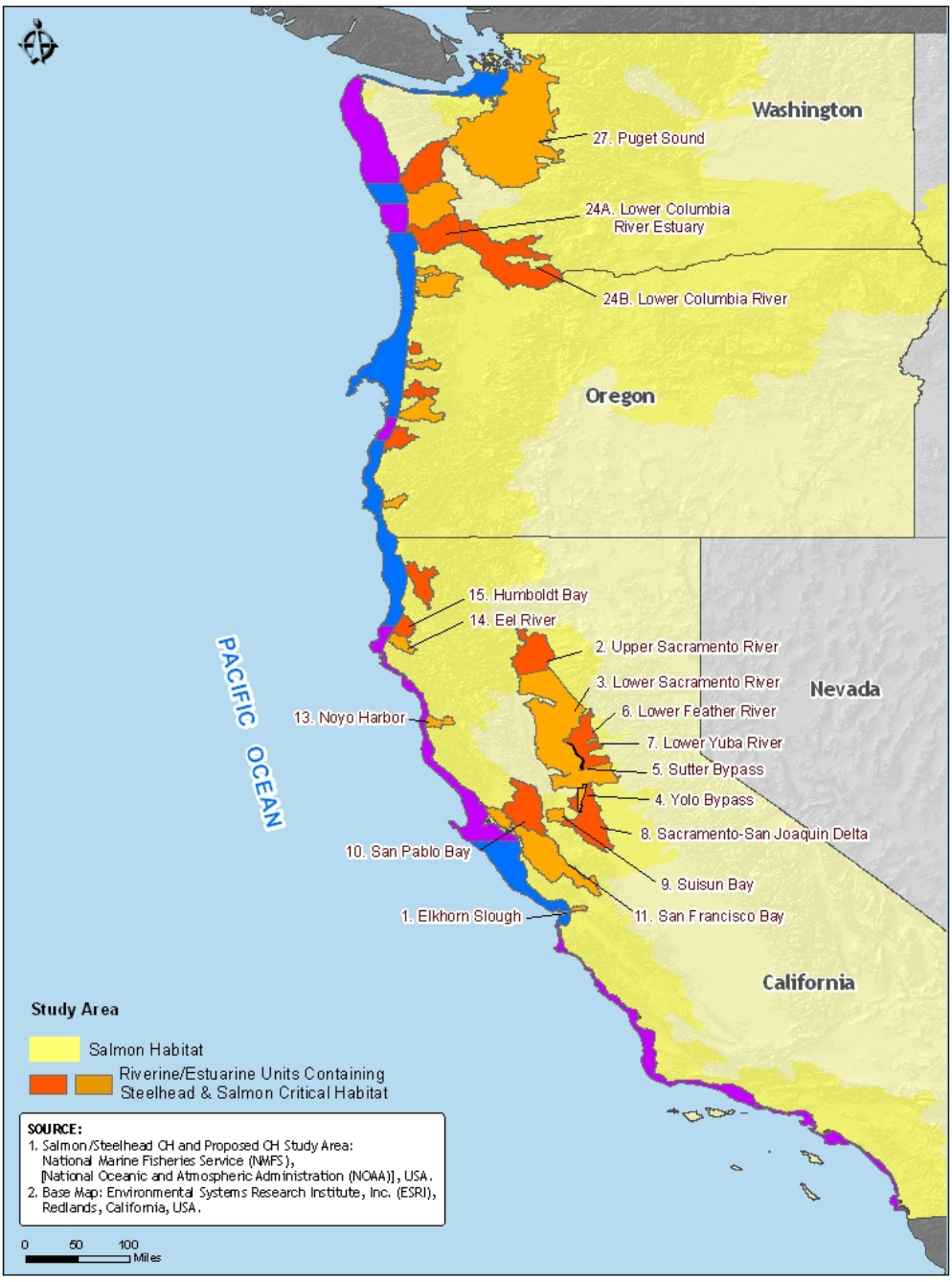


EXHIBIT 1-4. OTHER SPECIES INCLUDED IN COMPLETED GREEN STURGEON CONSULTATIONS TO DATE

SPECIES (ESU)	STATUS	CRITICAL HABITAT STATUS	NUMBER OF STURGEON CONSULTATIONS THAT INCLUDE SPECIES
Salmon, Chinook (Sacramento River winter-run)	Endangered	Designated	19
Salmon, Chinook (Central Valley spring-run)	Threatened	Designated	19
Salmon, Chinook (Central Valley fall/late fall-run)	Species of Concern	n/a	14
Salmon, Chinook (Lower Columbia River)	Threatened	Designated	11
Salmon, Chinook (Upper Willamette River)	Threatened	Designated	10
Salmon, Chinook (Snake River fall run)	Threatened		7
Salmon, Chinook (Upper Columbia River spring-run)	Endangered	Designated	7
Salmon, Chinook (Snake River spring/summer run)	Threatened	Designated	7
Salmon, Chinook (California Coastal)	Threatened	Designated	3
Salmon, Chinook (unspecified)	Mixed	n/a	17
Salmon, coho (Lower Columbia River)	Threatened	In process	12
Salmon, coho (Southern Oregon/Northern California Coast)	Threatened	Designated	9
Salmon, coho (Oregon Coast)	Threatened	Designated	5
Salmon, coho (Central California Coast)	Endangered	Designated	1
Salmon, coho (unspecified)	Mixed	n/a	17
Salmon, sockeye (Snake River)	Endangered	Designated	7
Salmon, chum (Columbia River)	Threatened	Designated	8
Steelhead (California Central Valley)	Threatened	Designated	21
Steelhead (Central California Coast)	Threatened	Designated	14
Steelhead (Lower Columbia River)	Threatened	Designated	11
Steelhead (Upper Willamette River)	Threatened	Designated	8
Steelhead (Upper Columbia River)	Endangered	Designated	7
Steelhead (Middle Columbia River)	Threatened	Designated	7
Steelhead (Snake River Basin)	Threatened	Designated	6
Steelhead (Northern California)	Threatened	Designated	2
Steelhead (South-Central California Coast)	Threatened	Designated	2
Groundfish (Pacific Coast Groundfish FMP)	n/a	n/a	7
Coastal pelagic (Coastal Pelagic Species FMP)	n/a	n/a	7
Sea lion, Steller	Threatened	Designated	2
Whale, killer (Southern Resident stock)	Endangered	Designated	6

Delta Smelt

The analysis considered baseline protections resulting from the presence of the endangered delta smelt, a fish species that is endemic to the San Francisco Bay delta area. While conservation recommendations for delta smelt may not always benefit green sturgeon, conservation recommendations for some activities, particularly dredging and in-water construction activities, may provide a measure of protection for green sturgeon habitat. For example, it is known that in some cases, project modifications for the delta smelt may provide more protections to green sturgeon than do project modifications for salmon and steelhead species, such as in the case of dredging during an approved salmon window. The Long Term Management Strategy for San Francisco Bay establishes consultation requirements year round for delta smelt, while dredging is allowed to proceed without ESA consultation for salmon during part of the year.[16] Thus, project modifications to dredging activities for the protection of delta smelt may provide protection for green sturgeon habitat during times when project modifications would not be considered for salmon and steelhead. To date, however, no green sturgeon consultations have also included Delta smelt.

Marine Mammals

The analysis also considers baseline protections resulting from the presence of marine mammals such as killer whales and Steller sea lions. While conservation recommendations for marine mammals may not always benefit green sturgeon, conservation recommendations for some activities, particularly those that may affect passage in marine areas such as tidal/wave energy projects, may provide a measure of protection for green sturgeon and its habitat. For example, NMFS has considered impacts on marine mammals and sea turtles when commenting on proposed tidal energy projects (See National Marine Fisheries, *Comments on preliminary permit for San Francisco Bay Tidal Energy Project (FERC No. 12585)*, August 12, 2005.) In another case, pollock fishing was prohibited within 10 to 20 nautical miles of rookeries and haulouts to reduce potential adverse modifications to Steller sea lion critical habitat. These conservation efforts could benefit green sturgeon. However, because the specific habitat requirements for marine mammals and green sturgeon are not closely related, no baseline protections for green sturgeon are assumed to exist in proposed critical habitat areas associated with marine mammal protections. This approach likely underestimates baseline protections that may exist for green sturgeon in marine mammal habitat areas. However, only two past consultations on green sturgeon have also included Steller sea lion, and six past consultations have also included killer whales.

[16] Current dredging windows and periods when consultations are required for salmon and delta smelt are presented by the San Francisco Bay Conservation and Development Commission at http://www.bcdc.ca.gov/pdf/Dredging/D_EWW.xls.

1.4.4 ESTABLISH EXISTING/EXPECTED LEVEL OF ECONOMIC ACTIVITY LIKELY TO BE AFFECTED BY CRITICAL HABITAT

After establishing the level of baseline protections that exist, the analysis then assesses the number of future actions likely to be affected by critical habitat designation for green sturgeon for each potentially affected economic activity in each proposed critical habitat unit. This level of future activity is developed using GIS data and other published data on existing, pending, or future actions (e.g., FERC permit license data on locations of liquefied natural gas projects). Because of uncertainties regarding 1) which particular projects will in fact take place in critical habitat areas, and 2) which projects Action agencies will consider to potentially adversely effect green sturgeon, the number of projects requiring modifications to avoid impacts to green sturgeon may be under or overstated. Where possible, the analysis is conservative, i.e., more likely to overestimate impacts rather than understate them. For example, although no liquefied natural gas (LNG) terminals exist in critical habitat areas, 12 are currently proposed. The analysis assumes that all of these projects move forward to the construction phase, and result in project modifications for the benefit of green sturgeon. In fact, it appears unlikely that all of these projects will be constructed.

In terms of determining the number of proposed actions for which modifications for green sturgeon are likely to be required, the analysis is also conservative, where possible. For example, for in-water construction projects, we assume that every projected future project will undergo consultation on green sturgeon and undertake conservation efforts for the species. In fact, permitting agencies may independently determine that adverse impacts on green sturgeon are unlikely for some or many projects. In that case, the number of projects affected by green sturgeon critical habitat would be overstated. However, data limitations are real, and we recognize that all potential future projects within the timeframe for this analysis may not be captured by existing data. Missing data on real future projects would lead to underestimates of future projects requiring green sturgeon consultation in affected areas. We also recognize that in areas where other listed species coexist with green sturgeon, particularly Pacific salmon and steelhead species, a portion of affected future projects in critical habitat areas would be expected to undertake conservation efforts that are protective of green sturgeon regardless of this rule. This issue is addressed in the next section, where per project costs are estimated.

1.4.5 ESTIMATE POTENTIAL ECONOMIC IMPACTS BY UNIT

This analysis first quantifies the impacts of all conservation efforts likely to offer some conservation benefit to the green sturgeon on project-specific basis. It then calculates the portion of those impacts likely to be driven by the green sturgeon, as opposed to other sensitive species and habitats.

A key challenge of this analysis is determining the extent to which the presence of the green sturgeon and its critical habitat affect the type or level of conservation efforts recommended by NMFS for a project or activity. The uncertainty at this stage of the analysis falls into two main categories:

1. **Identifying conservation efforts associated with the listing protections for the green sturgeon apart from those conservation efforts undertaken specifically due to its critical habitat designation.** For conservation efforts undertaken at least in part for purposes of green sturgeon conservation, the role of critical habitat in their implementation is unclear. That is, it is uncertain whether project modifications benefitting the green sturgeon would be the same with or without the critical habitat designation.
2. **Determining the probability that the green sturgeon and its critical habitat are primary drivers of a conservation effort.** As described in Section 1.4.3, project-specific conservation efforts are frequently undertaken due to the joint presence of multiple species and habitats and may therefore be implemented regardless of the presence of any single species. This further complicates the identification of changes in behavior associated specifically with the green sturgeon critical habitat.

With regard to the first category of uncertainty, it is difficult to separate potential conservation efforts expected to result from critical habitat from those that would already be expected to occur for green sturgeon due to the listing of the species. Absent a defensible method for isolating conservation efforts resulting solely from critical habitat, this analysis includes costs of all conservation efforts for green sturgeon (which may include efforts already undertaken to avoid jeopardy/take) regardless of whether costs may have already been expected to occur absent critical habitat. As such, this analysis analyzes impacts associated with the conservation of green sturgeon critical habitat, some of which may overlap with impacts resulting from baseline protections.

Regarding the second category of uncertainty, this analysis employs best professional judgment in calculating the probability that green sturgeon conservation needs are a primary driver of the implementation of a joint conservation effort. In other words, this analysis estimates the likelihood that consideration of the green sturgeon will weigh heavily in the implementation of a conservation effort undertaken due to the presence of multiple species and habitats. This probability is dependent upon a number of factors, including the details of the project and conservation effort in question and the number of sensitive species present. By excluding impacts for which the green sturgeon is not a key reason for a conservation effort implementation, this analysis focuses the quantification of impacts on those associated specifically with green sturgeon conservation.

A number of green sturgeon critical habitat units overlap other anadromous fish species' habitat, particularly listed salmon and steelhead species. Based on the existing history of formal consultations that considered green sturgeon, it appears that conservation efforts that benefit green sturgeon are most frequently associated with the joint presence of salmonid species.[17] Salmonid species and their associated critical habitats may therefore

[17] See for example: NMFS, Southwest Region, Conference and Biological Opinion on the Red Bluff Pumping Plant Project, and its effect on endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead, their respective critical habitats, and the southern distinct population

provide a strong baseline protection for green sturgeon critical habitat where habitats coexist. This analysis asserts that, for most projects in salmonid habitat, the majority of conservation efforts benefitting the green sturgeon would be undertaken regardless of the presence of the green sturgeon or its critical habitat.[18] As such, the presence of salmonid species is considered a primary driver of the implementation of a conservation effort where prior salmon and steelhead listings have been well established. In these cases, considering green sturgeon in consultations may require little additional effort, and subsequent economic impact, over and above that already expected to occur due to the presence of listed salmonid species. Specifically, to narrow the impact analysis to those impacts associated specifically with green sturgeon conservation, this analysis assumes that between ten and 50 percent of the time, green sturgeon is a primary driver of a conservation effort when salmonid species are present. The specific assumptions for a particular unit or activity depend on: a) the number of other salmon and steelhead species present; b) when those species were listed; and c) whether the other species have critical habitat.

In some cases, green sturgeon conservation may be a key reason for implementing a conservation effort. This may be true, for example, where few other sensitive species are present. The analysis assumes that when listed salmon or steelhead species are absent, green sturgeon is the key driver of conservation measures.

An example of this method is the calculation of green sturgeon conservation impacts associated with water diversions. Conservation efforts associated with forecast water diversions include installation of fish screens. In areas where salmon are present, these modifications are likely to have occurred regardless of green sturgeon conservation needs. In some cases, however, it may be that the presence of the green sturgeon or its habitat results in the recommendation to install a fish screen. This analysis attempts to capture only the impacts associated with those cases in which the green sturgeon is a primary driver. This analysis assumes that, for units where both salmon and green

---

segment of North American green sturgeon, March 5, 2009; Biological Opinion NMFS, Southwest Region, Biological Opinion on the proposed Airport Road Bridge Replacement Project located near the City of Anderson, Shasta County, California, and its effect on endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead, their respective critical habitats, and the southern distinct population segment of North American green sturgeon, January 6, 2006; NMFS, Southwest Region, Biological Opinion on the Mountain House Wastewater Treatment Plant (MHWWTP) expansion project in San Joaquin County, California, and its effects on Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, green sturgeon, and designated critical habitat for Central Valley steelhead, September 1, 2006. In these consultations, recommended measures are not separated among salmon and green sturgeon, and appear to be the same for all affected fish species.

[18] Two public commenters provide support for this statement. One commenter remarks that "In areas such as the San Francisco and San Pablo Bay units, most of the future conservation measures will occur even if green sturgeon critical habitat is not designated because future economic activities will consider impacts to salmon, steelhead, and Delta smelt." A second commenter states that although some additional costs associated with mitigation measures may be expected, "most of the projects would be required to consult on their effects to listed salmon and steelhead habitat, and measures taken to protect those species may also prove beneficial to green sturgeon." Public comments of Berkeley Economic Consulting, "Comments on the Economic Analysis of the Impacts of Designating Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon," Prepared for the Bay Planning Coalition, December 22, 2008; Public comments of Bruce McIntosh, the Oregon Department of Fish and Wildlife on December 29, 2008.

sturgeon are present, green sturgeon are assumed to be a primary driver of the installation of fish screens ten percent of the time. Another way of saying this is that 90 percent of the time when a fish screen is installed within critical habitat, it is primarily due to concern for other species, such as salmonids, and would occur regardless of the green sturgeon.

As noted above, the probability that any given conservation effort is being driven by green sturgeon conservation as opposed to other species is subject to significant uncertainty. Appendix E of this report therefore presents a sensitivity analysis for these assumptions. The appendix describes alternative results assuming the extreme case that green sturgeon is always a primary driver of the conservation efforts; e.g., that 100 percent of the time fish screens are installed it is primarily due to green sturgeon conservation needs.

1.4.6 CALCULATE TOTAL IMPACTS BY UNIT

To create a total impact estimate for each critical habitat unit, we multiplied the number of affected projects by the annualized costs per project and the probability score for each unit and economic activity type, then summed these activity scores across each unit. This process is summarized in the following equation:

$$C_U = \Sigma_A(N_{AU} * C_{AU} * P_{AU})$$

Where

C_U = Total annualized economic impacts (costs) for unit 'U' (*2007 dollars*)

N_{AU} = Annual number of affected projects for activity 'A' in unit 'U'

C_{AU} = Annualized economic impacts (costs) on activity 'A' in unit 'U' (*2007 dollars*)

P_{AU} = Probability of green sturgeon being primary driver of conservation effort for activity 'A' in unit 'U' (*0 – 1.0*)

The results of this calculation are presented in Section 5 of this analysis.

1.4.7 ANALYTIC TIME FRAME

The analysis estimates impacts based on activities that are reasonably foreseeable, including activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. In general, the time frame over which data are available to project land uses in the study area is 20 years. In most cases, therefore, the analysis estimates economic impacts from 2008 to 2027 (20 years from the expected year of critical habitat designation).

1.4.8 TREATMENT OF UNCERTAINTIES

As discussed throughout this report, many uncertainties exist with regard to potential economic impacts of critical habitat designation for the green sturgeon. This uncertainty stems from a number of factors, which are summarized in the table below.

UNCERTAINTY	ANALYTIC SOLUTION
Number and location of future projects occurring in critical habitat areas are uncertain. • For some activities, the number of potentially affected facilities or activities, such as existing point source facilities, is well understood. For other activities, the number of potentially affected actions are known for a particular time period, such as dredging projects. For other activities, such as tidal and wave energy projects, the future number of projects likely to occur or be constructed in the study is unknown. • Even where the number of projects in critical habitat is relatively well understood, the likelihood that a particular project will undertake conservation efforts that will benefit green sturgeon critical habitat is difficult to predict. First, Action agencies have discretion over which federally funded or permitted projects are submitted for NMFS review and consultation. In addition, the history of consultations on green sturgeon is short (since 2006), and thus does not present a reliable dataset for projecting likely consultation activity.	In response to the uncertainty with regard to whether a project is likely to occur in critical habitat areas, this analysis forecasts impacts associated with all known projects. In most cases, the analysis assumes that every potentially affected project will undertake conservation efforts to accommodate green sturgeon and its critical habitat. For example, with regard to liquefied natural gas projects, we assume that every project for which a project has been currently proposed will need to undertake conservation efforts for green sturgeon critical habitat. By presenting proposed impacts on an annualized basis, the analysis attempts to highlight areas where projects are most likely to occur given current data.
Conservation efforts for green sturgeon are uncertain. • NMFS has limited experience in managing green sturgeon, and there is general uncertainty about specific management actions likely to be undertaken on behalf of this species. As stated above, the consultation record is relatively thin.	The analysis includes a discussion about what is known about past recommendations that NMFS has made for green sturgeon or other species inhabiting the same habitat for each potentially affected economic activity type. In some cases, the analysis offers alternative management scenarios with an associated range of potential costs (e.g., for LNG projects).
Costs of conservation efforts on an individual project basis may be uncertain. • Even where the type of conservation effort can be reasonably estimated (e.g., installation of fish passage at dam facilities), the potential range of costs associated with implementing that conservation effort at a particular site can vary.	Generally, this analysis presents a range of potential costs associated with particular conservation efforts based on available data. Where data for a particular facility was available, it is included where possible.
Separating baseline impacts from incremental impacts due to critical habitat designation is difficult. • One of the tasks for this analysis is separating conservation measures that would have been undertaken without green sturgeon critical habitat from those that are incremental to critical habitat designation.	In general, the analysis includes costs associated with conservation efforts expected to occur due to the listing or critical habitat designation for green sturgeon, due to uncertainty surrounding whether those impacts would be incremental to critical habitat. The analysis attempts to exclude impacts associated with those projects for which the green sturgeon is not a primary driver of project modifications. Thus, where other listed salmonid species are present, this analysis excludes some costs. As noted above, the probability that any given conservation effort is being driven by green sturgeon conservation as opposed to other species is subject to significant uncertainty. Appendix E of this report therefore presents a sensitivity analysis for these assumptions. The appendix describes alternative results assuming the extreme case that green sturgeon is always a primary driver of the conservation efforts.

In summary, because of uncertainty concerning future actions likely to be undertaken specifically for the benefit of green sturgeon and its habitat, this analysis presents a range of possible impacts. Although this analysis arrives at estimated economic impacts on a cost per unit basis, a large degree of uncertainty exists with regard to these costs. However, because the biological values are classified into high, medium, and low values, the coarseness of the available cost information should suffice to produce an effective tool for balancing the benefits of exclusion versus benefits of inclusion.

1.5 REPORT ORGANIZATION

The remainder of this report proceeds through four sections, with five Appendices, including:

- Section 2. This section describes seven of the 15 categories of economic activity that may require modification to avoid destruction or adverse modification of green sturgeon critical habitat. These seven categories, for which we have certainty concerning potential management actions and costs, include: dredging and in-water construction; point and non-point source pollution; agriculture; dams and water diversions; and power plants.
- Section 3. This section describes five of the 15 activities for which we have quantified the potential economic effects of CH but where: (1) the nature of future management is highly uncertain, and/or (2) the number of future projects likely to be affected by green sturgeon critical habitat is speculative. These activities include: bottom-trawl fishing, tidal/wave energy projects, liquefied natural gas projects, desalination, and restoration.
- Section 4. This section describes three activity categories for which data limitations precluded a quantitative assessment of economic effects, including: aquaculture; commercial shipping; and non-native species management.
- Section 5. This section discusses the results of the analysis by CH unit and activity. These results are derived from the activity counts and related cost estimates presented in earlier sections.
- Appendix A. This Appendix summarizes threats to green sturgeon identified by NMFS.
- Appendix B. This Appendix summarizes laws and regulations that may provide baseline protection to green sturgeon.
- Appendix C. Final Regulatory Flexibility Analysis.
- Appendix D. Energy Impacts Analysis
- Appendix E. Sensitivity Analysis for Analytic Assumptions

SECTION 2 | ECONOMIC IMPACTS BY ACTIVITY

2.1 INTRODUCTION

NMFS identified 15 categories of economic activity that may require modification to avoid destruction or adverse modification of green sturgeon critical habitat. This section describes seven of those economic activities in terms of their threat to green sturgeon, extent of occurrence within critical habitat, specific baseline elements that may provide protection to green sturgeon, and potential economic impacts of green sturgeon conservation efforts. Appendix A summarizes the listed threats to each unit by activity.

2.2 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON DREDGING AND IN-WATER CONSTRUCTION ACTIVITIES

2.2.1 DESCRIPTION OF THREAT

NMFS identified dredging activity as a potential threat to the essential features of the green sturgeon critical habitat in 29 potential critical habitat units. Dredging activity may affect habitat depth, sediment quality, passage, and food resources for green sturgeon.

NMFS identified in-water construction or alteration as a potential threat to the essential features identified for green sturgeon critical habitat in 30 potential critical habitat units. Actions associated with in-water activities that could impact green sturgeon habitat include construction or repair of breakwaters, docks, piers, pilings, bulkheads, and boat ramps. Actions could also include transportation projects, such as road widening, bridge reconstruction, or ferry terminal restoration. In-steam construction may affect habitat depth, sediment quality, passage, and food resources for green sturgeon. Turbidity associated with in-stream activities may interfere with the species' visual foraging, increase susceptibility for predation, and interfere with migratory behavior. Chemicals and waste materials including toxic organic and inorganic chemicals that accumulate in sediment may be directly toxic to aquatic life or a source of contaminants for bioaccumulation in the food chain.

The Federal nexus for a transportation project may be through the permitting or funding provided by the USACE, the Federal Highways Administration (FHA), and/or the Federal Aviation Administration (FAA). The USACE permits bridgework, roadwork, and railroad restoration projects that need permits under Section 404 of the Clean Water Act permits. Although in-water construction projects are commonly undertaken by private or non-Federal parties, in most cases they must obtain a USACE permit. FHWA funds bridgework, roadwork, railroad restoration projects, and ferry terminal maintenance, and the FAA permits aircraft/airport repair and maintenance.

2.2.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

Maintenance dredging is common in shipping channels across California, Oregon, and Washington. Large scale maintenance dredging is less common in Alaska.[19] Dredging is also commonly conducted as part of large, in-water construction activities such as marina or airport expansion projects. In its public comments, the USACE San Francisco District expressed concern that green sturgeon critical habitat could place limitations on the 17.4 square miles of federal navigation channels and aquatic dredged material placement sites within critical habitat areas in that District.[20] For example, the USACE identifies maintenance of the Sacramento River Deep Water Ship Channel, Suisun Bay Channel, San Francisco Harbor, and Humboldt Bay projects as being potentially affected, among others.[21]

For this analysis, the location and frequency of dredging projects within proposed critical habitat is based on the latitude and longitude of USACE awarded dredging contracts advertised by the USACE from Fiscal Year 1990 to 2000.[22] This data is supplemented with data from the Long Term Management Strategy Working Group data for San Francisco Bay as well as data from the section 404 databases described below.[23] These data are shown in Exhibit 2-1.

In-water construction activities are prevalent throughout many waterways in proposed critical habitat areas. While the specific locations of future in-water construction activities are not known, this analysis assumes that a reasonable proxy for understanding the location of future actions is past actions. That is, this analysis identifies the location of in-water construction projects within proposed critical habitat units using the latitude and longitude of historic USACE section 404 permits, which are believed to contain the bulk of relevant projects to green sturgeon habitat impacts. Permit data were collected from the Seattle, Portland, San Francisco, Sacramento and Los Angeles USACE Districts. The data include permits from 1996 to 2003, and vary by district. USACE in-water construction permit data from different districts is adjusted to account for temporal differences in the data. For example, the data set from the Seattle USACE district covered four years, while the dataset from the Sacramento district covered eight years. The annual level of projects that may require modifications is estimated by dividing the level obtained from each district's data by the number of years covered by that district's dataset. These data are presented in Exhibit 2-2.

[19] Personal communication with NMFS, Anchorage Office, May 5, 2008.

[20] Public comments of Laurie H Suda, Chief, Environmental Section B, San Francisco District, U.S. Army Corps of Engineers, December 19, 2008.

[21] Ibid.

[22] "U.S. Waterway Data: Dredging Information System." U.S. Army Corps of Engineers CEIWR-NDC, Navigation Data Center, Alexandria, VA, 2002.

[23] Data is derived from the Environmental Work Windows' Short Term Solutions Working Group, which is a sub-group of the 50-year multi agency/stakeholder LTMS dredging program. The USACE is an actively participating member in the sub-group. Data provided by NMFS, San Francisco Office, May 6, 2008.

EXHIBIT 2-1. APPROXIMATE LOCATION OF DREDGING PROJECTS IN UNITS POTENTIALLY AFFECTED BY PROPOSED ACTION (BASED ON PAST PERMIT DATA)

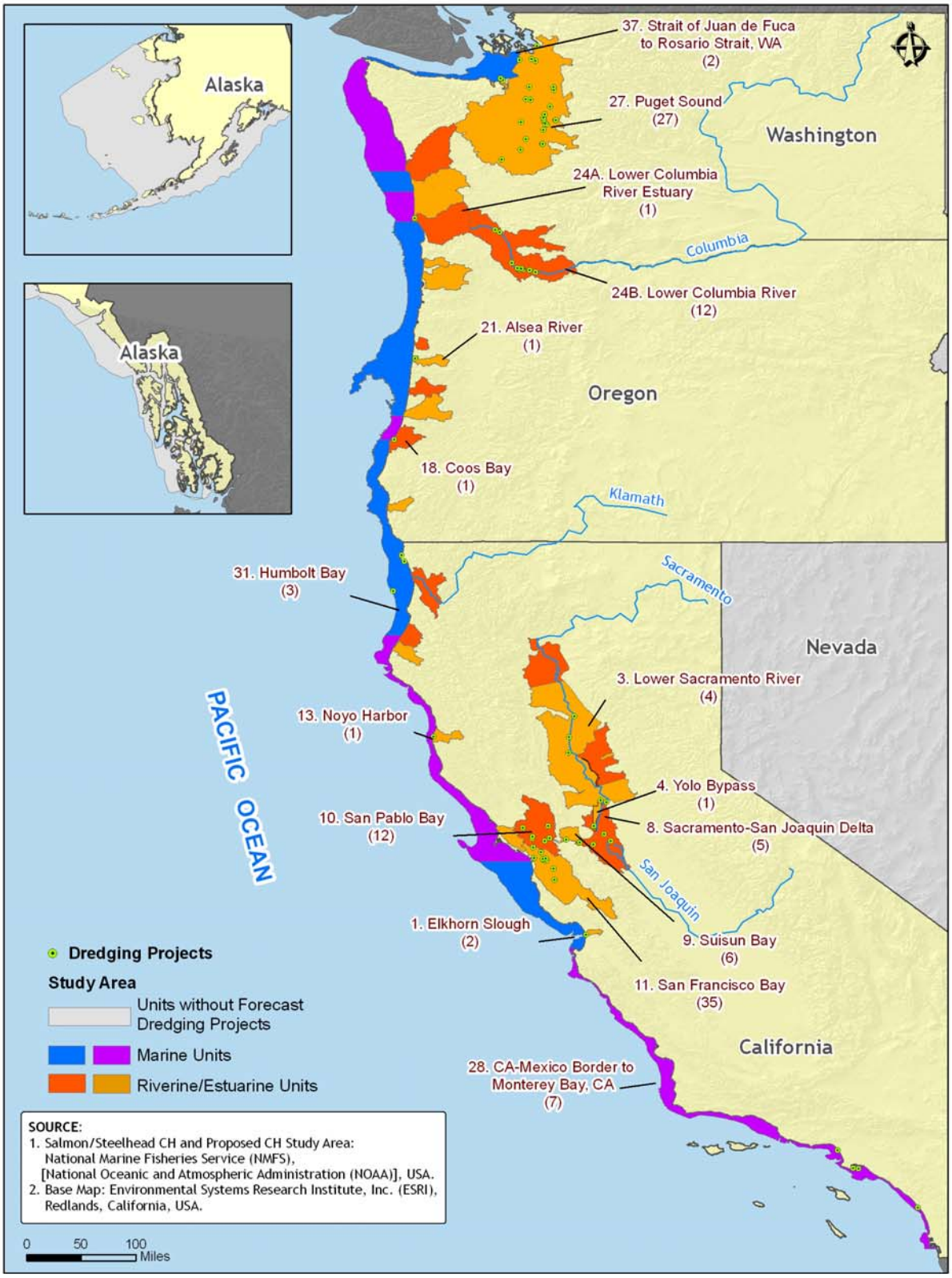
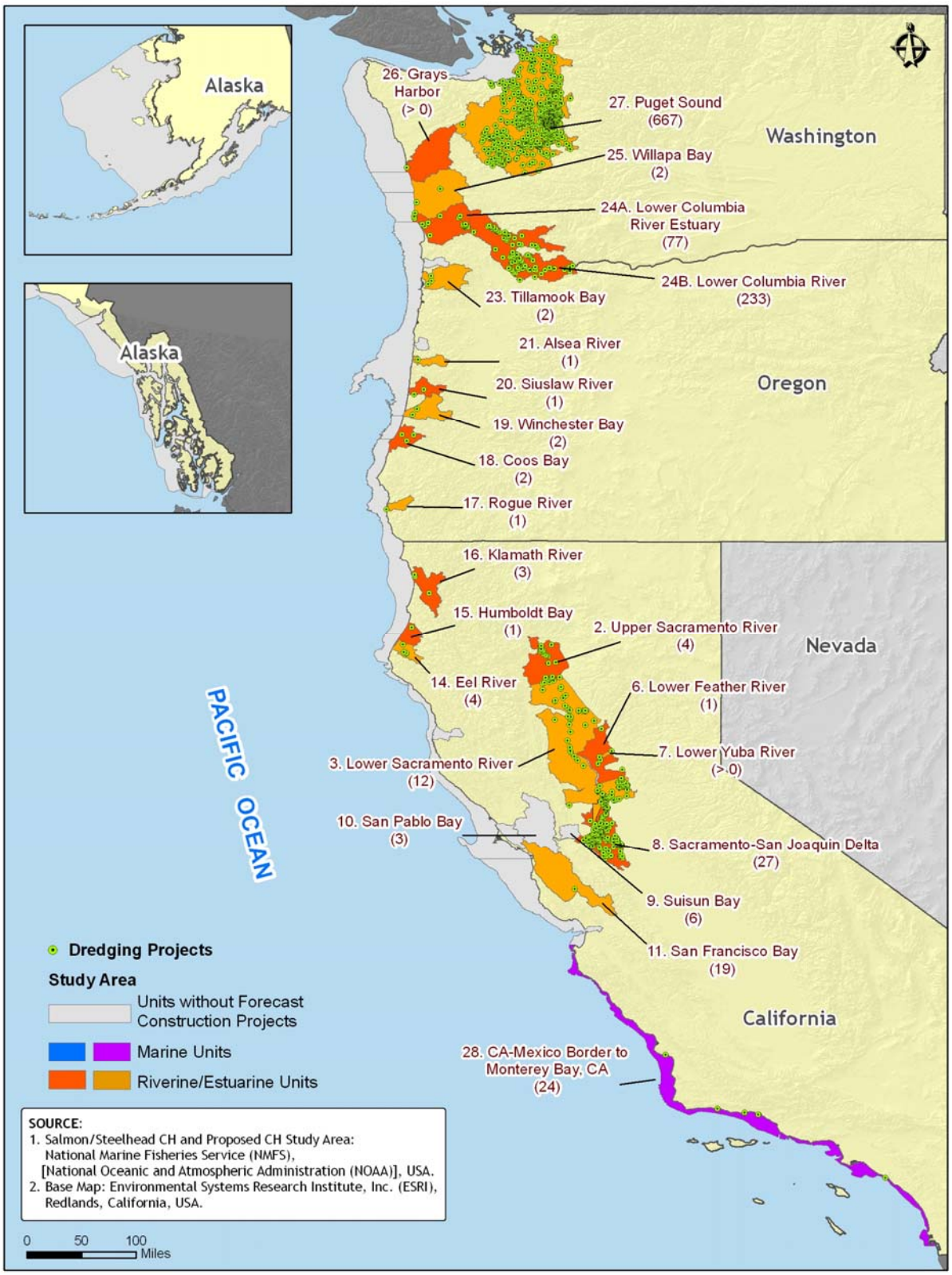


EXHIBIT 2-2. IN-WATER CONSTRUCTION PROJECTS POTENTIALLY AFFECTED BY PROPOSED ACTION (BASED ON PAST PERMIT DATA)



2.2.3 REGULATORY BASELINE

The Long-Term Management Strategy (LTMS) For the Placement of Dredged Material in the San Francisco Bay Region is a multi-agency effort on the part of USACE, EPA, NOAA and others to: (a) eliminate unnecessary dredging; and (b) maintain in an economically and environmentally sound manner those channels necessary for navigation in San Francisco Bay and Estuary. The LTMS considered three long-term strategies for channel maintenance, all of which attempt to reduce the amount of sediment disposed within the San Francisco Bay estuary. The LTMS also establishes dredging windows for salmon and other aquatic species, not including green sturgeon. Seasonal limitations on dredging were established to accommodate salmon spawning. Generally, NOAA reviews USACE dredging permit applications at the programmatic level, as opposed to the individual permit level, unless projects cannot occur within the allotted dredging windows and a formal consultation is required. Dredging project windows of six months out of the year and establishment of appropriate disposal sites are required by the LTMS; these potential project modifications are considered baseline protection for green sturgeon habitat.

2.2.4 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON IN-WATER CONSTRUCTION AND DREDGING ACTIVITIES

Based on consultations conducted for salmon and steelhead species, economic impacts related to direct project costs for in-water construction and dredging activities could include restrictions on the duration and extent of in-water work, erosion and sediment control measures, heavy equipment restrictions, and efforts to minimize take. Exhibit 2-3 summarizes typical project modifications that have been conducted on behalf of salmon and steelhead species for these types of projects. These modifications may be similar, or identical, to those that could be requested for green sturgeon.

Exhibit 2-4 summarizes potential per project costs for modifications to in-water construction project and dredging activities resulting from critical habitat designation for green sturgeon. These costs are based on costs of modifications resulting from critical habitat designations for salmon and steelhead species.

EXHIBIT 2-3. TYPICAL PROJECT MODIFICATIONS FOR IN-WATER ACTIVITIES FOR SALMON AND STEELHEAD SPECIES

PROJECT TYPE	PROJECT MODIFICATIONS
Boat Dock	• Date restrictions; • Temporary silt fences and floating silt barriers to limit sediment entry into river and reduce turbidity effects; • Disposal of excavated material at upland disposal site; • Assurance of clean, inert material making contact with water • Maintenance of all heavy equipment to insure cleanliness and devoid of external oil, fuel or other pollutants; • Strict following of permit and contract requirements; • Use of bubble curtain to minimize effects of sound waves from pile driving on listed fish; • Minimize creation of predator habitat by minimizing incidental take from heavy equipment use; • Minimization of incidental take from use of heavy equipment that may disturb riparian and aquatic systems; • Minimization of incidental take from erosion control activities by using best available technology; • Removal of pilings and associated docks.
Boat Launch	• Date restrictions; • Insure isolation from flowing water to minimize take; • Development and implementation of erosion and pollution control measures through area of disturbance; • Implementation of measures to minimize impacts to riparian and instream habitat; • Implementation of measures to treat water and limit fill within the 100-year floodplain; • Ensure temporary/permanent impacts to riparian instream habitat are restored and mitigated.
Bank Stabilization	• Limit the extent of rock placement in the channel; • Spill Prevention Contaminant Control Plan; • Erosion control; • Submit a monitoring and evaluation to USACE and NMFS • Replant disturbed areas with native plants with 80 percent survival after three years; • Ensure that the in-water work activities (toe trench excavation and scour protection placement) are isolated from flowing water • Use fish screens on all water intakes; • Fisheries biologist oversee capture and release program; • Move excavated materials to upland areas; • Restore all damaged areas to pre-work conditions; • Install fencing as necessary to protect revegetated sites; • Breakwater - Minimize incidental take from general construction by excluding authorized permit actions and applying permit conditions; • Comprehensive monitoring and reporting program to make sure objectives are met; • Equipment will be fueled and lubricated in designated refueling areas at least 150 feet away from stream.

PROJECT TYPE	PROJECT MODIFICATIONS
Bulkhead	• In-water work restrictions; • Fish passage; • Removal of treated wood; • Restricted use of heavy equipment; • Isolation of in-water work area; • Compensatory mitigation; • Water intake screening; • Pollution/erosion control; • Capture and release; • Conservation of native materials; • Earthwork; • Site restoration; • Date restrictions; • Minimize disturbance to riparian habitat; • Minimize disturbance due to construction barges; • Minimized contamination of riverine habitat; • Monitoring.
Dredging	• Work windows; • Dredge material disposal requirements.
San Francisco Bay Dredging	• Dredging windows; • Disposal sites; • Targets for distribution of dumping among sites.
Roadwork, Bridgework, Culvert Projects	• Limit time of in-water work to avoid take during vulnerable life stages; • Ensure isolation of in-water work area and proper fish handling methods; • Develop effective erosion and pollution control measures; • Stormwater management measures; • Restoration of construction site through contouring, mulching, • seeding and planting with native vegetation; • Monitoring and evaluation both during and following construction.

Sources: National Oceanic and Atmospheric Administration. Biological Opinion for Construction of a new boat dock at Columbia Cove Park, Okanogan County, Washington, May 16, 2003. 2001/01013; National Oceanic and Atmospheric Administration. Biological Opinion for Rogue River (Depot Street) Bridge Replacement Project, Jackson County, Oregon, October 23, 2003. 2002/00816; National Oceanic and Atmospheric Administration. Biological Opinion for McCormick Pier Repair Project, Willamette River Mile 11.3, Multnomah County, Oregon, May 23, 2003. 2002/01399; National Oceanic and Atmospheric Administration. Biological Opinion for the Georgia-Pacific Bulkhead Replacement Project, Yaquina River Basin, Lincoln County, Oregon, February 21, 2003. 2002/01314; Personal communication with Peter Losavita, U.S. Army Corps of Engineers, San Francisco District, personnel, December 4, 2003; Personal communication with Michael Dillabaugh, U.S. Army Corps of Engineers, San Francisco District, Operations and Readiness Division, Project Manager, November 24, 2003.

EXHIBIT 2-4. POTENTIAL PER PROJECT COSTS OF IMPLEMENTING CONSERVATION EFFORTS FOR IN-WATER CONSTRUCTION PROJECTS AND DREDGING ACTIVITIES ($2007)

SPECIFIC ACTIONS	TYPICAL CONSERVATION MEASURES TAKEN FOR SALMON AND STEELHEAD SPECIES	PER PROJECT ANNUALIZED COSTS (DISCOUNTED AT 7%)		
		LOW	MID	HIGH
In-Stream Construction				
Construction or repair of breakwaters, docks, piers, pilings, bulkheads, boat ramp, utility lines, and dredging.	Shoreline planting, construction materials restrictions, use of bubble curtains, habitat restoration, spill prevention contaminant control plan, erosion controls, timing restrictions, requirements to use directional drilling, monitoring	$3,250	$14,875	$26,500
Road construction, road widening, road maintenance, bridge reconstruction, bridge replacement, culverts, ferry terminal restoration/expansion, aircraft/airport repair and maintenance	Pre-construction surveys, development and implementation of a site specific spill prevention, containment, and control plan (SPCCP), removal of toxicants as they are released, water quality monitoring, use of boulders, rock, and woody materials from outside of the riparian area, monitoring and evaluation both during and following construction.			
Dredging				
Dredging activities	Work window constraints, extension of the prescribed work window, additional survey work, and mobilization costs. Could also include identification of disposal sites.	$44,000	$108,063	$172,125

Note: Adapted from NMFS, Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs, Long Beach, CA, August 2005. Adjusted to 2007 dollars using the U.S. Bureau of Economic Analysis, National Economic Accounts, National Income and Product Accounts table, 2008.

Based on several past examples of formal consultations on in-water construction projects that considered green sturgeon, it appears that, in some cases if not all, conservation measures for green sturgeon may be identified together with other salmonid species when they are present.[24] That is, salmonid species and their associated critical habitats may provide a strong baseline protection for green sturgeon critical habitat where habitats coexist. As such, it is possible that few additional requirements could result from green sturgeon critical habitat designation. In an attempt to be conservative, i.e., more likely to overstate costs than understate costs, this analysis assumes that given the universe of

[24] See for example, NMFS, Southwest Region, Biological Opinion on the proposed Airport Road Bridge Replacement Project located near the City of Anderson, Shasta County, California, and its effect on endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead, their respective critical habitats, and the southern distinct population segment of North American green sturgeon, January 6, 2006. In this consultation, recommended measures are not separated among salmon and green sturgeon, and appear to be the same for all affected fish species.

expected in-stream construction projects, green sturgeon critical habitat would be expected to result in an additional 20 percent of projects undertaking project modifications than would have occurred without green sturgeon. In areas where the study area overlaps Oregon Coast coho habitat, which was listed after the green sturgeon (December 2007), this analysis assumes that green sturgeon critical habitat will increase the number of in-water construction and dredging projects needing to undertake project modifications by 50 percent. Appendix E provides a sensitivity analysis for these assumptions, providing estimates assuming that green sturgeon critical habitat is responsible for the generation of all project modification costs for all projects.

Finally, where salmon and steelhead species are not present, project modification costs are assumed to be attributable to green sturgeon critical habitat designation. Although some level of protection would be already expected to exist under the listing of the green sturgeon, this analysis is unable to separate those costs from critical habitat costs.

2.2.5 SUMMARY OF IMPACTS TO IN-WATER CONSTRUCTION AND DREDGING ACTIVITIES BY UNIT

Exhibits 2-5 and 2-6 below presents a summary of potential impacts to dredging and in-water construction activities.

EXHIBIT 2-5. SUMMARY OF IMPACTS TO DREDGING ACTIVITIES BY UNIT

UNIT	DESCRIPTION	ACTIVITY COUNT (EST. ANNUAL NUMBER OF PROJECTS)	PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)		
				LOW	MID	HIGH
1	Elkhorn Slough, CA	2	1.0	$88,000	$216,000	$344,000
3	Lower Sacramento River, CA	4	0.2	$35,200	$86,500	$138,000
8	Sacramento-San Joaquin Delta, CA	5	0.2	$44,000	$108,000	$172,000
9	Suisun Bay, CA	6	0.2	$54,600	$134,000	$213,000
10	San Pablo Bay, CA	12	0.2	$107,000	$264,000	$420,000
11	San Francisco Bay, CA	35	0.2	$304,000	$748,000	$1,190,000
13	Noyo Harbor, CA	1	0.2	$8,000	$21,600	$34,400
15	Humboldt Bay, CA	0		$0	$0	$0
18	Coos Bay	1	0.5	$22,000	$54,000	$86,100
22	Yaquina River, OR	0	0.5	$0	$0	$0
23	Tillamook Bay, OR	0	0.5	$0	$0	$0
24a	Lower Columbia River Estuary, OR	1	0.2	$8,800	$21,600	$34,400
24b	Lower Columbia River, OR	12	0.2	$106,000	$259,000	$413,000
25	Willapa Bay, WA	0	1.0	$0	$0	$0
26	Grays Harbor, WA	0	1.0	$0	$0	$0
27	Puget Sound, WA	27	0.2	$238,000	$584,000	$929,000
28	CA-Mexico Border to Monterey Bay, CA	7	1.0	$308,000	$756,000	$1,200,000
29	Monterey Bay, CA to San Francisco Bay, CA	0	1.0	$0	$0	$0
30	San Francisco Bay, CA to Humboldt Bay, CA	0	1.0	$0	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	3	1.0	$132,000	$324,000	$516,000
32	Coos Bay, OR to Winchester Bay, OR	0	1.0	$0	$0	$0
33	Winchester Bay, OR to Columbia River and Estuary, OR	0	1.0	$0	$0	$0
34	Columbia River and Estuary to Willapa Bay, WA	0	1.0	$0	$0	$0
35	Willapa Bay, WA to Grays Harbor, WA	0	1.0	$0	$0	$0
36	Grays Harbor, WA to Cape Flattery, WA	0	1.0	$0	$0	$0
37	Strait of Juan de Fuca to Rosario Strait, WA	2	1.0	$88,000	$216,000	$344,000
38	AK/Canada border to Yakutat Bay, AK	0	1.0	$0	$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	0	1.0	$0	$0	$0
40	Nehalem Bay, OR	0	0.5	$0	$0	$0

EXHIBIT 2-6. SUMMARY OF IMPACTS TO IN-WATER CONSTRUCTION ACTIVITIES BY UNIT

UNIT	DESCRIPTION	ACTIVITY COUNT (ESTIMATED ANNUAL NUMBER OF PROJECTS)	PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)		
				LOW	MID	HIGH
1	Elkhorn Slough, CA	0	1.0	$0	$0	$0
2	Upper Sacramento River, CA	4	0.2	$2,600	$11,900	$21,200
3	Lower Sacramento River, CA	12	0.2	$7,800	$35,700	$63,600
5	Sutter Bypass, CA	0	0.2	$0	$0	$0
6	Lower Feather River, CA	1	0.2	$650	$2,980	$5,300
7	Lower Yuba River, CA	0*	0.2	$65	$298	$530
8	Sacramento-San Joaquin Delta, CA	27	0.2	$17,600	$80,300	$143,000
9	Suisun Bay, CA	6	0.2	$3,900	$17,900	$31,800
10	San Pablo Bay, CA[1]	3	0.2	$2,170	$9,920	$17,700
11	San Francisco Bay, CA[1]	19	0.2	$12,400	$56,500	$101,000
12	Tomales Bay, CA	0	0.2	$0	$0	$0
13	Noyo Harbor, CA	0	0.2	$0	$0	$0
14	Eel River, CA	4	0.2	$2,600	$11,900	$21,200
15	Humboldt Bay, CA	1	0.2	$650	$2,975	$5,300
16	Klamath River, CA	3	0.2	$1,950	$8,930	$15,900
17	Rogue River, OR	1	0.2	$325	$1,490	$2,650
18	Coos Bay, OR	2	0.5	$2,440	$11,200	$19,900
19	Winchester Bay, OR	2	0.5	$2,440	$11,200	$19,900
20	Siuslaw River, OR	1	0.5	$1,630	$7,440	$13,300
21	Alsea River, OR	1	0.5	$813	$3,720	$6,630
22	Yaquina River, OR	0	0.5	$0	$0	$0
23	Tillamook Bay, OR	2	0.5	$2,440	$11,200	$19,900
24a	Lower Columbia River Estuary, OR	77	0.2	$50,100	$229,000	$408,000
24b	Lower Columbia River, OR	233	0.2	$151,000	$693,000	$1,230,000
25	Willapa Bay, WA	2	1.0	$6,500	$29,750	$53,000
26	Grays Harbor, WA	0*	1.0	$813	$3,719	$6,625
27	Puget Sound, WA	667	0.2	$434,000	$1,980,000	$3,540,000
28	CA-Mexico Border to Monterey Bay, CA	24	1.0	$78,000	$357,000	$636,000
29	Monterey Bay, CA to San Francisco Bay, CA	0	1.0	$0	$0	$0
40	Nehalem Bay, OR	0	0.5	$0	$0	$0

UNIT	DESCRIPTION	ACTIVITY COUNT (ESTIMATED ANNUAL NUMBER OF PROJECTS)	PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)		
				LOW	MID	HIGH

Notes:
* Because an average was used to estimate the annual number of projects, these units are estimated to have an average number of projects between 0.1 and 0.33. Due to rounding, these units appear to have zero projects affected in a given year.

[1] Public comments of the Bay Planning Coalition identified approximately 8 annual transportation projects in San Pablo Bay and San Francisco Bay watersheds between 2008 and 2105 (including both funded and planned projects). These are assumed to be included in the estimated annual 21 in-water construction projects in these two units, but data differences make comparisons difficult. "Comments on the Economic Analysis of the Impacts of Designating Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon", Prepared by Berkeley Economic Consulting for the Bay Planning Coalition, December 22, 2008.

2.3 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON NPDES-PERMITTED FACILITIES[25]

2.3.1 DESCRIPTION OF THREAT

NMFS has identified point source pollution as threats to green sturgeon habitat in 40 units, including eight marine units. According to NMFS, point-source pollution can adversely affect water quality, the availability of food resources, and the quality of the sediment in green sturgeon habitat.

2.3.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

Exhibit 2-7 provides an estimate of the number of NPDES-regulated facilities under EPA's NPDES program for each unit where point source pollution has been identified as a potential threat. The largest number of facilities is found in the Puget Sound and Lower Columbia River and Estuary units, which contain over 1,000 and 300 facilities, respectively. These data are shown graphically in Exhibit 2-8.

[25] Non-point source pollution, including agricultural pesticide use is addressed separately in Section 2.4. Impacts to power plants are considered in Section 2.6. NPDES-permitted construction activity is assumed to be captured as part of the in-stream construction data projections, which are built from section 404 permit databases from the USACE.

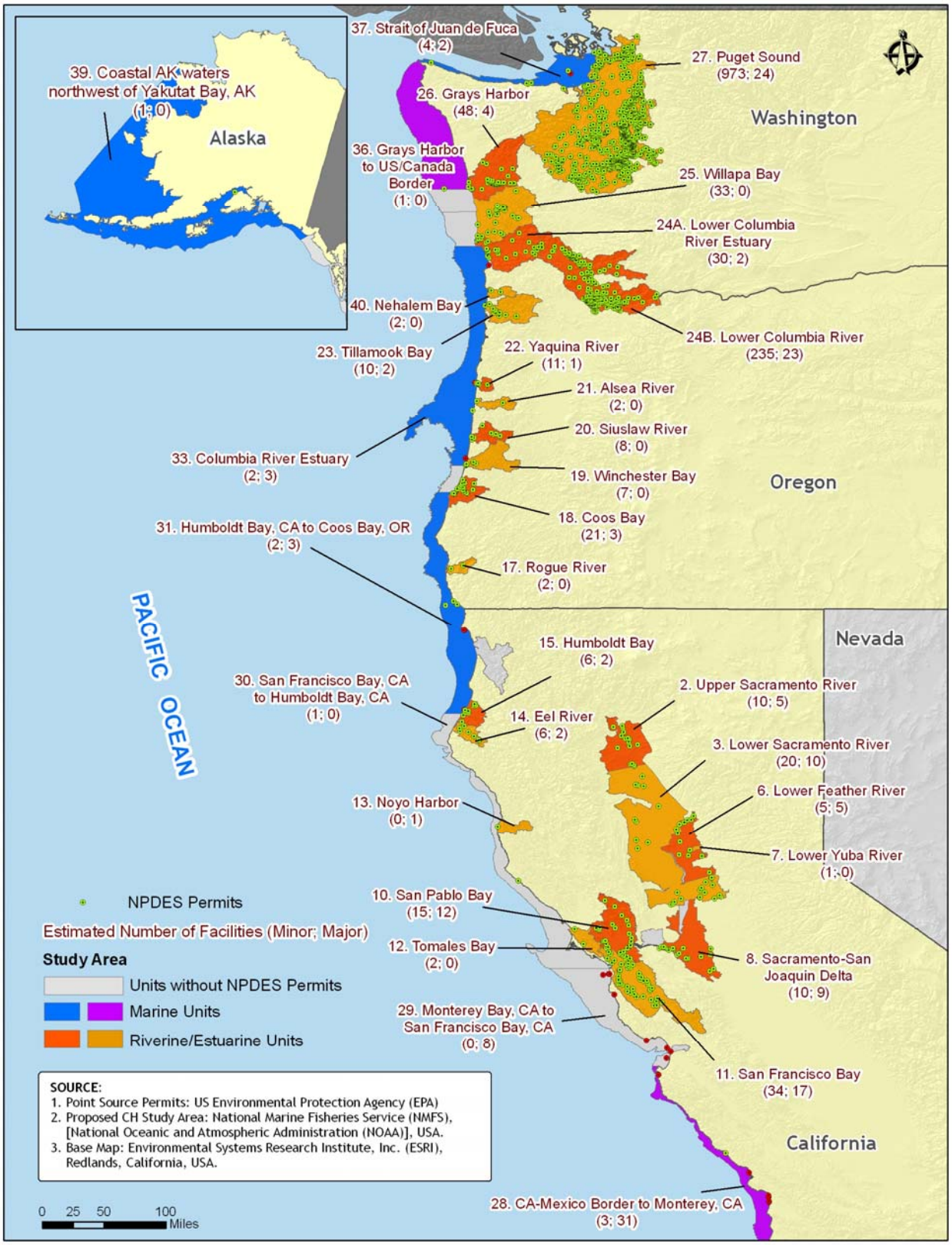
EXHIBIT 2-7. ESTIMATE OF NUMBER OF NPDES-PERMITTED FACILITIES POTENTIALLY AFFECTED BY PROPOSED ACTION

UNIT	DESCRIPTION	ESTIMATED NUMBER OF FACILITIES[1]	
		MINOR	MAJOR
1	Elkhorn Slough, CA	0	0
2	Upper Sacramento River, CA	10	5
3	Lower Sacramento River, CA	20	10
4	Yolo Bypass, CA	0	0
5	Sutter Bypass, CA	0	0
6	Lower Feather River, CA	5	5
7	Lower Yuba River, CA	1	0
8	Sacramento - San Joaquin Delta, CA	10	9
9	Suisun Bay, CA	0	0
10	San Pablo Bay, CA	15	12
11	San Francisco Bay, CA	34	17
12	Tomales Bay, CA	2	0
13	Noyo Harbor, CA	0	1
14	Eel River, CA	6	2
15	Humboldt Bay, CA	6	2
16	Klamath/Trinity River, CA	0	0
17	Rogue River, OR	2	0
18	Coos Bay, OR	21	3
19	Winchester Bay, OR	7	0
20	Siuslaw River, OR	8	0
21	Alsea River, OR	2	0
22	Yaquina River, OR	11	1
23	Tillamook Bay, OR	10	2
24a	Lower Columbia River Estuary, OR	30	2
24b	Lower Columbia River, OR	235	23
25	Willapa Bay, WA	33	0
26	Grays Harbor, WA	48	4
27	Puget Sound, WA	973	24
28	CA/Mexico border to Monterey Bay, CA	3	31
29	Monterey Bay, CA to San Francisco Bay, CA	0	8
30	San Francisco Bay, CA to Humboldt Bay, CA	1	0
31	Humboldt Bay, CA to Coos Bay, OR	2	3
33	Winchester Bay, OR to Columbia River and Estuary	2	3
36	Grays Harbor, WA to Cape Flattery, WA	1	0

UNIT	DESCRIPTION	ESTIMATED NUMBER OF FACILITIES[1]	
		MINOR	MAJOR
37	Strait of Juan de Fuca to Rosario Strait, WA	4	2
38	AK/Canada border to Yakutat Bay, AK	0	0
39	Coastal AK waters northwest of Yakutat Bay, AK	1	0
40	Nehalem Bay, OR	2	0

Note:
[1] The number of NPDES facilities is likely somewhat underestimated because, for a large number of facilities, EPA's dataset did not contain sufficient information to determine facility location at a sub-county level.
Source: Permit Compliance System (PCS) of the Envirofacts online program developed by United States Environmental Protection Agency (EPA). Data accessed at http://www.epa.gov/enviro/html/pcs/adhoc.html on May 1, 2008.

EXHIBIT 2-8. NPDES-PERMITTED FACILITIES IN UNITS POTENTIALLY AFFECTED BY PROPOSED ACTION



2.3.3 REGULATORY BASELINE

Under the National Pollutant Discharge Elimination System (NPDES) program, EPA sets pollutant-specific limits on the point source discharges for major industries and provides permits to individual point sources that apply to these limits. EPA delegates permitting authority to States and Tribes pursuant to the requirements of the Clean Water Act.[26] Athough development and implementation of State water quality standards are subject to a section 7 consultation between NOAA and the EPA, NOAA may review each individual NPDES permit application to confirm that listed species are not adversely affected by water quality impacts. If the proposed permit allows water quality impacts that may adversely affect listed species, NOAA may object to issuance of the permit, and the State may ask the applicant to alter the permit to meet the standards.

For example, in Washington, direct sewage dischargers and municipalities with storm water runoff must obtain a NPDES Permit from WDOE for non-Federal facilities and from the EPA for Federal facilities. WDOE also issues permits for discharges to sewers and to the ground.[27] Although a Federal nexus does not apply directly to each NPDES-permitted facility (due to EPA's delegation of permitting to state water quality agencies), this analysis includes the project modifications and costs resulting from future compliance with any new standards by NPDES-permitted facilities that may be associated with critical habitat for green sturgeon.

2.3.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON NPDES-PERMITTED FACILITIES

Although there have been no formal consultations regarding water quality issues associated with green sturgeon to date, a number of such consultations have occurred with regard to Pacific salmon species. NOAA Fisheries has consulted with EPA on various aspects of its approval of State Water Quality Standards, including development of Total Maximum Daily Loads (TMDLs), review of non-temperature related Water Quality Standards, clean up of Superfund sites, and review of pesticide applications.

In general, the only project modification resulting from consultation for salmon or steelhead species pertained to water temperature controls. While NPDES-permitted facilities have always been required to adhere to certain temperature criteria associated with effluent discharge, the 2003 guidance has led to stricter standards where salmon and steelhead are known to spawn or rear. As a result, this analysis focuses on costs associated with the temperature criteria.

The EPA and NOAA Fisheries authored guidance to States and tribes in 2003 on the development of temperature criteria deemed protective of salmon and steelhead. As a

[26] A 2001 Memorandum of Agreement between the EPA, NMFS, and the Fish and Wildlife Service provides for interagency coordination regarding these transfers. The U.S. Environmental Protection Agency, Department of the Interior, and the Department of Commerce, *Memorandum of Agreement Between the Environmental Protection Agency, Fish and Wildlife Service and National Marine Fisheries Service Regarding Enhanced Coordination Under the Clean Water Act and Endangered Species Act; Notice*, Federal Register Vol. 66, No. 36, February 22, 2001.

[27] State of Washington Puget Sound Water Quality Action Team, "Puget Sound Water Quality Management Plan," Adopted December 14, 2000, page 44.

result, NPDES-permitted facilities in the Pacific Northwest are required to ensure effluent discharge does not raise the temperature in receiving waters above site-specific minimum temperature standards.[28]

This analysis estimates that if modifications to pollution discharge operations are required to comply with the temperature control criteria, NPDES-permitted facilities may identify and employ a number of temperature control procedures through Temperature Management Plans (TMPs). Control efforts may include process optimization, pollution prevention, land application, and/or cooling towers. The analysis estimates the operations and maintenance (O&M) costs and capital expenditures necessary to comply with the temperature control criteria.

Impacts of section 7 implementation resulting from NOAA's consultation on temperature control criteria will vary depending on a facility's compliance with existing temperature standards and whether it is subject to these requirements at all. To reflect this uncertainty, this analysis assumes that any "major" NPDES-permitted facility (as defined by EPA) has a 25 percent probability of requiring compliance-related expenditures, and any "minor" NPDES-permitted facility has a 20 percent chance of incurring related costs. These assumptions are based on an EPA assessment of impacts of water control criteria on permitted facilities which concluded that one of four major facilities would require significant capital expenditures along with incurring incremental O&M costs to comply. Of five minor facilities, only one would incur incremental O&M costs, while the remaining four would experience no incremental costs.[29]

Using EPA data, as interpreted in the West Coast salmon and steelhead economic analysis of critical habitat designation economic analysis, major facilities are assumed to require significant capital expenses to comply with the temperature criteria, while minor facilities are assumed only to require O&M expenditures. This analysis assumes that minor facilities will incur costs of $0 to $14,000 annually (2007$) to comply with temperature control criteria, while major facilities will incur $5,500 to $36,000 annually in O&M costs. In addition, major facilities are assumed to incur capital costs of $446,000.[30] Based on EPA's sample of facilities, capital costs are assumed to be incurred in the first year, and operations and maintenance (O&M) costs are incurred uniformly over a 20 year period. Twenty-year annualized costs are therefore estimated to be $504,700 to $827,800 ($46,640 to $78,140 annualized).

Existing Federal standards and regulations appear to offer the green sturgeon a high level of baseline protection. In addition, based on several past examples of formal

[28] U.S. Environmental Protection Agency, EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards, EPA 910-B-03-002, April 2003.

[29] These compliance costs are based on a sample of major and minor NPDES-permitted facilities considered in EPA's Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon. Science Applications International Cooperation: Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon . Science Applications International Corporation. Reston, VA. 2003. EPA No. 68-C-99-252.

[30] Science Applications International Cooperation: Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon . Science Applications International Corporation. Reston, VA. 2003. EPA No. 68-C-99-252; Adapted from NMFS, Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs, Long Beach, CA, August 2005. Adjusted to 2007 dollars using the U.S. Bureau of Economic Analysis, National Economic Accounts, National Income and Product Accounts table, 2008.

consultations, it appears that, in some cases if not all, conservation measures for green sturgeon may be identified together with other salmonid species when they are present. That is, salmonid species and their associated critical habitats may provide a strong baseline protection for green sturgeon critical habitat where habitats coexist. As such, it is possible that few additional requirements could result from green sturgeon critical habitat designation. In an attempt to be conservative, i.e., more likely to overstate costs than understate costs, this analysis assumes that given the universe of NPDES-permitted facilities, green sturgeon critical habitat would be expected to result in an additional 10 percent of projects undertaking project modifications than would have occurred without green sturgeon. In areas where the study area overlaps Oregon Coast coho habitat, which was listed after the green sturgeon (December 2007), this analysis assumes that green sturgeon critical habitat will increase the number of projects needing to undertake project modifications by 50 percent. Appendix E provides a sensitivity analysis for these assumptions, providing estimates assuming that green sturgeon critical habitat is responsible for the generation of all project modification costs for all projects.

2.3.5 SUMMARY OF IMPACTS TO NPDES-PERMITTED FACILITIES

Exhibit 2-9 below presents a summary of our findings regarding the economic impacts arising out of special management considerations for NPDES-permitted facilities as a result of this designation. The Puget Sound unit is estimated to be associated with the highest economic impacts related to management of pollutant discharge into water bodies. The Lower Columbia River and Estuary unit is also associated with a substantial number of facilities releasing pollutants, and which may be affected by the proposed action.

EXHIBIT 2-9. SUMMARY OF IMPACTS TO NPDES-PERMITTED FACILITIES

UNIT	DESCRIPTION	ESTIMATED NUMBER OF FACILITIES[1]		PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)					
					MINOR			MAJOR		
		MINOR	MAJOR		LOW	MID	HIGH	LOW	MID	HIGH
1	Elkhorn Slough, CA	0	0	0.2	$0	$0	$0	$0	$0	$0
2	Upper Sacramento River, CA	10	5	0.1	$0	$1,440	$2,880	$5,960	$7,860	$9,770
3	Lower Sacramento River, CA	20	10	0.1	$0	$2,880	$5,760	$11,900	$15,720	$19,500
4	Yolo Bypass, CA	0	0	0.1	$0	$0	$0	$0	$0	$0
5	Sutter Bypass, CA	0	0	0.1	$0	$0	$0	$0	$0	$0
6	Lower Feather River, CA	5	5	0.1	$0	$720	$1,440	$5,960	$7,860	$9,770
7	Lower Yuba River, CA	1	0	0.1	$0	$144	$288	$0	$0	$0
8	Sacramento - San Joaquin Delta, CA	10	9	0.1	$0	$1,440	$2,880	$10,700	$14,150	$17,600
9	Suisun Bay, CA	0	0	0.1	$0	$0	$0	$0	$0	$0
10	San Pablo Bay, CA	15	12	0.1	$0	$2,160	$4,320	$14,300	$18,900	$23,400
11	San Francisco Bay, CA	34	17	0.1	$0	$4,900	$9,790	$20,200	$26,700	$33,200
12	Tomales Bay, CA	2	0	0.1	$0	$288	$576	$0	$0	$0
13	Noyo Harbor, CA	0	1	0.1	$0	$0	$0	$1,190	$1,570	$1,950
14	Eel River, CA	6	2	0.1	$0	$864	$1,730	$2,380	$3,140	$3,910
15	Humboldt Bay, CA	6	2	0.1	$0	$864	$1,730	$2,380	$3,140	$3,910
16	Klamath/Trinity River, CA	0	0	0.1	$0	$0	$0	$0	$0	$0
17	Rogue River, OR	2	0	0.2	$0	$576	$1,150	$0	$0	$0
18	Coos Bay, OR	21	3	0.1	$0	$3,020	$6,050	$3,570	$4,720	$5,860
19	Winchester Bay, OR	7	0	0.1	$0	$1,010	$2,020	$0	$0	$0
20	Siuslaw River, OR	8	0	0.1	$0	$1,150	$2,300	$0	$0	$0
21	Alsea River, OR	2	0	0.1	$0	$288	$576	$0	$0	$0
22	Yaquina River, OR	11	1	0.1	$0	$1,580	$3,170	$1,190	$1,580	$1,950
23	Tillamook Bay, OR	10	2	0.1	$0	$1,440	$2,880	$2,380	$3,140	$3,910
24a	Lower Columbia River Estuary, OR	30	2	0.1	$0	$4,320	$8,640	$2,380	$3,140	$3,910

UNIT	DESCRIPTION	ESTIMATED NUMBER OF FACILITIES[1]		PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)					
					MINOR			MAJOR		
		MINOR	MAJOR		LOW	MID	HIGH	LOW	MID	HIGH
24b	Lower Columbia River, OR	235	23	0.1	$0	$33,800	$67,700	$27,400	$36,200	$44,900
25	Willapa Bay, WA	33	0	0.2	$0	$9,510	$19,010	$0	$0	$0
26	Grays Harbor, WA	48	4	0.2	$0	$13,800	$27,700	$9,530	$12,600	$15,600
27	Puget Sound, WA	973	24	0.1	$0	$140,100	$280,000	$28,600	$37,700	$46,900
28	CA/Mexico border to Monterey Bay, CA	3	31	0.2	$0	$864	$1,730	$73,800	$97,500	$121,000
29	Monterey Bay, CA to San Francisco Bay, CA	0	8	0.2	$0	$0	$0	$19,100	$25,200	$31,300
30	San Francisco Bay, CA to Humboldt Bay, CA	1	0	0.2	$0	$288	$576	$0	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	2	3	0.2	$0	$576	$1,150	$7,150	$9,430	$11,700
33	Winchester Bay, OR to Columbia River and Estuary	2	3	0.2	$0	$576	$1,150	$7,150	$9,430	$11,700
36	Grays Harbor, WA to Cape Flattery, WA	1	0	0.2	$0	$288	$576	$0	$0	$0
37	Strait of Juan de Fuca to Rosario Strait, WA	4	2	0.2	$0	$1,150	$2,300	$4,760	$6,290	$7,810
38	AK/Canada border to Yakutat Bay, AK	0	0	0.2	$0	$0	$0	$0	$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	1	0	0.2	$0	$288	$576	$0	$0	$0
40	Nehalem Bay, OR	2	0	0.2	$0	$288	$576	$0	$0	$0

Source: Permit Compliance System (PCS) of the Envirofacts online program developed by United States Environmental Protection Agency (EPA). Data accessed at http://www.epa.gov/enviro/html/pcs/adhoc.html on May 1, 2008.

[1] The number of NPDES facilities is likely somewhat underestimated because, for a large number of facilities, EPA's dataset did not contain sufficient information to determine facility location at a sub-county level.

2.4 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON AGRICULTURAL PESTICIDE APPLICATION

2.4.1 DESCRIPTION OF THREAT

NMFS identified agricultural pesticide application activities as a threat to the essential features of green sturgeon critical habitat in six units: Lower Sacramento River, Yolo Bypass, Sutter Bypass, Lower Feather River, Lower Yuba River, and Humboldt Bay. Pesticide application is believed to affect water quality, sediment quality, and food resources available within proposed critical habitat areas.

This analysis assumes that agricultural pesticide use is the primary non-point source pollution issue that would be addressed by green sturgeon critical habitat. Potential threats from industrial or municipal runoff do not have a clear Federal connection; therefore, they are assumed to be dealt with primarily outside of the section 7 consultation realm.

Note that agricultural operations have the potential to also be impacted by changes to flow regimes at dams and water diversions.[31] These potential impacts are discussed in Section 2.5.

2.4.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

The units where agricultural pesticide is considered a threat are located in the Sacramento Valley, which is the northern part of the Central Valley of California. The Central Valley is the primary source for a number of food products in the United States, including tomatoes, almonds, grapes, cotton, apricots, and asparagus. Within the HUC5 watersheds that feed the affected units are approximately 759,300 acres of cropland. This analysis identifies cropland using the number of acres within these affected HUCs for each of three crop types using GIS data provided by the California Department of Conservation's Farmland Mapping & Monitoring Program (FMMP).[32] The distribution of these croplands are shown in Exhibits 2-10 and 2-11.

[31] See, for example, Public Comment, Tehama-Colusa Canal Authority, December 22, 2008, Public Comment, State Water Contractors and San Luis & Delta-Mendota Water Authority, December 22, 2008, and Public Comment, California Farm Bureau Federation, November 7, 2008.

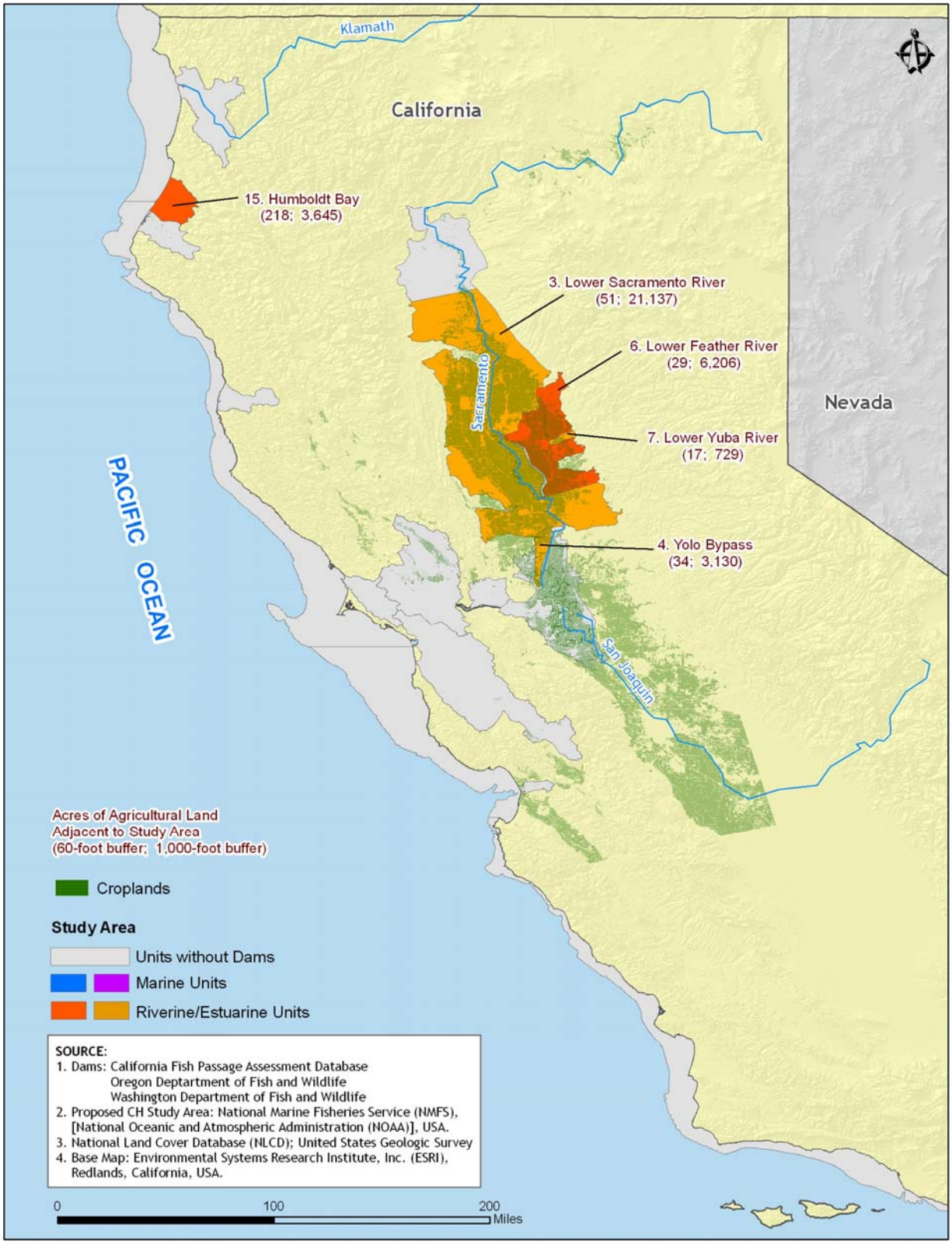
[32] California Department of Conservation. Farmland Mapping & Monitoring Program (FMMP). Year 2006 GIS data downloaded from ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/2006.

EXHIBIT 2-10. ESTIMATE OF ACRES FARMED (ALL CROPS) IN UNITS POTENTIALLY AFFECTED BY PROPOSED ACTION

UNIT	DESCRIPTION	ESTIMATED ACRES (60 FOOT BUFFER)[1]	ESTIMATED ACRES (1000 FOOT BUFFER)[1]
3	Lower Sacramento River, CA	51	21,137
4	Yolo Bypass, CA	34	3,130
5	Sutter Bypass, CA	0	0
6	Lower Feather River, CA	29	6,206
7	Lower Yuba River, CA	17	729
12	Tomales Bay, CA	0	0
15	Humboldt Bay, CA	218	3,645

Source: California Department of Conservation. Farmland Mapping & Monitoring Program (FMMP). Year 2006 GIS data downloaded from ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/2006.

EXHIBIT 2-11. POTENTIAL ANNUALIZED IMPACTS TO CROP PRODUCTION WITHIN POTENTIALLY AFFECTED CRITICAL HABITAT (2007$)



2.4.3 REGULATORY BASELINE

Under the ESA, the EPA must consult with the Fish and Wildlife Service and NMFS to ensure that the registration of products under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) complies with section 7 of the ESA. Historically, there were few consultations analyzing the impacts of product registration on anadromous species. In January 2004, the EPA was enjoined from authorizing the application of a set of pesticides within certain distances from "salmon-supporting waters."[33] EPA was required to consult with NMFS concerning possible adverse effects of pesticide applications on salmon and steelhead protected under the ESA.

The court imposed two types of restrictions on application of pesticides covered in the lawsuit. For aerial applications, no pesticides can be applied within 100 yards of "salmon-supporting waters"; for ground applications, the distance is 20 yards.[34] These measures are mandatory in Washington, Oregon, and California, pending completion of consultation with EPA, or EPA determination that the pesticides have no affect, or are unlikely to adversely affect listed salmonid species.[35] The green sturgeon critical habitat rule states that compliance with EPA standards may suffice to avoid take of green sturgeon for these activities.

Since 2004, some consultations on specific pesticides have been completed for salmon and steelhead species. In 2008, NMFS determined that current use of chlorpyrifos, diazinon, and malathion is likely to jeopardize the continued existence of 28 listed salmonid ESUs. NMFS provided EPA with reasonable and prudent alternatives (RPAs), including buffers and vegetative strips, to reduce pesticide exposure to listed salmon. The RPA includes no-application buffers of 500 feet for ground application and 1000 feet for aerial application.[36]

On April 20, 2009, NMFS released a biological opinion on the effects of the U.S. Environmental Protection Agency's (EPA) proposed registration of pesticide products containing the active ingredients carbaryl, carbofuran, and methomyl on endangered species, threatened species, and critical habitat that has been designated for those species.[37] NMFS determined that current use of carbaryl and carbofuran is likely to jeopardize the continued existence of 22 listed salmonid ESUs, and methomyl is likely to jeopardize the continued existence of 19 listed salmonid ESUs. Again, NMFS provided EPA with reasonable and prudent alternatives (RPAs), including buffers and vegetative

[33] Washington Toxics Coalition, *et al*. v. EPA, No. 04-35138 (W.D. WA), 22 January 2004.

[34] Ibid.

[35] California Department of Pesticide Regulation, Endangered Species Project Salmonid Habitat Locations in California, Accessed at http://www.cdpr.ca.gov/docs/endspec/salmonid.htm on July 20, 2009; NMFS, Silver Springs, MD Office, Endangered Species Act Section 7 Formal Consultation on EPA's proposed registration of pesticide products containing the active ingredients carbaryl, carbofuran, and methomyl on 28 listed Pacific salmonids, April 30, 2009.

[36] NMFS (2008). National Marine Fisheries Service endangered species act section 7 consultation: Environmental Protection Agency registration of pesticides containing chlorpyrifos, diazinon, and malathion. Biological Opinion. Silver Spring, MD, U.S. Department of Commerce: 482.

[37] NMFS, Silver Springs, MD Office, Endangered Species Act Section 7 Formal Consultation on EPA's proposed registration of pesticide products containing the active ingredients carbaryl, carbofuran, and methomyl on 28 listed Pacific salmonids, April 30, 2009.

strips, to reduce pesticide exposure to listed salmon.[38] Established buffers only apply to those salmonid habitats where NMFS concluded jeopardy or the destruction or adverse modification of designated critical habitat for listed Pacific salmonids.

Nonetheless, a number of pesticides have yet to be consulted on, and as such, have in place the court-ordered buffers. Because the pesticides continue to be reviewed by EPA and NMFS, this analysis assumes that for affected green sturgeon critical habitat areas, the range of potential buffers are from 60 feet (20 yards for ground applications , as in the injunction) to 1000 feet (as for aerial applications in the recent consultations).

2.4.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON AGRICULTURAL PESTICIDE APPLICATION ACTIVITIES

This analysis assumes that the court-ordered injunction restricting pesticide use will provide necessary protections for green sturgeon in critical habitat areas. The analysis utilizes the methods for estimating impacts of the injunction for pesticides to crop production developed as part of the economic analysis of critical habitat for the Pacific salmon and steelhead. The methodology is as follows:

1. Assume that pesticide restrictions on 60 foot and 1000 foot areas surrounding green sturgeon critical habitat will preclude harvest on three primary crop types: oil send and grain farming; vegetable and melon farming; and fruit and tree nut farming.
2. Estimate the number of affected acres of each crop type within the buffered areas using data from the U.S. Geological Survey's National Land Cover Data (NLCD).[39] The land cover types used were small grains (NLCD Code 83), row crops (NLCD code 82), and orchards/vineyard/other (NLCD Code 61).
3. To assess the potential annual lost crop value in critical habitat areas, this analysis obtained from the National Agriculture Statistics Service (NASS) county-specific data on the net operational gain (ignoring government payments) per farm, acres of farm in production, number of farms in production, and related data for three crop categories.[40] The analysis then produces an estimate of the average net operational dollar gain per acre by crop type and county.
4. To determine an estimate of the foregone value of cropland due to pesticide restrictions, the analysis uses the per acre value of three crop categories, oil seeds and grains, vegetables and melons, and fruit and tree nuts, combined with the geographic estimates of harvest within the 60 and 1000 foot buffer areas for each watershed.

[38] NMFS (2008). National Marine Fisheries Service endangered species act section 7 consultation: Environmental Protection Agency registration of pesticides containing chlorpyrifos, diazinon, and malathion. Biological Opinion. Silver Spring, MD, U.S. Department of Commerce: 482.

[39] 2001 National Land Cover Data is available at http://www.epa.gov/mrlc/nlcd-2001.html.

[40] National Agricultural Statistics Service, 2002 Census of Agriculture, net cash farm income of operations by county for each of three crop types: oil send and grain farming; vegetable and melon farming; and fruit and tree nut farming. Data pull by Jim Burt, NASS Datalab, June 2004.

5. The analysis assumes that the impacts of the agricultural pesticide application restrictions are certain and borne as an annual impact. Because we have no data on the distribution of spraying by application type (aerial or ground), we assume there is a 50 percent probability of each type for the "mid" estimate. For the High and Low cost estimates, we assume that pesticide applications are 100 percent aerial and 100 percent ground, respectively, which implies that all buffers would be 100 yards and 20 yards, respectively.

EXHIBIT 2-12. ESTIMATED PER ACRE IMPACTS BY CROP TYPE

TYPE OF CROP	ESTIMATED ANNUAL IMPACTS PER ACRE, CROSS-COUNTY AVERAGE (HIGH AND LOW VALUES), 2007 DOLLARS
Oil seed and grain	$68 (-$1,079 to $291)
Vegetable and melon	$1,138 (-$858 to $4,489)
Fruit and tree nut	$696 (-$5,628 to $4,931)

This exhibit present ranges for crop types across the critical habitat area. Specific county estimates were used to calculate impacts by watershed and unit.
Sources: National Agricultural Statistics Service, 2002 Census of Agriculture, net cash farm income of operations by county. Data pull by Jim Burt, NASS Datalab, June 2004; National Marine Fisheries Service. Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs. August 2005.

This analysis focuses on potential impacts to pesticide use. To the extent that management actions are needed for herbicide use, they could include the following best management practices for application of herbicides that were outlined in a consultation on salmon and steelhead species:[41]

- All vegetation removal will be restricted to above the ground surface, thus leaving the root systems intact and retaining bank stability.
- Within 100 ft of each side of any waterway vegetation taller than 15 ft may be cut to the 15 ft level.
- No Garlon will be applied with a 100-foot buffer on either side of all streams with ESA-listed fish. Rodeo may be used within this area.
- Trained individuals will apply herbicides using only low pressure spot spray and direct wicking application methods. All herbicide applications will be conducted in accordance with label instructions.
- Spray activities will only occur during dry, calm weather conditions to prevent drift and runoff. No spraying will occur during winds greater than five mph or during rain events. No spraying of the herbicide will occur if rain is forecast within 24 hours.

[41] NMFS, Northwest Region, Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation on the Port of St. Helens Industrial Outfall and Portland General Electric Power Plant, Port Westward Industrial Park, Columbia River, Columbia County, Oregon (Corps No. 200200448), August 1, 2003.

- Spill response procedures have been developed and reviewed with each applicator before commencing herbicide application operations.
- All chemical storage, chemical mixing, and post-application equipment cleaning is completed in such a manner as to prevent the potential contamination of any perennial or intermittent waterbody, unprotected ephemeral waterway, or wetland.
- Use only those sprayers with a single nozzle, such as backpack or hand sprayers, to spray the herbicide in the riparian zone.
- All hand operated application equipment is leak and spill proof.

Impacts to herbicide use are not expressly quantified in this analysis, but are captured to the extent that lost crop value within riparian buffers represent the expected effect of conservation efforts.

Caveats

The Proposed Action states that monitoring or voluntary compliance with EPA standards may suffice to avoid take of green sturgeon for these activities. Listed salmon and steelhead species are found in all units where agricultural pesticide application is a threat to green sturgeon habitat. Thus, to the extent that the current injunction and current biological opinions are followed within proposed green sturgeon critical habitat, it appears likely that the salmon and steelhead injunction and subsequent RPAs will provide adequate protections for green sturgeon. As such, green sturgeon critical habitat would not be expected to add costs to those already expected to occur without the current rulemaking. However, due to its longevity, biologists worry that green sturgeon may be more sensitive to pesticide bioaccumulation over the long term.[42] Since the additional sensitivities of green sturgeon are not well understood, this analysis assumes that green sturgeon may require protections equal to those required for salmon species.

This analysis also assumes that the court-ordered injunction restricting pesticide use and current biological opinions represent the likely outcome of section 7 consultations for this activity. In fact, other outcomes may occur. For example, for some pesticides, the injunction may at some point be lifted, removing buffers in some areas. This analysis also assumes that no adjustments in cropping or pesticide practices are possible that would allow continued crop production without these pesticides.

2.4.5 SUMMARY OF IMPACTS TO AGRICULTURAL PESTICIDE APPLICATION ACTIVITIES

Exhibit 2-13 below presents a summary of our findings regarding the economic impacts arising out of special management considerations for agricultural pesticide application.

[42] Personal communication with NMFS, Sacramento Office, on March 10, 2008.

EXHIBIT 2-13. SUMMARY OF IMPACTS TO AGRICULTURAL PESTICIDE APPLICATION

UNIT	DESCRIPTION	ESTIMATED FARMED ACRES, 60 FOOT BUFFER	ESTIMATED FARMED ACRES, 1000 FOOT BUFFER	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)		
				LOW	MID	HIGH
3	Lower Sacramento River, CA	51	20,844	$11,900	$2,670,00	$5,330,000
4	Yolo Bypass, CA	34	3,081	$9,840	$449,000	$888,000
5	Sutter Bypass, CA	0	0	$0	$0	$0
6	Lower Feather River, CA	6	6,116	$15,400	$1,470,000	$2,920,000
7	Lower Yuba River, CA	17	729	$46,000	$228,000	$410,000
12	Tomales Bay, CA	0	0	$0	$0	$0
15	Humboldt Bay, CA	1	35	$129	$3,710	$7,280

2.5 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON DAMS AND WATER DIVERSIONS

2.5.1 DESCRIPTION OF THREAT

In the respective regions affected by the critical habitat rule, dams and water diversion projects provide water, hydropower, and flood protection to a wide variety of public and private uses. Generally, Federal agencies, State agencies, regional public agencies, and regional private agencies supply water to end users by means of highly developed water systems consisting of dams and reservoirs, pumping plants, power plants and aqueducts. Agricultural operations rely on water diversion for irrigation of crops. Municipal suppliers provide water and power for both commercial and residential use.

The rule designating critical habitat for green sturgeon states that dam operations and water diversions may adversely alter water flow and quality and block green sturgeon passage. Because passage is considered a primary constituent element for green sturgeon, installation of fish screens on water diversions may be needed to prevent adverse modification. In addition, dam operations may alter substrate quality and depth.

Dams are listed as threats in 10 units within the study area: Upper Sacramento River, Lower Sacramento River, Yolo Bypass, Sutter Bypass, Lower Feather River, Lower Yuba River, Sacramento – San Joaquin Delta, Klamath/Trinity Rivers, Lower Columbia River Estuary, and the Lower Columbia River. Water diversions have been identified as threats in nine units: Upper Sacramento River, Lower Sacramento River, Yolo Bypass, Sutter Bypass, Lower Feather River, Lower Yuba River, Sacramento-San Joaquin Delta, Tomales Bay in California, and the Alsea River in Oregon.

2.5.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

Exhibit 2-14 summarizes the primary sources of data on dams, and other fish passage barriers and water diversions for California, Oregon and Washington.[43] These databases identify the type (dam, road crossing, tidegate, diversion etc.) and location of potential barriers to fish passage and also include best available information on whether efforts have been made to install fish screens or other structures to facilitate fish passage through the barrier. However, such information still remains unavailable for a majority of the mapped barriers. Based on these data, this analysis identifies the dams and water diversions for which project modifications may be required as a result of the proposed critical habitat for green sturgeon. Exhibits 2-15 and 2-16 list the number of known dams and water diversions, respectively, that may affect green sturgeon habitat in proposed units for which dams and water diversions have been identified as threats. These data are shown graphically in Exhibits 2-17 and 2-18.

EXHIBIT 2-14. GIS DATABASES FOR WATER DIVERSIONS AND FISH PASSAGE BARRIERS BY STATE

STATE	DATABASE DESCRIPTION
California	California Fish Passage Assessment Database (PAD) and Fish Screen and Fish Passage Program (FSFPP). PAD is an ongoing inventory (available via internet download) of known and potential barriers to anadromous fish in California. This dataset also includes FSFPP's inventories of all screened and unscreened diversions and fish passage problems for the Central and San Joaquin Valley region.
Oregon	Oregon Department of Fish & Wildlife (ODFW) County Culvert Inventory Database. ODFW maintains a dataset that contains an inventory of barriers to fish passage that potentially affect anadromous and/or resident fish migration within the state of Oregon. The ODFW barrier database has been developed over the past several years primarily through the compilation of data from published reports and databases.
Washington	Washington Department of Fish and Wildlife (WDFW) Fish Passage and Diversion Screening Inventory (FPDSI). WDFW's database contains information on location, diversion type, and fish passage status of road-based stream and crossing structures across Washington State. This data set is continually updated as the result of ongoing inventory efforts.

[43] Fish barrier data for Alaska were not available for this analysis.

EXHIBIT 2-15. NUMBER OF DAMS IN CRITICAL HABITAT UNITS IDENTIFIED AS POTENTIALLY AFFECTED BY CRITICAL HABITAT DESIGNATION

UNIT	DESCRIPTION	NUMBER OF DAMS
2	Upper Sacramento River, CA	33
3	Lower Sacramento River, CA	58
4	Yolo Bypass, CA	1
5	Sutter Bypass, CA	0
6	Lower Feather River, CA	16
7	Lower Yuba River, CA	1
8	Sacramento - San Joaquin Delta, CA	7
16	Klamath/Trinity River, CA	0
24A	Lower Columbia River Estuary, OR	21
24B	Lower Columbia River and Estuary, OR	60

Sources: California Fish Passage Assessment Database; Oregon Department of Fish and Wildlife County Culvert Inventory Database; and Washington Department of Fish and Wildlife Fish Passage and Diversion Screening Inventory.

EXHIBIT 2-16. NUMBER OF WATER DIVERSIONS IN CRITICAL HABITAT UNITS IDENTIFIED AS POTENTIALLY AFFECTED BY CRITICAL HABITAT DESIGNATION

UNIT	DESCRIPTION	NUMBER OF WATER DIVERSIONS
2	Upper Sacramento River, CA	45
3	Lower Sacramento River, CA	577
4	Yolo Bypass, CA	78
5	Sutter Bypass, CA	12
6	Lower Feather River, CA	201
7	Lower Yuba River, CA	23
8	Sacramento - San Joaquin Delta, CA	2210
12	Tomales Bay, CA	117
21	Alsea River, OR	1

Sources: California Fish Passage Assessment Database; Oregon Department of Fish and Wildlife County Culvert Inventory Database; and Washington Department of Fish and Wildlife Fish Passage and Diversion Screening Inventory.

EXHIBIT 2-17. DAMS IN UNITS POTENTIALLY AFFECTED BY PROPOSED ACTION

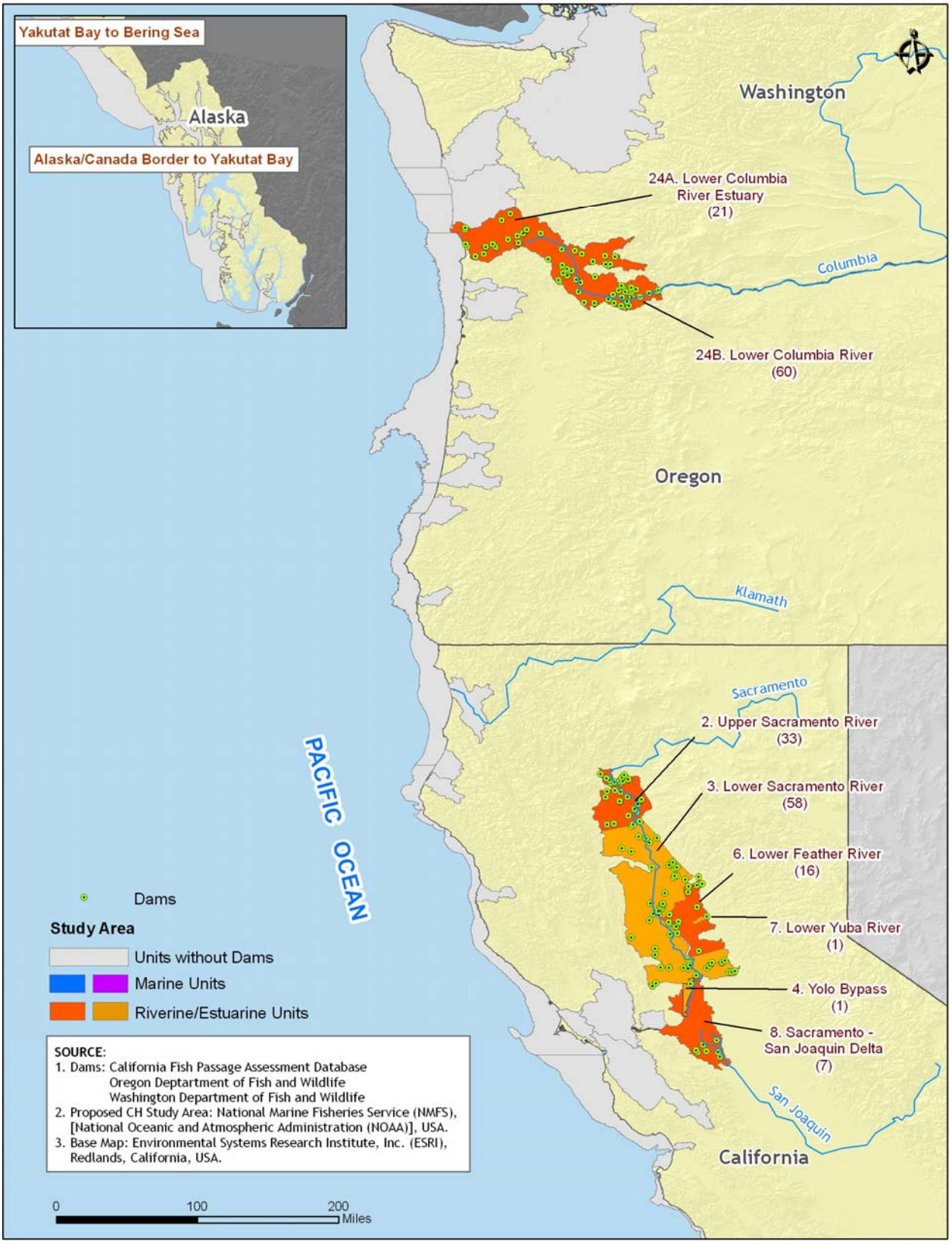
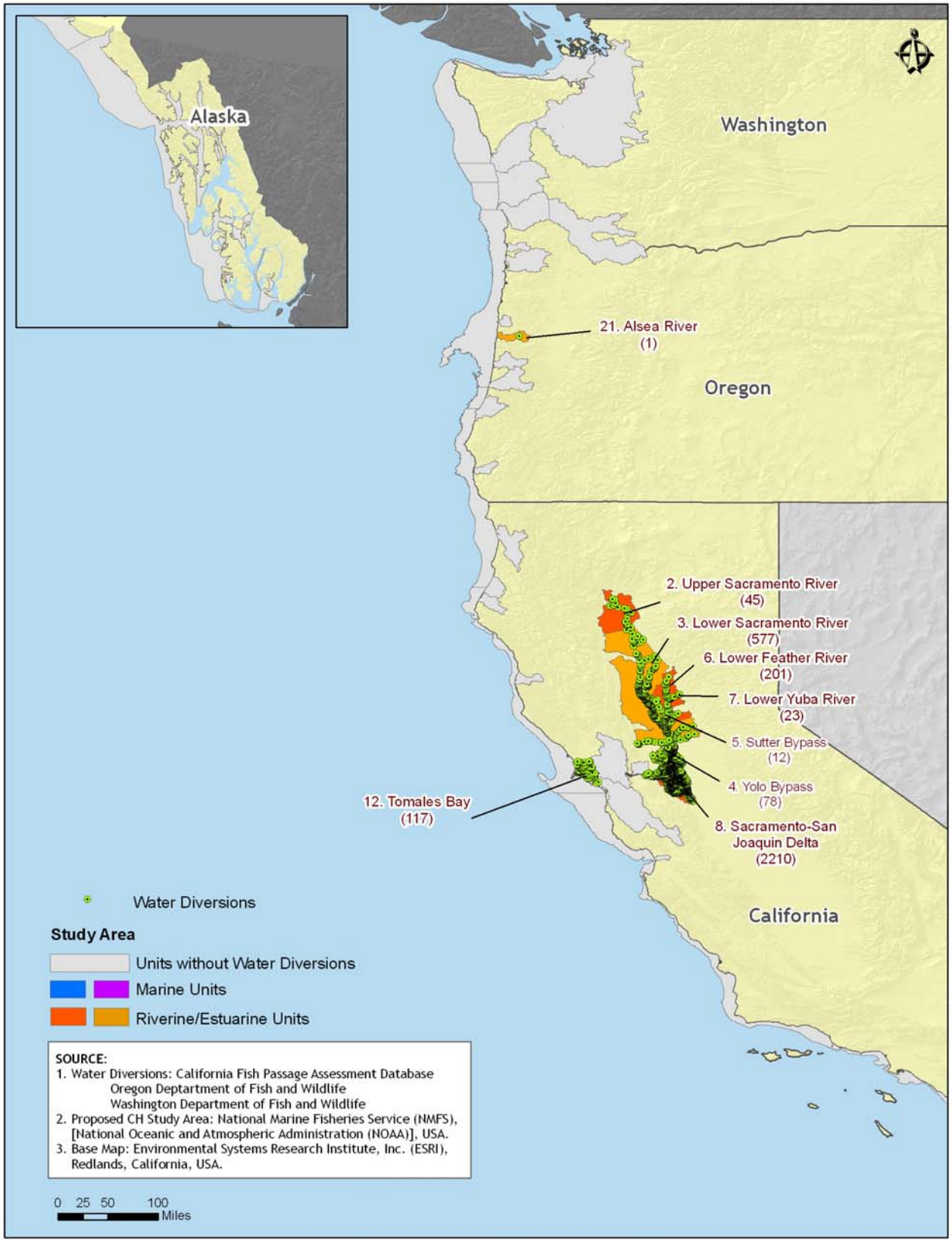


EXHIBIT 2-18. WATER DIVERSIONS IN UNITS POTENTIALLY AFFECTED BY PROPOSED ACTION



Facilities that form part of the California State Water Project (SWP) and the Federal Central Valley Project (CVP) fall within the study area, and are included in Exhibits 2-15 through 2-18. These projects include: Red Bluff Diversion Dam, Oroville Dam, the Tehama-Colusa and Corning Canals, numerous Delta pumping facilities and conveyance canals, as well as smaller water control and diversion facilities throughout the Central Valley.

2.5.3 REGULATORY BASELINE

For hydropower projects, the Federal Power Act may provide protection to green sturgeon. Section 10(j) of the Federal Power Act (FPA) was promulgated to ensure that FERC considers both power and non-power resources during the licensing process. More specifically, section 18 of the FPA states that FERC shall require the construction, operation, and maintenance by a licensee at its own expense of a fishway if prescribed by the Secretaries of Interior (delegated to the Fish and Wildlife Service) and Commerce (NOAA). The recommendation to install or improve a fish ladder may be brought about through consultation under section 7 of the ESA or through the FPA. In the absence of information on which regulation may serve as the causative factor, this analysis considers the cost of these modifications as section 7 impacts.

In addition, as noted in Section 1, nearly all riverine and estuarine areas in the range of the green sturgeon overlap with the range of listed West Coast salmon and steelhead species. A number of efforts are already underway for anadromous species in the area occupied by the green sturgeon concerning fish passage and fish screens. As shown in Exhibit 2-19, and summarized in Appendix B, California, Oregon and Washington maintain a number of regulations that require fish screens or fish passage facilities for new diversions and/or for existing diversions undergoing significant modifications, such as diversion enlarging, relocation, or repair.

Based on the best information currently available, NMFS expects that existing or potential fish screens that comply with salmon criteria will be considered to comply with green sturgeon habitat requirements if they have been approved by a NOAA Engineer. However, NMFS is currently seeking information on differences between the biology of salmon and steelhead and of green sturgeon that may allow them to refine these assumptions.

EXHIBIT 2-19. SUMMARY OF ANADROMOUS FISH PASSAGE/SCREEN PROGRAMS BY STATE

STATE	PROGRAM DESCRIPTION
California	In June 2001 the California Department of Fish and Game released a "Statewide Fish Screening Policy." Under this policy, the installation of fish screens is required for any new diversion, or on the intake of any existing diversion that is either enlarged, relocated, or at which the season of use is changed, in salmon and steelhead (anadromous) waters of the State. In addition, all diversions covered by this section which are located within the essential habitat of a State (CESA) listed species, or the critical habitat of a federally (ESA) listed species, shall be deemed to require screening.
Oregon	Since August 2001, the owner or operator of an artificial obstruction located in waters in which native migratory fish (including sturgeon) are currently or were historically present must address fish passage requirements prior to certain trigger events. Trigger events include installation, major replacement, a fundamental change in permit status (e.g., new water right, renewed hydroelectric license), or abandonment of the artificial obstruction. In order to sufficiently address fish passage requirements, the owner/operator is typically required to develop a fish passage plan that provides adequate passage and is approved by ODFW.
Washington	Beginning in 1981, all water diversion devices must be equipped at or near its intake with a WDFW approved fish guard or screen to prevent the passage of game fish into the device and, if necessary, with a means of returning game fish from immediately in front of the fish guard or screen to the waters of origin.[44]

2.5.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON DAMS AND WATER DIVERSIONS

Dam owners and operators may undertake capital, programmatic, and/or operational changes to existing projects in order for projects to avoid adverse impacts on critical habitat. The primary modification likely to be necessary to avoid destruction or adverse modification of green sturgeon critical habitat appear to be the installation of fish screens and the construction of fish passage facilities to accommodate green sturgeon needs. It is also possible that some changes to the operations of dams could be required to reduce impacts on spawning and critical habitat.

It should be noted that individual dams vary substantially in their potential for harming green sturgeon and its habitat, and thus the type and extent of necessary modifications to avoid adverse modification to habitat will vary. Following the pattern established by listed West coast salmon and steelhead species, it appears likely that the changes needed to accommodate the biological needs and PCEs of the green sturgeon at a particular dam or diversion project will be determined on a case by case basis. Thus, until a particular project is reviewed by NMFS, the type and level of changes necessary and feasible to

[44] See Revised Code of Washington (RCW) (Sections 77.57.010; 77.57.020; 77.57.030; and 77.57.040) at http://apps.leg.wa.gov/RCW/default.aspx. Last accessed on November 7, 2007.

avoid adverse modification of species habitat is speculative, and the data needed to estimate these impacts for all projects are not available.

Several public commenters were concerned about potential impacts at particular dams and diversion projects. Many of these projects form part of the CVP and SWP projects. These projects have undergone section 7 consultation as part of the Operations Criteria and Plan (OCAP) biological opinion. The first OCAP opinion was completed in 1992, and the most recent draft opinion was issued in June 2009. This draft opinion concluded that OCAP would jeopardize the green sturgeon and cause destruction or adverse modification of designated and proposed critical habitat, in addition to several salmon species. The draft biological opinion recommends the following conservation efforts as part of the draft biological opinion:[45]

- Gate openings at the Red Bluff Diversion Dam, and the construction of an alternative pumping plant.
- Improved juvenile rearing habitat in the lower Sacramento River basin and Delta.
- Additional closures of the Delta Cross Channel Gates during key times when listed fish are likely to be migrating through the area.
- Increased San Joaquin River flows and water export curtailments.
- New flow management measures on the American and Stanislaus Rivers.

The Tehama-Colusa Canal Authority and the US Bureau of Reclamation currently are designing the alternative pumping plant at the Red Bluff Diversion Dam, and expect that it will be in operation beginning in 2012. The pumping plant is expected to cost approximately $165 million.[46] The annualized costs associated with construction of this plant are included in the cost estimate for the relevant unit.

This analysis does not estimate economic impacts associated with potential operational changes that may be engendered by required modifications to flow regime. It is possible that green sturgeon conservation may impact dam operations, for example, by imposing minimum flow releases to ensure adequate downstream flows, and requiring maximum release rates and ramping rates. Some dams and water diversions within the study area may already have certain minimum flow requirements for salmon species. For example, the Lower Yuba River Accord specifies minimum instream flows for the Lower Yuba River downstream of Daguerre Point Dam "to protect and enhance habitat conditions for salmonid species including Fall-run and Spring-run Chinook salmon and steelhead."[47] The current minimum flow requirements may or may not be considered adequate for green sturgeon. As one public commenter points out, "salmonid and green sturgeon life histories may suggest different optimal flow schedules." The commenter further states that green sturgeon passage at Daguerre Point Dam will likely not be accomplished

[45] National Marine Fisheries Service, *2009 Biological Opinion on the California's Central Valley Water Project*, June 3, 2009. Accessed at: http://swr.nmfs.noaa.gov/ocap/2009_OCAP_Powerpoint_060309.pdf on July 1, 2009.

[46] Public comments of the Tehama-Colusa Canal Authority dated December 22, 2008.

[47] Public comments of the Yuba County Water Agency, dated December 18, 2008.

through conventional anadromous salmonid passage infrastructure.[48] However, alternative passage designs and associated costs have not yet been developed, as discussed in the proposed rule.

Requirements for changes to flow regimes at dams may also affect water uses other than hydropower, such as agricultural and municipal water users. Impacts on these users could occur if the amount of water stored behind a dam is decreased, making it unavailable for its planned use at the time it is required. Impacts could also occur if the timing of water releases is altered so that water deliveries do not occur as scheduled.

Whether or not flow regime changes are necessary for green sturgeon at a particular project, and the level and method of change required, would be determined on a case-by-case basis. Potential impacts may vary by orders of magnitude depending upon the particular project and specific flow regime changes recommended. At this time, it is unclear if changes in flow regime will be required for green sturgeon; therefore, this analysis does not forecast any associated impacts.

Costs Related to Provision of Fish Passage and Fish Screens

Costs of fish passage for West Coast salmon and steelhead species have varied widely. Costs may be similar for green sturgeon, though it is also possible that passage requirements may differ from salmon requirements.[49] An analysis of the Pacific Northwest Hydrosite Database in 2005 found that costs of fish passage and fish screens for salmonids (at predominantly hydropower facilities) ranged from $97,000 to $4.4 million (2007 dollars).[50] The California Habitat Restoration Project Database (CHRPD), a database created in 1999 to capture and maintain data about habitat restoration projects in California benefiting anadromous fish, includes data on 72 fish passage projects, for which the average cost is $239,000 (2007 dollars).[51] The estimated range of costs used in this analysis is presented in Exhibit 2-20.

As discussed above, one public commenter states that green sturgeon passage at Daguerre Point Dam will likely not be accomplished through conventional anadromous salmonid passage infrastructure. However, alternative passage designs and associated costs have not yet been developed, as discussed in the proposed rule. Current passage plans at that dam, designed for salmonids at Daguerre Point Dam are anticipated to cost $17.5 million.[52] A second public comment estimates costs of providing safe fish passage at Red Bluff Diversion Dam's new pumping facility at $165 million.[53] These estimates are included in the analysis as outliers.

Fish screen costs have also varied widely according to the scale of the project, ranging from $600 for a small pump screen to $1.7 million for a complex ditch screen at a high

[48] Ibid.

[49] Churchwell, Roger. "Sturgeon passage study," Department of Water Resources, Division of Environmental Services/Fish Facilities Section, Presentation at Green Sturgeon Workshop, June 2006.

[50] NMFS, Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs, Long Beach, CA, August 2005.

[51] Fish barrier data is available from the Calfish program, a cooperative effort headed by CDFG Wildlife and Habitat Data Analysis Branch and CDFG NCNCR Information Services Branch. Accessed at http://www.calfish.org/ on August 21, 2007.

[52] Public comments of the Yuba County Water Agency, dated December 18, 2008.

[53] Public comments of the Tehama-Colusa Canal Authority dated December 22, 2008.

water volume facility. The CHRPD includes records of several small (less than 25 cubic feet per second) agricultural diversions, for which costs ranged from $6,000 to $40,000 (2007 dollars).[54] An approximate estimate of average costs for all project types is $80,000 to $130,000 per fish screen (2007 dollars) (see Exhibit 2-20).[55]

EXHIBIT 2-20. ESTIMATED COSTS OF INSTALLING FISH SCREENS OR FISH PASSAGE

PROJECT MODIFICATION	LOW	HIGH
Dam Projects		
Cost of Installing Fish Passage	$92,000	$4,200,000*
Water Diversion Projects		
Cost of Installing a Fish Screen	$80,000	$130,000

Notes:

* One public commenter states that green sturgeon passage at Daguerre Point Dam will likely not be accomplished through conventional anadromous salmonid passage infrastructure. However, alternative passage designs and associated costs have not yet been developed, as discussed in the proposed rule. Current passage plans at that dam, designed for salmonids, are anticipated to cost $17.5 million. A second public comment estimates costs of providing safe fish passage at Red Bluff Diversion Dam's new pumping facility at $165 million. These estimates are included in the analysis as outliers in relevant units. Public comments of the Yuba County Water Agency, dated December 18, 2008; Public comments of the Tehama-Colusa Canal Authority dated December 22, 2008.

Comments of the Federal Energy Regulatory Commission point out that two fish passage projects have considered the shortnose sturgeon on the East Coast. However, cost estimates associated with these projects are not readily available. In addition, the site specific nature of fish passage costs complicate transfer to the West Coast. In contrast, the West Coast fish passage costs associated with salmonid species, which are typically considered jointly with green sturgeon in section 7 consultations, are fairly well documented. Written communication from Allan Creamer, Federal Energy Regulatory Commission on August 21, 2009.

Source: Adapted from NMFS, Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs, Long Beach, CA, August 2005. Adjusted to 2007 dollars using the U.S. Bureau of Economic Analysis, National Economic Accounts, National Income and Product Accounts table, 2008.

It is unclear to what extent habitat requirements for critical habitat would be more stringent than those under the listing of the species for other aspects of dams and water diversions. Currently, where fish screens or fish passage facilities have been put in place for salmon, no additional costs are anticipated for green sturgeon other than administrative costs to demonstrate compliance. Where fish screens or fish passage facilities currently do not exist, but are put in place in the future as a result of consultation on green sturgeon critical habitat separate from consultation for listed salmon or steelhead species and their critical habitat, costs are assumed to result from this designation. Given the large amount of overlap in habitat areas with salmon species, and the protection already afforded by the listing of green sturgeon, this analysis assumes that impacts

[54] Ibid.

[55] Oregon Fish Screen Program, Fish Screen Costs from 2003-2005. Bernie Kepshire, Fish Screening State Coordinator, Oregon Department of Fish and Wildlife, Fish Division. Email communication on January, 23, 2007; Fish Screen Projects Funded by the California Department of Fish and Game Fisheries Restoration Grant Program, February 2007.

associated with approximately 20 percent of dams or water diversions may be attributable to green sturgeon critical habitat (the probability score). Where fish passage projects are planned but not yet constructed, as in the Red Bluff Diversion Dam pumping plant project, 20 percent of expected costs are attributed to green sturgeon critical habitat. On the Alsea River, where there is no salmon and steelhead critical habitat, this analysis attributes impacts associated with provision of fish screens to green sturgeon critical habitat.

2.5.5 SUMMARY OF ECONOMIC IMPACTS TO DAM AND WATER DIVERSION PROJECTS

Exhibits 2-21 and 2-22 below present a summary of our findings regarding the economic impacts arising out of special management considerations for dams and water diversions, respectively. It is estimated that the Lower Columbia Estuary and River and Lower Sacramento River units are associated with a substantial number of dams that could potentially be required to implement special conservation measures for green sturgeon. Similarly, the Sacramento-San Joaquin Delta unit is associated with over 2,000 water diversions that may be affecting the habitat.

EXHIBIT 2-21. SUMMARY OF ECONOMIC IMPACTS TO DAM PROJECTS BY UNIT

UNIT	DESCRIPTION	ACTIVITY COUNT (# OF DAMS)	PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)		
				LOW	MID	HIGH
2	Upper Sacramento River, CA	33	0.2	$3,150,000	$3,820,000	$4,500,000
3	Lower Sacramento River, CA	58	0.2	$53,400	$1,240,000	$2,440,000
4	Yolo Bypass, CA	1	0.2	$920	$21,500	$42,000
5	Sutter Bypass, CA	0	0.2	$0	$0	$0
6	Lower Feather River, CA	16	0.2	$14,700	$343,000	$672,000
7	Lower Yuba River, CA	1	0.2	$332,000	$352,000	$372,000
8	Sacramento - San Joaquin Delta, CA	7	0.2	$6,440	$150,000	$294,000
16	Klamath/Trinity River, CA	0	0.2	$0	$0	$0
24A	Lower Columbia River Estuary, OR	20	0.2	$19,300	$451,000	$882,000
24B	Lower Columbia River, OR	61	0.2	$55,200	$1,290,000	$2,520,000

Note: Costs are developed by multiplying the number of affected facilities by the total estimated costs of fish passage, then annualized over 20 years. Because salmon species are present in these areas the costs are again multiplied by the probability that green sturgeon will be the driver of passage costs. Costs in the Lower Yuba River and Upper Sacramento River units reflect specific passage cost estimates provided by public commenters. Current passage plans in the Lower Yuba River at Daguerre Point Dam, designed for salmonids, are anticipated to cost $17.5 million. Costs of providing safe fish passage at Red Bluff Diversion Dam's new pumping facility on the Upper Sacramento River are estimated at $165 million. Public comments of the Yuba County Water Agency, dated December 18, 2008; Public comments of the Tehama-Colusa Canal Authority dated December 22, 2008. One public commenter states that green sturgeon passage at Daguerre Point Dam will likely not be accomplished through conventional anadromous salmonid passage infrastructure. However, alternative passage designs and associated costs have not yet been developed, as discussed in the proposed rule.
Sources: U.S. Army Corps of Engineers, National Inventory of Dams.

EXHIBIT 2-22. SUMMARY OF ECONOMIC IMPACTS TO WATER DIVERSIONS BY UNIT

UNIT	DESCRIPTION	ACTIVITY COUNT (# OF WATER DIVERSIONS)	PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)		
				LOW	MID	HIGH
2	Upper Sacramento River, CA	45	0.2	$36,000	$47,300	$58,500
3	Lower Sacramento River, CA	577	0.2	$462,000	$606,000	$750,000
4	Yolo Bypass, CA	78	0.2	$62,400	$81,900	$101,000
5	Sutter Bypass, CA	12	0.2	$9,600	$12,600	$15,600
6	Lower Feather River, CA	201	0.2	$161,000	$211,000	$261,000
7	Lower Yuba River, CA	23	0.2	$18,400	$24,200	$29,900
8	Sacramento - San Joaquin Delta, CA	2210	0.2	$1,770,000	$2,320,000	$2,870,000
12	Tomales Bay, CA	117	0.2	$93,600	$123,000	$152,000
21	Alsea River, OR	1	1.0	$4,000	$5,250	$6,500

Sources: CalFish, California Fish Passage Assessment Database Project, 2006; Oregon Fish Barriers, Department of Fish and Wildlife database, 2007; Washington Department of Fish and Wildlife, Fish Passage Barrier and Surface Water Diversion Screening Assessement and Prioritization Manual, 2000.

2.6 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON POWER PLANTS

2.6.1 DESCRIPTION OF THREAT

NMFS identified power plants as a threat to green sturgeon critical habitat in ten units within the study area. These include Elkhorn Slough, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, San Francisco Bay, Humboldt Bay, and marine units between the California Mexico border and Coos Bay. The primary threat from power plants to green sturgeon is the release of thermal effluents that may raise water temperature in green sturgeon habitat to lethal or sub-lethal levels.

2.6.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

This analysis uses data provided by the California Energy Commission, to identify the power plants that could be affected by the proposed rule.[56] Exhibits 2-23 and 2-24 present the estimated number of power plants for the affected critical habitat units.

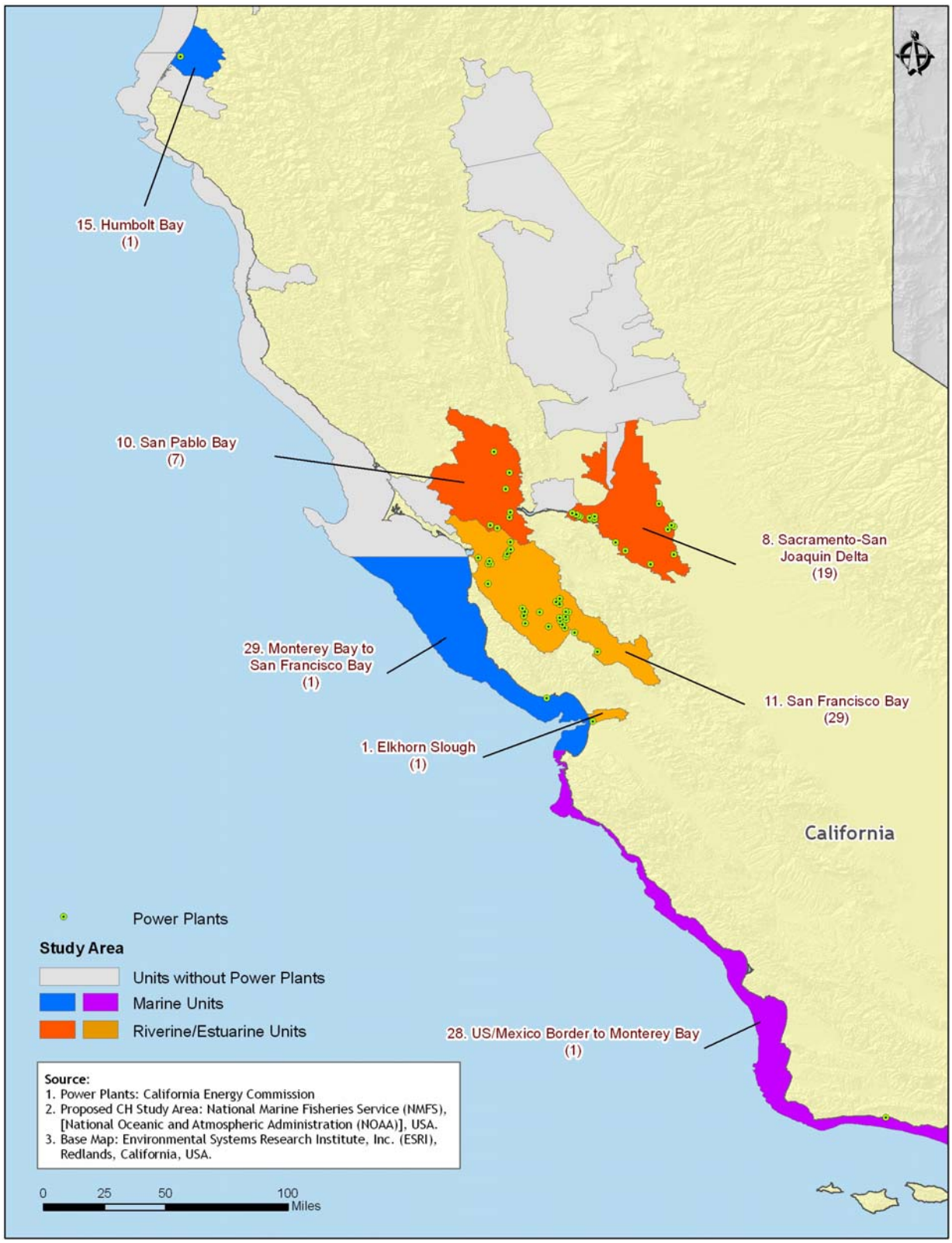
[56] California Energy Commission. California Statewide Plants map. Available at http://www.energy.ca.gov. Last accessed on April 20, 2008.

EXHIBIT 2-23. NUMBER OF POWER PLANTS POTENTIALLY AFFECTING CRITICAL HABITAT UNITS

UNIT	DESCRIPTION	APPROXIMATE NUMBER OF POWER PLANTS
1	Elkhorn Slough, CA	1
8	Sacramento-San Joaquin Delta, CA	19
9	Suisun Bay, CA	0
10	San Pablo Bay, CA	7
11	San Francisco Bay, CA	29
15	Humboldt Bay, CA	1
28	CA-Mexico Border to Monterey Bay, CA	1
29	Monterey Bay, CA to San Francisco Bay, CA	1
30	San Francisco Bay, CA to Humboldt Bay, CA	0
31	Humboldt Bay, CA to Coos Bay, OR	0

Source: California Energy Commission, Systems Assessment & Facilities Siting Division, Cartography Unit.

EXHIBIT 2-24. POWER PLANTS IN UNITS POTENTIALLY AFFECTED BY PROPOSED ACTION



2.6.3 REGULATORY BASELINE

Thermal effluent from power plants has been previously identified as a threat to Pacific salmon and steelhead species and their habitat. Several past salmon consultations have resulted in the installation of temperature control devices at hydropower facilities to reduce impacts on salmon. For example, as part of a large consultation on the Central Valley Project/State Water Project in California, a temperature control device was installed at Shasta Dam on the Upper Sacramento River. As a result of this installation, water temperature is not believed to be a current threat to green sturgeon on the Upper Sacramento.[57] To the extent that other such efforts are being implemented within green sturgeon critical habitat, it would appear reasonable to assume that these may be adequate to address impacts to green sturgeon critical habitat as well. Other types of conservation efforts that have been conducted on behalf of salmon at power plants include the following:[58]

- Construct new or modify existing fish screen systems;
- Minimize modification of riparian habitat and construction and use of facilities and equipment;
- Preparing and implementing pollution and erosion control plans to minimize use of herbicides, metals and other degraders of water quality;
- Monitor and report monthly to NOAA the concentration levels of effluents and temperature in affected waters.

2.6.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON POWER PLANTS

As stated in section 2.3, NOAA Fisheries has consulted with EPA on various aspects of its approval of State Water Quality Standards, including development of Total Maximum Daily Loads (TMDLs), review of non-temperature related Water Quality Standards, clean up of Superfund sites, and review of pesticide applications.

In general, the only project modification resulting from consultation for salmon or steelhead species pertained to water temperature controls. While NPDES-permitted facilities have always been required to adhere to certain temperature criteria associated with effluent discharge, 2003 guidance has led to stricter standards where salmon and steelhead are known to spawn or rear. As a result, this analysis focuses on costs associated with the temperature criteria.

To the extent that the proposed rule leads to power plants installing new technology to cool their thermal effluents to maintain water quality to avoid adverse destruction or modification of green sturgeon critical habitat, the associated impacts may be substantial. Assuming, as with major NDPES facilities, that efforts to control temperature would be similar to salmon and steelhead efforts, costs would be expected to range from $0 to $1.2

[57] Personal communication with NMFS biologist, Sacramento Field Office, March 10, 2008.

[58] National Marine Fisheries, Section 7 Consultation on the Port of St. Helens Industrial Outfall and Portland General Electric Power Plant, Port Westward Industrial Park, Columbia River, Columbia County, Oregon (Corps No. 200200448), August 1, 2003.

million (2007 dollars) (see Section 2.3.4). Using EPA data, as interpreted in the West Coast salmon and steelhead economic analysis of critical habitat designation economic analysis, major facilities are assumed to require significant capital expenses to comply with the temperature criteria. This analysis assumes that facilities will incur costs of $5,500 to $36,000 annually in O&M costs. In addition, facilities are assumed to incur capital costs of $446,000.[59] Based on EPA's sample of facilities, capital costs are assumed to be incurred in the first year, and operations and maintenance (O&M) costs are incurred uniformly over a 20 year period. Twenty-year annualized costs are therefore estimated to be $504,700 to $827,800 ($46,640 to $78,140 annualized). For each facility, these costs are then multiplied by a 25 percent probability of requiring compliance-related expenditures (see section 2.3.4).

As discussed above, based on several past examples of formal consultations, it appears that, in some cases if not all, conservation measures for green sturgeon may be identified together with other salmonid species when they are present. That is, salmonid species and their associated critical habitats may provide a strong baseline protection for green sturgeon critical habitat where habitats coexist. As such, it is possible that few additional requirements could result from green sturgeon critical habitat designation. In an attempt to be conservative, i.e., more likely to overstate costs than understate costs, this analysis assumes that green sturgeon critical habitat would be expected to result in an additional 20 percent of power plants undertaking project modifications than would have occurred without green sturgeon. Appendix E provides a sensitivity analysis for these assumptions, providing estimates assuming that green sturgeon critical habitat is responsible for the generation of all project modification costs for all projects.

Finally, where salmon and steelhead species are not present, project modification costs are assumed to be attributable to green sturgeon critical habitat designation. Although some level of protection would be already expected to exist under the listing of the green sturgeon, this analysis is unable to separate those costs from critical habitat costs.

2.6.5 SUMMARY

Exhibit 2-25 below presents a summary of our findings regarding the potential project modifications for power plants. The marine unit that extends from the California-Mexico border to Monterey Bay is associated with more than twice as many power plants as other units, and also receives a high probability score because it does not overlap with salmon critical habitat. Hence, this marine unit is estimated to be associated with the highest economic impacts to power plant operations.

[59] Science Applications International Cooperation: Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon . Science Applications International Corporation. Reston, VA. 2003. EPA No. 68-C-99-252; Adapted from NMFS, Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs, Long Beach, CA, August 2005. Adjusted to 2007 dollars using the U.S. Bureau of Economic Analysis, National Economic Accounts, National Income and Product Accounts table, 2008.

EXHIBIT 2-25. SUMMARY OF ACTIVITY COUNT, PROBABILITY SCORE, AND IMPACT SCORE BY UNIT FOR POWER PLANTS

UNIT	DESCRIPTION	ACTIVITY COUNT (ESTIMATED NUMBER OF POWER PLANTS)	PROBABILITY SCORE	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)		
				LOW	MID	HIGH
1	Elkhorn Slough, CA	1	0.2	$2,380	$3,140	$3,910
8	Sacramento-San Joaquin Delta, CA	19	0.2	$45,260	$59,700	$74,200
9	Suisun Bay, CA	0	0.2	$0	$0	$0
10	San Pablo Bay, CA	7	0.2	$16,700	$22,000	$27,300
11	San Francisco Bay, CA	29	0.2	$69,100	$91,200	$113,000
15	Humboldt Bay, CA	1	0.2	$2,470	$3,260	$4,050
28	CA-Mexico Border to Monterey Bay, CA	1	1.0	$11,900	$15,700	$19,500
29	Monterey Bay, CA to San Francisco Bay, CA	1	1.0	$11,900	$15,700	$19,500
30	San Francisco Bay, CA to Humboldt Bay, CA	0	1.0	$0	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	0	1.0	$0	$0	$0

SECTION 3 | ECONOMIC IMPACTS FOR ACTIVITIES WITH UNCERTAIN SPECIES CONSERVATION EFFORTS

3.1 INTRODUCTION

Of the 15 categories of economic activity that may require modification to avoid destruction or adverse modification of green sturgeon critical habitat, there are five activities where: (1) the nature of future management is highly uncertain, and/or (2) the number of future projects likely to be affected by green sturgeon critical habitat is speculative. These activities, for which projections of future impacts are highly uncertain, include: bottom-trawl fishing, tidal/wave energy projects, liquefied natural gas projects, desalination, and restoration.

This section describes each of these five economic activities in terms of its threat to green sturgeon, extent of occurrence within critical habitat, specific baseline elements that may provide protection to green sturgeon, prospective management scenarios, and associated economic impacts. Because of the high level of uncertainty associated with these activities, this analysis presents a range of impacts of green sturgeon critical habitat that are associated with varying management scenarios.

3.2 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON BOTTOM TRAWL FISHING ACTIVITIES

3.2.1 DESCRIPTION OF THREAT

NMFS identified bottom trawl fisheries as a potential threat to the essential features of green sturgeon critical habitat in 11 units within the study area. These include all marine units. Because green sturgeon are believed to feed primarily on benthic fauna, fishing vessels using bottom trawl gear may affect green sturgeon critical habitat by affecting sediment quality and available food resources for green sturgeon. Green sturgeon bycatch occurs in commercial groundfish trawl fisheries off the coasts of California, Oregon, Washington, and Alaska, including the at-sea hake fishery.

3.2.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

The Pacific Coast groundfish fishery is one of the largest fisheries on the West Coast. In 2007, groundfish landings in Washington, Oregon, and California were approximately 108,000 metrics tons (MTONs), or 238 million pounds. These landings corresponded with an ex-vessel value of $59 million in 2007.[60] In 2007, total groundfish landings in

[60] Pacific Fisheries Information Network (PacFIN), "2007: PFMC Groundfish Management Team Reports," "All W-O-C Species Rpt: 2007 Commercial Landed Catch: Metric-tons, Revenue, and Price-per-pound;" "NPFMC Area Report: Groundfish Landed-catch (Metric tons) for 2007 for all Gears,". Accessed at http://www.psmfc.org/pacfin/data.html on March 19, 2008.

Alaska were 2.18 million tons, or 4.8 billion pounds, which was over 19 times as much as was caught off the coasts of Washington, Oregon, and California together.[61]

The majority of catch by Alaska and Pacific Coast trawlers is not expected to be affected by critical habitat for green sturgeon. This is because the fishing vessels most likely affected by green sturgeon critical habitat designation are vessels using bottom trawl gear who are part of the Limited Entry, federally permitted groundfish fisheries, while the vast majority of trawl vessel groundfish is caught with midwater trawl gear. As discussed in public comments, the State waters of Washington and California are closed to trawling, and trawling in Oregon generally occur deeper than 40 fathoms because of interactions with other fisheries.[62] This analysis assumes that state-managed fisheries, such as the commercial crab fishery and pink shrimp fishery will not be affected by this rule.[63]

The study area analyzed for the critical habitat designation includes the Pacific Coast and Alaska shoreline (from the U.S-Mexico border to the Bering Sea) outward to 60 fathoms. Based on information from trawl logbooks from 2003 through 2006 for Washington, Oregon, and California, the amount of bottom trawl effort (in terms of trawl hours) occurring at depths less than 60 fathoms was approximately 25 percent of all bottom trawl effort over that time period.[64] Public comments from the Washington Department of Fish and Wildlife (WDFW) suggested that improvements to the estimates of bottom trawl landings could be made from the Draft Economic Analysis.[65] In response, WDFW queried the Pacific Fisheries Information Network (PacFIN) database,[66] and excluded gear types that can only be fished seaward of the Rockfish Conservation Areas (RCAs).[67] WDFW was also able to utilize finer scale port code data than were applied previously.

---

[61] Pacific Fisheries Information Network (PacFIN), North Pacific Fisheries Management Council Data, "NPFMC Area Report: Groundfish Landed-catch (Metric tons) for 2007 for all Gears." Accessed at http://www.psmfc.org/pacfin/npfmc.html on March 19, 2008.

[62] Public comments of Rod Moore, West Coast Seafood Processors Association, October 23, 2008.

[63] Two public commenters expressed concern that this analysis does not analyze potential impacts to the shrimp industry. ODFW notes in its comments that should the designation affect the shrimp fishery, "the effect would be relatively small," because only a fraction of the effort occurs within 110 meters depth. One commenter estimates that an average of two percent of shrimping tows were made shallower than 60 fathoms between 2000 and 2005, but that the number of shallower tows can be as high as 11 percent in large recruitment years.

[64] Personal communication with Merrick Burden, Groundfish Staff Officer, Pacific Fisheries Management Council, March 25, 2008.

[65] Public comments of Phil Anderson, Department of Fish and Wildlife, State of Washington, December 19, 2008.

[66] The PacFIN central database includes fish-ticket and vessel registration data provided by the Washington, Oregon, and California (W-O-C) state fishery agencies. In addition the W-O-C data sources supply species-composition and catch-by-area proportions developed from their port sampling and trawl logbook data systems. The NMFS/NWR supplies the central database with limited-entry permit data and the U.S. Coast Guard vessel data is also incorporated. The NMFS/AFSC inputs weekly aggregates developed from their tow-by-tow observer database. The data for the Alaska groundfish fishery are provided by the Alaska Department of Fish & Game (ADFG) and the NMFS/AKR in the form of monthly and weekly aggregates. The Department of Fisheries and Oceans, Canada also makes a contribution to this West Coast fisheries data system. The best estimates of catch for each groundfish species by month, area, and gear-type are developed from the source data mentioned above.

[67] Rockfish Conservation Areas (RCAs), which are coast-wide, depth-dependent closures that vary throughout the year. RCAs generally result in areas closed to trawling from between 60 to 75 fathoms to 100 to 200 fathoms. See NOAA Northwest Region, Rockfish Conservation Areas, http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/Groundfish-Closed-Areas/Index.cfm#CP_JUMP_30272 .

This analysis now includes the results of that query for the volumes and values of bottom trawl landings off the coasts of Washington, Oregon, and California.[68]

For Alaska units, we estimated potentially affected bottom trawl catch by critical habitat unit, by gathering PacFIN data on groundfish catch by Alaska port group and excluding walleye Pollock, a species that is not caught using bottom trawl gear. In Alaska waters, walleye pollock comprised approximately 75 percent of the groundfish catch off Alaska, or 1.6 million MTONs in 2007.[69] After excluding walleye pollock, the Alaska groundfish fishery landed approximately 541,000 MTONS of groundfish in 2007.[70] Pollock, which are caught with midwater trawl gear, make up a large portion of the volume of catch relative to value. We then apportioned the approximated bottom trawl catch by port group by critical habitat unit and assumed that 25 percent of those landings were associated with bottom trawl fishing effort within proposed critical habitat areas.

These results are reported in Exhibit 3-1. Note that the estimates of bottom trawl catch is approximate--the reported landings of groundfish by port group do not necessarily match the fishing patterns of fishing vessels.[71] Data reporting the level of fishing effort by marine area, however, and more particularly by the units selected for this analysis, were not available for this analysis.[72] Nonetheless, for the purpose of identifying which critical habitat units have relatively more groundfish effort occurring than others, the current methodology appears reasonable.[73]

[68] Public comments of the Oregon Department of Fish and Wildlife include estimates of bottom trawl effort with an average depth of 110 meters or less between Humboldt Bay, California and Cape Flattery, Washington in 2006 and 2007. ODFW estimates that $2.2 million in 2006 and $1.5 million in gross vessel revenue from fish tickets (GVR) was gleaned from this area. Public comments of Bruce McIntosh, the Oregon Department of Fish and Wildlife on December 29, 2008.

[69] National Marine Fisheries Service, Alaska Fisheries Science Center, Accessed at http://www.afsc.noaa.gov/species/pollock.php, on May 20, 2008.

[70] National Marine Fisheries Service, Northwest Region, Pacific Coast Groundfish Fishery Management Plan Essential Fish Habitat Designation and Minimization of Adverse Impacts: Final Environmental Impact Statement, December 2005.

[71] Written communication with C. Niles, WADFW, July 22, 2009.

[72] Some information about location of fishing effort is available at Pacific Fishery Management Council's analysis of the trawl rationalization amendment to the groundfish fishery management plan, accessed at http://www.pcouncil.org/groundfish/gffmp/gfa20/gfa20decdoc.html

[73] See public comments of Phil Anderson, Department of Fish and Wildlife, State of Washington, December 19, 2008.

EXHIBIT 3-1. ESTIMATED BOTTOM TRAWL CATCH IN CRITICAL HABITAT AREAS BY UNIT, AVERAGE 2005-2007

UNIT	DESCRIPTION	PORT GROUP(S)	GROUNDFISH LANDINGS (RWT LBS) [A]	ESTIMATED EX-VESSEL VALUE
28	CA-Mexico Border to Monterey Bay, CA	Morro Bay and other	119,899	$91,162
29	Monterey Bay, CA to San Francisco Bay, CA	Monterey, Santa Cruz, Moss Landing	1,102,582	$785,000
30	San Francisco Bay, CA to Humboldt Bay, CA	Fort Bragg, SF, and other	1,229,332	$894,000
31	Humboldt Bay, CA to Coos Bay, OR	Eureka, Crescent City, Brookings	1,489,447	$831,000[c]
32	Coos Bay, OR to Winchester Bay, OR	Coos Bay	828,872	$414,000 [c]
33	Winchester Bay, OR to Columbia River and Estuary	Newport and other	1,056,304	$539,000 [c]
34	Columbia River and Estuary to Willapa Bay, WA	Astoria	5,715,110	$2,710,000 [c]
35	Willapa Bay, WA to Grays Harbor, WA	No ports	0	$0 [c]
36	Grays Harbor, WA to Cape Flattery, WA	Westport, Billingham, and Tribal	4,567,242	$1,990,000 [c]
37	Strait of Juan de Fuca to Rosario Strait, WA	No Federal groundfish[b]	0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	Aleut-Bering Strait	919,260,392	$180,000,000

Source: PacFin data query performed by C. Niles, WADFW, July 22, 2009, and Pacific Fisheries Information Network (PacFIN), North Pacific Fisheries Management Council Data, "NPFMC Area Report: Groundfish Landed-catch (Metric tons) for 2007 for all Gears." Accessed at http://www.psmfc.org/pacfin/npfmc.html on March 19, 2008.

[a] For California, Oregon, and Washington ports, data include approximate landings for groundfish caught shoreward of the Rockfish Conservation Areas. Data excludes PacFin gear codes for Midwater Trawl (MDT), Groundfish Trawl Footrope > 8 In (GFL), Roller Trawl (RLT), Midwater Trawl - Catcher/Processor (MPT). Data includes landings from Other Trawl Gear (OTW), Groundfish Trawl (Otter) (GFT), Groundfish Trawl, Footrope < 8 In (GFS), Selective Flatfish Trawl, Small Footrope (FTS), Danish/Scottish Seine (Trawl) (DNT), Beam Trawl (BMT). For Alaska waters, total bottom trawl catch is estimated by assuming that bottom trawl landings include all non-pollock landings, and that 25 percent of total landed non-pollock catch occurred within 60 fathoms.

[b] Although no Federal bottom trawling occurs within Unit 37, there are state authorized bottom trawling fisheries. The Strait of Georgia and San Juan Islands are open to commercial trawl fishing for bottomfish; Strait of Juan de Fuca for Pacific cod and other bottomfishes. However, these fisheries operate on very low levels. Public comments of Phil Anderson, Washington Department of Fish and Wildlife, December 19, 2008.

[c] Public comments of the Oregon Department of Fish and Wildlife include estimates of bottom trawl effort with an average depth of 110 meters or less between Humboldt Bay, California and Cape Flattery, Washington in 2006 and 2007 (Units 31-36). ODFW estimates that $2.2 million in 2006 and $1.5 million in gross vessel revenue from fish tickets (GVR) was gleaned from catch effort in this area. Public comments of Bruce McIntosh, the Oregon Department of Fish and Wildlife on December 29, 2008. This exhibit utilizes estimates of ex-vessel value of landed catch from WDFW for these areas ($6.4 million for Units 31-36). ODFW estimates suggest that using ex-vessel value of catch may overstate the level of bottom trawl fishing effort actually occurring in CHD areas.

3.2.3 REGULATORY BASELINE

The Pacific Fishery Management Council (Council), one of eight regional fishery management councils established by the Magnuson-Stevens Fishery Conservation and Management Act, recommends management measures to NMFS for the Pacific Coast groundfish fishery in the Exclusive Economic Zone (EEZ), which is the area between three and 200 miles offshore of the U.S. coastline. They also work cooperatively with coastal states to develop management measures for groundfish fishing activity within state waters (within three miles of the shoreline).[74]

The Council's process is based on fishery management plans (FMPs) that contain a set of management objectives and strategies for implementing them. The Council has developed FMPs for salmon, groundfish, coastal pelagic species, and highly migratory species. The Pacific Coast Groundfish FMP "specifies how the Council develops recommendations for management of the groundfish fishery. In some cases, it contains specific fishery management recommendations. The plan establishes a non-numerical optimum yield for all groundfish species that do not have specified harvest guidelines, and establishes a way to set quotas and harvest guidelines for individual species that do have harvest guidelines."[75] Annual fishery management plans are developed under FMPs to meet year-specific circumstances related to the status of the stocks affected by the fisheries. NMFS reviews and approves these annual plans.

The most recent amendment to the groundfish FMP provides for a comprehensive program to describe and protect essential fish habitat (EFH) for Pacific coast groundfish under the Magnuson-Stevens Fishery Conservation and Management Act. The EFH measures are intended to minimize, to the extent practicable, adverse effects to EFH from fishing. The measures include fishing gear restrictions and prohibitions, areas that are closed to bottom trawl, and areas that are closed to all fishing that contacts the bottom.[76] NMFS approved the EFH plan in March 2006 and implemented it through regulation.[77] Current closures include some permanent closed areas as well as large Rockfish Conservation Areas (RCAs), which are coast-wide, depth-dependent closures that vary throughout the year. RCAs generally result in areas closed to trawling from between 60 to 75 fathoms to 100 to 200 fathoms.[78]

3.2.4 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON BOTTOM TRAWL FISHERIES

Because the Limited Entry Pacific Coast groundfish fishery is Federally managed, critical habitat designation for the green sturgeon could result in a consultation on the existing Groundfish Fisheries Management Plan. Impacts on the bottom trawl fishing industry will depend on the results of a particular consultation, but could include:

---

[74] Personal Communication with Sustainable Fisheries Division, Northwest Regional Office, NMFS, on March 24, 2008.

[75] Pacific Fisheries Management Council, The Pacific Coast Groundfish Fishery Management Plan, Accessed at http://www.pcouncil.org/groundfish/gffmp.html on April 15, 2008.

[76] Final Groundfish Essential Fish Habitat (EFH) Environmental Impact Statement, Accessed at http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/NEPA-Documents/EFH-Final-EIS.cfm on April 15, 2008.

[77] "NOAA Designates Extensive Area Off West Coast as Essential Fish Habitat," NMFS Press Release, March 8, 2006.

[78] Personal Communication with Sustainable Fisheries Division, Northwest Regional Office, NMFS, on March 24, 2008.

- Loss of fishing days/value of catch due to fishing area closures. Depending on the extent and duration of closures, impacts could vary widely. As a result, fishing closures may result in the largest economic impacts on the fishing industry;
- Gear modifications/restrictions. Specific gear modifications that could be required to avoid impacts on green sturgeon habitat have not been identified at this time. Some devices are under development that would allow for more selective catch of species than typical gear types. It is not known whether these devices would be effective for avoiding green sturgeon bycatch or impacts on green sturgeon habitat;
- Administrative costs of consultations to accommodate green sturgeon critical habitat requirements.

To the extent that incremental fisheries closures are undertaken for green sturgeon or gear modifications or restrictions are required, green sturgeon take prohibitions could affect commercial fishing efforts and affect landed catch. Assuming that fishing effort outside critical habitat areas is not increased to make up for reduced effort inside critical habitat areas, then reduced catch in critical habitat areas could lead to direct effects on fishermen, in terms of lost profits, and lost income to crew, as well as indirect and induced impacts on the local and regional economies that rely on that fishing effort.

As stated above, recent data suggest that approximately 25 percent of bottom trawl fishing effort occurs within 60 fathoms of the shoreline in Washington, Oregon, and California. A closure of this magnitude, combined with the RCAs (which vary from 60 to 75 fathoms to 100 to 200 fathoms), could require fishermen to head out into very deep waters (greater than 100 to 200 fathoms) at all times. Depending on whether the shallow waters are more or less productive than deeper waters as a whole, a 25 percent reduction in effort could result in a greater or less than 25 percent reduction in fishing catch. Travel time and fuel required to access deeper waters would increase costs of fishing efforts for those fishermen who previously utilized shallow waters. In addition, to the extent that shallow waters are typically fished during foul weather events, a closure of shallow waters could encourage the fleet to fish in more dangerous weather conditions to catch the same volume of fish, or to make more or longer trips at other times.

Because of the uncertainties both about future management and the potential response of the fishing industry, this analysis presents a range of possible impacts. Both impacts assume some reduction in bottom-trawl fishing, corresponding to a loss in revenues and profits. At the low end, this analysis assumes that the bottom trawl fishing industry will experience a reduction in catch (and a corresponding reduction in revenues and profits) of approximately 20 percent within critical habitat areas. At the high end, this analysis assumes essentially all bottom trawl effort within proposed critical habitat areas will be curtailed as a result of green sturgeon critical habitat management efforts.

While some area closures may already exist within portions of proposed critical habitat areas, most closures appear to protect areas of greater depth than proposed critical habitat areas and thus provide little baseline protection for green sturgeon and its habitat. Although a certain level of protection, if small, would be already expected to exist under the listing of the green sturgeon, this analysis is unable to separate those costs from

critical habitat costs. In the absence of specific information about the extent of the regulatory baseline for green sturgeon, project modification costs for bottom trawl fisheries are assumed to be attributable to green sturgeon critical habitat designation.

3.2.5 SUMMARY OF IMPACTS TO BOTTOM TRAWL FISHERIES BY UNIT

As discussed above, potential economic impacts of green sturgeon critical habitat designation on bottom trawl fisheries are subject to high levels of uncertainty for the following reasons:

- Future management and required project modifications are uncertain and could range from changes in equipment to area closures.
- Potential reductions in fishing effort in critical habitat areas may not lead to reductions in profits depending on the availability and quality of substitute sites. As such, regional economic impacts of this rulemaking are unknown.
- If the industry experiences a reduction in profits, the magnitude of this reduction is unclear and could vary by area.

Exhibit 3-2 presents a summary of our findings. Appendix C of this analysis estimates the number of affected entities for bottom trawl fishing in each affected critical habitat unit, and the per entity impact for each entity.

EXHIBIT 3-2. SUMMARY OF IMPACTS TO BOTTOM TRAWL FISHERIES BY UNIT

UNIT	DESCRIPTION	PORT GROUP(S)	EX-VESSEL VALUE OF AFFECTED FISHING ACTIVITY (AVERAGE 2005-2007) [A]	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7 PERCENT)[B]	
				LOW	HIGH
28	CA-Mexico Border to Monterey Bay, CA	Morro/Santa Barbara/Los Angeles/San Diego	$91,162	$18,200	$91,162
29	Monterey Bay, CA to San Francisco Bay, CA	Monterey	$785,000	$157,000	$785,000
30	San Francisco Bay, CA to Humboldt Bay, CA	San Francisco/Fort Bragg/Bodega	$894,000	$179,000	$894,000
31	Humboldt Bay, CA to Coos Bay, OR	Eureka/Crescent City/Brookings	$831,000	$166,000	$831,000
32	Coos Bay, OR to Winchester Bay, OR	Coos	$414,000	$82,900	$414,000
33	Winchester Bay, OR to Columbia River and Estuary	Newport, Tillamook	$539,000	$108,000	$539,000
34	Columbia River and Estuary to Willapa Bay, WA	Columbia River	$2,710,000	$542,000	$2,710,000
35	Willapa Bay, WA to Grays Harbor, WA	No ports	$0	$0	$0
36	Grays Harbor, WA to Cape Flattery, WA	Westport, Billingham, and Tribal	$1,990,000	$398,000	$1,990,000
37	Strait of Juan de Fuca to Rosario Strait, WA	North Puget/South Puget	$0	$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	Aleut-Bering Strait	$180,000,000	$36,100,000	$180,000,000

[a] For California, Oregon, and Washington ports, data include approximate landings for groundfish caught shoreward of the Rockfish Conservation Areas. Data excludes PacFin gear codes MDT, GFS, RLT, MPT. Includes landings from OTW, GFT, GFS, FTS, DNT, BMT. For Alaska waters, total bottom trawl catch is estimated by assuming that bottom trawl landings include all non-pollock landings, and that 25 percent of total landed non-pollock catch occurred within 60 fathoms. This analysis assumes that Alaska ports sold non-pollock groundfish at an average ex-vessel value of $1,730 per MTON for all ports, which is the average ex-vessel value for these landings across all ports in 2007.

[b] The high estimate assumes that all bottom trawl catch within 60 fathoms is precluded following critical habitat for green sturgeon; the low estimate assumes that 20 percent of bottom trawl catch within 60 fathoms is precluded following critical habitat for green sturgeon.

Sources: : PacFin data query performed by C. Niles, WADFW, July 22, 2009; Pacific Fisheries Information Network (PacFIN), "2007: PFMC Groundfish Management Team Reports," "All W-O-C Species Rpt: 2007 Commercial Landed Catch: Metric-tons, Revenue, and Price-per-pound;" "NPFMC Area Report: Groundfish Landed-catch (Metric tons) for 2007 for all Gears,". Accessed at http://www.psmfc.org/pacfin/data.html on March 19, 2008.

3.3 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON TIDAL- AND WAVE-ENERGY PROJECTS

3.3.1 DESCRIPTION OF THREAT

Tidal- and wave-energy projects harness the kinetic energy contained in ocean waves or tidal currents. Tidal- and wave-energy projects require the placement of equipment such as buoys or turbines into the water column. According to NMFS, the placement of energy generation equipment in the water column may obstruct the passage of fish including green sturgeon.[79]

The critical habitat rule identifies tidal and wave energy projects as a potential threat to green sturgeon in 13 units within the study area, but proposed and pending projects were identified in only 11 of those units. These units include all marine units as well as San Francisco Bay, Willapa Bay, and Puget Sound.

3.3.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

There currently are no actively generating wave or tidal energy projects located within the study area. However, 36 projects have applied to the Federal Energy Regulatory Commission (FERC) for preliminary permits to investigate the feasibility of project development within the study area.[80] A preliminary permit is the first step in the FERC licensing and permitting process. A preliminary permit covers a three-year time frame, and allows the applicant to test and refine project components. Under some preliminary permits like the one for the Tacoma Narrows project, applicants have placed test equipment in the water; however, full construction of the project requires further permitting. Of the 36 projects that have applied for a preliminary permit, 24 have already received their permits and are proceeding with further project scoping (see Exhibit 3-3).

[79] See also Table 5.1, California Energy Commission, *Developing Wave Energy in Coastal California: Potential Socio-Economic and Environmental Effects,* November 2008. Accessed at: http://www.energy.ca.gov/2008publications/CEC-500-2008-083/CEC-500-2008-083.PDF.

[80] Federal Energy Regulatory Commission. *Issued Hydrokinetic Permits.* Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.asp on March 19, 2008. Federal Energy Regulatory Commission. *Pending Hydrokinetic Permits.* Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-pending.asp on March 19, 2008.

EXHIBIT 3-3. ISSUED AND PENDING PRELIMINARY PERMITS ISSUED BY FERC FOR TIDAL AND WAVE ENERGY PROJECTS (AS OF MARCH 2008)

UNIT	PROJECT #	PROJECT NAME	WATER BODY	APPLICANT	FILING DATE	ISSUED DATE	CLASSIFICATION
Issued Preliminary Permits							
11	P-12585	San Francisco Bay	San Francisco Bay	Golden Gate Energy	4/26/2005	10/11/2005	Tidal -- Current
25	P-12729	Willapa Bay	Willapa Bay	Natural Currents Energy Services, LLC	5/30/2006	3/29/2007	Tidal -- Current
27	P-12690	Admiralty Inlet	Puget Sound	PUD No.1 of Snohomish County, WA	11/22/2006	3/9/2007	Tidal -- Current
27	P-12687	Deception Pass	Puget Sound	PUD No.1 of Snohomish County	6/15/2006	3/1/2007	Tidal -- Current
27	P-12698	Guemes Channel	Puget Sound	PUD No.1 of Snohomish County	9/20/2006	2/22/2007	Tidal -- Current
27	P-12688	Rich Passage	Puget Sound	PUD No.1 of Snohomish County	6/15/2006	2/22/2007	Tidal -- Current
27	P-12692	San Juan Channel	Puget Sound	PUD No.1 of Snohomish County	6/15/2006	2/22/2007	Tidal -- Current
27	P-12691	Agate Passage	Puget Sound	PUD No.1 of Snohomish County	4/28/2006	2/22/2007	Tidal -- Current
27	P-12689	Spieden Channel	Puget Sound	PUD No.1 of Snohomish County	11/2/2006	2/22/2007	Tidal -- Current
27	P-12612	Tacoma Narrows	Puget Sound	Tacoma Power	9/14/2005	2/22/2006	Tidal -- Current
30	P-12753	Humboldt County Wave Project	Pacific Ocean	Finavera Renewables	12/7/2006	2/14/2008	Wave
31	P-12752	Coos County Wave Project	Pacific Ocean	Aqua-Energy Group	4/17/2006	4/26/2007	Wave
32	P-12743	Douglas County	Pacific Ocean	Douglas County	6/15/2006	4/6/2007	Wave
32	P-12749	Coos Bay	Pacific Ocean	Oregon Wave Energy Partners I, LLC	3/27/2006	3/9/2007	Wave
33	P-12713	Reedsport OPT Wave Park	Pacific Ocean	Ocean Power Technologies, Inc.	3/29/2006	2/16/2007	Wave
38	P-12731	Angoon	Kootznahoo Inlet	Natural Currents Energy Services, LLC	4/3/2006	3/29/2007	Tidal -- Current
38	P-12696	Gastineau Channel	Gastineau Channel	Oceana	8/28/2006	3/23/2007	Tidal -- Current
38	P-12697	Wrangell Narrows	Wrangell Narrows	Oceana	8/28/2006	3/23/2007	Tidal -- Current
38	P-12695	Icy Passage	Icy Passage/Strait	Oceana	6/15/2006	3/23/2007	Tidal -- Current
39	P-12744	Cook Inlet	Cook Inlet	Chevron Technology Ventures, LLC	10/6/2006	6/11/2007	Tidal -- Current
39	P-12705	Central Cook Inlet	Cook Inlet	Oceana	6/28/2006	6/7/2007	Tidal -- Current

UNIT	PROJECT #	PROJECT NAME	WATER BODY	APPLICANT	FILING DATE	ISSUED DATE	CLASSIFICATION
39	P-12694	Kachemak Bay	Cook Inlet	Oceana	6/15/2006	5/18/2007	Tidal -- Current
39	P-12679	Cook Inlet	Cook Inlet	ORPC Alaska	6/15/2006	4/17/2007	Tidal -- Current
39	P-12678	Resurrection Bay	Gulf of Alaska	ORPC Alaska	6/15/2006	4/16/2007	Tidal -- Current
Pending Preliminary Permits							
28	P-13052	Green Wave San Luis Obispo Wave Park	Pacific Ocean	Green Wave Energy Solutions, LLC	10/19/2007	N/A	Wave
30	P-13076	Sonoma coast Hydrokinetic Energy	Pacific Ocean	Sonoma County Water Agency	11/15/2007	N/A	Wave
30	P-13075	Centerville OPT Wave Energy Park	Pacific Ocean	California Wave Energy Partners, LLC	11/9/2007	N/A	Wave
30	P-13053	Green Wave Mendocino Wave Park	Pacific Ocean	Green Wave Energy Solutions, LLC	10/19/2007	N/A	Wave
30	P-12781	Mendocino County WaveConnect	Pacific Ocean	PG & E	2/27/2007	N/A	Wave
31	P-12780	Fairhaven Wave Power Station	Pacific Ocean	Fairhaven O.P.T. Ocean Power	2/28/2007	N/A	Wave
31	P-12779	Humboldt County WaveConnect	Pacific Ocean	PG & E	2/27/2007	N/A	Wave
33	P-13047	Oregon Coastal Wave Energy	Pacific Ocean	Tillamook Intergovernmental Development Entity	10/1/2007	N/A	Wave
33	P-12793	Florence Oregon Ocean Wave Energy Project	Pacific Ocean	Energetech America LLC	4/16/2007	N/A	Wave
33	P-12750	Newport OPT Wave Park	Pacific Ocean	Oregon Wave Energy Partners II, LLC	11/2/2006	N/A	Wave
33	P-12727	Lincoln County Wave Energy	Pacific Ocean	Lincoln County, Oregon	8/17/2006	N/A	Wave
36	P-13058	Grays Harbor Ocean Energy and Coastal Protection	Gray Harbor to US/Canada border	Washington Wave Company, LLC	11/5/2007	N/A	Wave

Source: Federal Energy Regulatory Commission, *Issued Hydrokinetic Permits,* accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.asp on March 19, 2008; Federal Energy Regulatory Commission, *Pending Hydrokinetic Permits,* accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-pending.asp on March 19, 2008. Public comments of Oregon Department of Fish and Wildlife dated December 29, 2008.

The number of future projects that are likely to be permitted for construction within proposed critical habitat areas is unknown. Projects that receive preliminary permits and undergo further scoping ultimately may not be constructed for a variety of reasons unrelated to green sturgeon critical habitat; based on available data, it is not possible to predict how many of these projects will or will not be constructed. Therefore, this analysis assumes that all projects that have currently applied for or received preliminary permits will ultimately be constructed and will incur costs as a result of critical habitat designation for green sturgeon. Given the necessary timeframes for project construction, it may be reasonable to assume that this set of projects will incur project modification costs related to green sturgeon critical habitat within the next 20 years. However, it should also be noted that other new permit applications are likely to be filed in the future, and that rate of application may be increasing. The Federal Energy Regulatory Commission (FERC) points out that while it received only one application between 2004 and 2005 for hydrokinetic (tidal- and wave- energy) projects, it received seven preliminary permit applications in both 2006 and 2007 within the critical habitat study area, excluding Alaska waters.[81]

3.3.3 REGULATORY BASELINE

Because tidal and wave energy projects in green sturgeon habitat on the West Coast are in the preliminary stages of development, NMFS has yet to make specific recommendations about project modifications that may be required to mitigate potential adverse impacts on green sturgeon or its habitat. Tidal and wave energy projects have the potential to affect the habitat of a wide range of species, including green sturgeon, Pacific salmon and steelhead, and marine mammal species, which have similar habitat requirements. Again, due to the preliminary stages of permitting for most projects, NMFS has made few conservation recommendations related to these species. Nonetheless, some level of baseline protection is thought to exist for these species under the Act.

3.3.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON TIDAL AND WAVE ENERGY PROJECTS

Tidal and wave energy projects are subject to FERC permitting and licensing requirements, and thus may require section 7 consultations as a result of this designation.

Both NMFS and the U.S. Fish and Wildlife Service have commented on several of the preliminary permit applications for these projects. In its comments, NMFS noted affected areas that represent essential fish habitat (EFH) for Federally managed species, but indicated that the breadth and magnitude of potential adverse impacts on this habitat are unknown and cannot be evaluated without further information on and analysis of the specific projects at issue.[82]

In the absence of specific conservation efforts recommended for green sturgeon, the potential impact of the proposed green sturgeon critical habitat on tidal/wave energy

[81] "FERC Comments on NOAA Fisheries Proposed Rule for Designation of Critical Habitat for Green Sturgeon," Interagency comments of the Federal Energy Regulatory Commission to NMFS, August 25, 2008.

[82] See, for example, National Marine Fisheries, *Comments on San Francisco Bay Tidal Energy Project (FERC No. 12585),* August 12, 2005.

project remains uncertain. Potential modifications to these projects to mitigate adverse impacts may include spatial restrictions on project installation. Data on the costs of these measures were not widely available. To develop an estimate of potential costs, this analysis relies on the estimated costs of environmental measures for a single project, and assumes that these costs will be incurred by all tidal/wave energy projects (see Exhibit 3-4). We recognize that this sample is small, and thus large uncertainties exist with respect to estimated potential impacts to these projects. In addition, FERC points out that license application costs and costs related to environmental review of the projects may increase due to critical habitat designation.[83] While costs of section 7 consultation are discussed in Section 1 of this report, other environmental review costs are not explicitly captured in current estimates. To the extent that future projects require more or fewer project modifications than have been included in this example, these costs may over- or underestimate economic effects.

EXHIBIT 3-4. ENVIRONMENTAL MEASURES FOR EXAMPLE WAVE ENERGY PROJECT

PROJECT MODIFICATION	CAPITAL COST	ANNUAL O&M COST	TOTAL 30 YR COST
Use HDD to deploy transmission cable from shore station under beach and intertidal area, out to depth of 10 to 30 ft below mean lower low tide (2005$)	$500,000	$0	$500,000
Design features to achieve a closed-loop system to prevent any marine life entering pressurized water flow (2005$)	$500,000	$20,000	$1,100,000
Design features to minimize scale of anchor devices, project footprint on seafloor, and chain/cable sweep of seafloor (2005$)	$250,000	$0	$250,000
Develop a schedule of regular system maintenance that minimizes site visits, disturbance to marine growth, and activity at the site. (2005$)	$2,500	$500	$17,500
		Total	**$1,867,500**
		Total (2007$)	**$1,978,000**
		Annual Cost[a]	**$66,000**

Source: Federal Energy Regulatory Commission, Preliminary Draft Environmental Assessment: Makah Bay Offshore Wave Energy Pilot Project, October 2006.
[a] Because the precise payment scheme for these projects is unknown, this analysis applies a simple annual cost estimate for these projects.

This analysis assumes that all projects with pending or approved preliminary permits are moved through to the construction phase, and undertake project modifications for green sturgeon. In the absence of specific information about the extent of the regulatory baseline for green sturgeon, project modification costs for tidal and wave energy projects

[83] "FERC Comments on NOAA Fisheries Proposed Rule for Designation of Critical Habitat for Green Sturgeon," Interagency comments of the Federal Energy Regulatory Commission to NMFS, August 25, 2008.

are assumed to be attributable to green sturgeon critical habitat designation. Although some level of protection would be already expected to exist under the listing of the green sturgeon, this analysis is unable to separate those costs from critical habitat costs.

For one unit, San Francisco Bay, a number of listed salmon species are also listed with critical habitat. Based on several past examples of formal consultations that considered green sturgeon, conservation measures for green sturgeon are frequently identified together with other salmonid species when they are present.[84] That is, salmonid species and their associated critical habitats may provide a strong baseline protection for green sturgeon critical habitat where habitats coexist. As such, it is possible that few additional requirements could result from green sturgeon critical habitat designation than would have occurred with only salmon species being present. In an attempt to be conservative, i.e., more likely to overstate costs than understate costs, this analysis assumes that the likelihood of the proposed project needing to undertake project modifications will be increased by 50 percent due to green sturgeon critical habitat, increasing expected costs by that amount. Appendix E provides a sensitivity analysis for this assumption, providing estimates assuming that green sturgeon critical habitat is responsible for the generation of all project modification costs for all projects.

3.3.5 SUMMARY OF ECONOMIC IMPACTS TO TIDAL/WAVE ENERGY PROJECTS

As discussed above, potential impacts on tidal and wave energy projects are subject to high levels of uncertainty for the following reasons:

- The number of future tidal and wave energy projects is unknown.
- Future management and required project modifications for green sturgeon critical habitat related to tidal and wave energy projects are uncertain and could vary in scope from project to project.

Exhibit 3-5 presents a summary of our findings regarding impacts to tidal and wave energy projects.

[84] See for example, NMFS, Southwest Region, Biological Opinion on the proposed Airport Road Bridge Replacement Project located near the City of Anderson, Shasta County, California, and its effect on endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead, their respective critical habitats, and the southern distinct population segment of North American green sturgeon, January 6, 2006. In this consultation, recommended measures are not separated among salmon and green sturgeon, and appear to be the same for all affected fish species.

EXHIBIT 3-5. SUMMARY OF ECONOMIC IMPACTS TO TIDAL/WAVE ENERGY PROJECTS BY UNIT

UNIT	DESCRIPTION	NUMBER OF AFFECTED PROJECTS[a]		PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)
		ISSUED PRELIM. PERMIT	PENDING PRELIM. PERMIT		
11	San Francisco Bay, CA	1	0	0.5	$33,000
25	Willapa Bay, WA	1	0	1.0	$68,300
27	Puget Sound, WA	8	0	0.5	$273,000
28	CA-Mexico Border to Monterey Bay, CA	0	1	1.0	$65,900
29	Monterey Bay, CA to San Francisco Bay, CA	0	0	1.0	$0
30	San Francisco Bay, CA to Humboldt Bay, CA	1	4	1.0	$330,000
31	Humboldt Bay, CA to Coos Bay, OR	1	2	1.0	$198,000
32	Coos Bay, OR to Winchester Bay, OR	2	0	1.0	$132,000
33	Winchester Bay, OR to Columbia River and Estuary, OR	1	4	1.0	$330,000
34	Columbia River and Estuary to Willapa Bay, WA	0	0	1.0	$0
35	Willapa Bay, WA to Grays Harbor, WA	0	0	1.0	$0
36	Grays Harbor, WA to Cape Flattery, WA	0	1	1.0	$65,900
37	Strait of Juan de Fuca to Rosario Strait, WA	0	0	1.0	$0
38	AK/Canada border to Yakutat Bay, AK	4	0	1.0	$264,000
39	Coastal AK waters northwest of Yakutat Bay, AK	5	0	1.0	$330,000

Note:
[a] The number of affected projects assumes that each proposed project will 1) proceed to construction stage and 2) undergo modifications equal to those exhibited by the example project described in this section (i.e., each will incur annual costs of $66,000) over the next 30 years.

3.4 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON LIQUEFIED NATURAL GAS PROJECTS

3.4.1 DESCRIPTION OF THREAT

The proposed rule identifies proposed liquefied natural gas (LNG) projects as a potential threat to green sturgeon critical habitat in 14 units, including Coos Bay, the Lower Columbia River estuary, and all marine units. According to NMFS, LNG projects represent a potential threat to water quality in the event of leaks, spills, or pipeline breakage.

3.4.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

No LNG projects have yet been constructed within the study area. This analysis identified a total of 12 LNG terminals that have been proposed within the study area (see Exhibit 3-6). These projects are still in the development stages, and are awaiting approval from FERC and/or the U.S. Coast Guard (depending on their location).

EXHIBIT 3-6. NUMBER OF PROPOSED LNG PROJECTS (AS OF MARCH 2008)

UNIT	DESCRIPTION	NUMBER OF PROJECTS
18	Coos Bay, OR	1
24a	Lower Columbia River Estuary, OR	3
28	CA-Mexico Border to Monterey Bay, CA	4
29	Monterey Bay, CA to San Francisco Bay, CA	-
30	San Francisco Bay, CA to Humboldt Bay, CA	-
31	Humboldt Bay, CA to Coos Bay, OR	-
32	Coos Bay, OR to Winchester Bay, OR	-
33	Winchester Bay, OR to Columbia River and Estuary, OR	-
34	Columbia River and Estuary to Willapa Bay, WA	-
35	Willapa Bay, WA to Grays Harbor, WA	-
36	Grays Harbor, WA to Cape Flattery, WA	-
37	Strait of Juan de Fuca to Rosario Strait, WA	-
38	AK/Canada border to Yakutat Bay, AK	-
39	Coastal AK waters northwest of Yakutat Bay, AK	4

Note that the potential exists for LNG development in listed units, though data show that, to date, proposed facilities only exist in four units.

Source: California Energy Commission, *Location and Capacity of Proposed LNG Terminals,* March 2008. Accessed at: http://www.energy.ca.gov/lng/projects.html. Public comments of Oregon Department of Fish and Wildlife dated December 29, 2008.

In addition to the LNG terminals themselves, pipelines are necessary to distribute natural gas. Usually an LNG terminal connects to a large, interstate pipeline (which may service several terminals) via smaller sendout pipelines. This network of pipelines has yet to be fully developed on the West Coast.

Similar to tidal/wave energy projects, the number of future LNG projects likely to be built within proposed critical habitat areas is highly speculative. Many LNG projects are abandoned during the development stages for various reasons unrelated to green sturgeon critical habitat. Based on available data, this analysis cannot forecast how many projects may or may not ultimately be constructed. Therefore, it assumes that all currently proposed projects will be constructed.

3.4.3 REGULATORY BASELINE

Because the proposed LNG projects are still in the preliminary stages, NMFS has yet to make specific recommendations about any project modifications that might be required to mitigate potential adverse impacts on green sturgeon or its habitat. Other listed species, including the Oregon Coast coho salmon and Pacific salmon and steelhead, are present in Coos Bay and the Lower Columbia River units. Although marine mammals exist in units 28 and 39, it is not clear that protections for these species would be protective of green sturgeon. Thus, this analysis assumes that little current baseline protection exists in those units. Since a certain level of protection, if small, would be already expected to exist under the listing of the green sturgeon, this analysis assumes that approximately 90 percent of estimated impacts are attributable to green sturgeon critical habitat conservation efforts.

3.4.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON LNG PROJECTS

LNG projects are subject to either FERC or Coast Guard permitting and licensing requirements depending on the proximity of the facility to shore, and thus may require section 7 consultations as a result of this designation.

Until specific plans for the projects are made available, their potential impact on green sturgeon habitat will remain uncertain, as will the nature of any project modifications that might be requested to mitigate adverse impacts. According to NMFS, these modifications may include spatial restrictions on project installation, site relocation, and specific measures to prevent or respond to catastrophes. Because there is a high level of uncertainty associated with anticipating future management efforts for green sturgeon related to LNG projects, this analysis presents a range of potential costs.

At the low end, this analysis assumes that LNG projects would not be required to undertake additional measures for the protection of green sturgeon and its habitat, or that any required project modifications would result in minimal additional costs. While LNG projects on the West Coast are still in the preliminary stages, NMFS has consulted on several projects on the East Coast, and has not yet required project modifications to mitigate adverse impacts to an aquatic fish species.[85]

[85] Personal communication with NMFS on July 17, 2008.

An Environmental Impact Statement (EIS) has been completed for the Bradwood Landing LNG Project, which is located within the study area. This EIS considered a wide range of activities associated with LNG terminals that might affect the green sturgeon or its habitat (see Exhibit 3-7). Because most west-coast LNG projects are still in the preliminary stages, the total estimated costs of these measures are unknown at this time, and may vary widely by LNG site depending on its operational structure and location. However, any costs associated with project modifications are likely to fall within the range of impacts forecast by this analysis. That is, they are likely to be less than impacts associated with re-siting the facility as discussed in the high-end scenario.

EXHIBIT 3-7. EXAMPLE OF POTENTIAL IMPACTS AND MITIGATION MEASURES FOR SALMONIDS AND STURGEON AT THE BRADWOOD LANDING PROJECT

ACTIVITY	EXAMPLE MITIGATION MEASURE
Fish strandings associated with LNG marine traffic	▪ Speed limits on LNG carriers in the Columbia River. ▪ Determine appropriate carrier speed, or other applicable measures, to avoid or minimize wake stranding impacts.
Shoreline erosion	▪ Determine appropriate carrier speed, or other applicable measures, to avoid or minimize shoreline erosion impacts. ▪ Prepare a shoreline monitoring plan.
Ship ballast and cooling water appropriations and discharges	▪ Change project design to provide screened water at docks for cooling engines and filling ballast tanks, thus minimizing entrainment ▪ Offer contract incentives for ships to retrofit in order to utilize the system ▪ Develop performance standards for water temperature impacts and biocide use associated with LNG carrier water intakes and discharges. ▪ Develop and implement a monitoring program to assess the effects of impingement and entrainment from use of the screened water supply system on juvenile salmonids.
Accidental spill or leak of hazardous materials	▪ Each LNG carrier would maintain a shipboard oil pollution plan (SOPEP), which would contain measures to be implemented in the event of a spill or release. ▪ Prohibit liquid transfer as well of refueling of vehicles and equipment within 100 feet of waterbodies.
Dredging, including initial dredging and maintenance dredging	▪ Use best management practices (BMPs) to minimize sedimentation impacts. ▪ Loss of sediment for downstream habitat would be partially avoided by placing dredged material back into the river system. ▪ Prepare a plan to monitor areas after dredging. ▪ Prepare a dredging noise mitigation plan that identifies measures to be implemented during dredging to reduce noise levels. ▪ Dredging would occur during the NMFS recommended in-water work windows.

ACTIVITY	EXAMPLE MITIGATION MEASURE
Pile driving	▪ Pile driving would occur during the NMFS recommended in-water work windows. ▪ Piles installed vertically to allow the use of bubble curtains to minimize sound pressure levels.
Upland pipeline construction	▪ Implement procedures to minimize potential impacts on water quality. ▪ Allow a riparian buffer at least 25 feet wide to permanently re-vegetate with native moody plant species across the entire right-of-way after construction completed.
Water appropriation and discharge	▪ Install screens on all water intakes using NMFS fish-screen criteria. ▪ Conduct post-installation flow mapping through all intake screens, and develop and implement a monitoring program to assess the effects of impingement and entrainment.
Stormwater runoff	▪ Install additional culverts and drainage ditches to improve stormwater drainage.
Routine discharge of condensate water	▪ Neutralize discharge water as required under its NPDES permit.
Source: FERC, final Environmental Impact Statement (EIS) for the construction and operation of the Bradwood Landing Project, June 6, 2008. Accessed at: http://www.ferc.gov/industries/lng/enviro/eis/2008/06-06-08-eis.asp.	

At the high end, spatial restrictions might require an LNG project to be re-sited (i.e., the project would need to be moved to a less preferred alternative site). The impacts associated with re-siting an LNG terminal to a less preferred site would be expected to vary widely from project to project depending on a number of factors, including:

- **Availability of alternative sites.** If alternative sites are widely available, the impact of moving to an alternative site may be minimal. In other cases, developers may be unable to find an alternative site, and the project may be abandoned.[86]
- **Quality of alternative site.** If the alternative site is relatively comparable to the preferred site, the economic impact of re-siting may be minimal. However, some alternative sites may pose additional spatial, safety, or environmental restrictions, resulting in greater impacts.
- **Size of project.** A larger project can cost more to re-site given that more land needs to be purchased.

[86] For example, in 2004, two proposed projects in Maine and California were unable to find an alternative site. See National Association of State Fire Marshals, *Liquefied Natural Gas: An Overview of the LNG Industry for Fire Marshals and Emergency Responders,* 2005.

- **Surrounding land value.** It can be more expensive to re-site a project in areas where land is highly valued because, in addition to higher prices, developers may face increased competition for land.
- **Location relative to existing infrastructure.** Moving to a less preferred site may cause LNG projects to move farther away from existing pipeline infrastructure. Developers then would need to construct additional send-out pipelines to connect the facility to transport pipelines.
- **Point in the permitting process at which green sturgeon is considered.** If a project is still early in the siting and development process, it may be less costly for the project to consider its impacts on green sturgeon and its habitat. For example, prospective sites can be chosen to minimize impacts to green sturgeon.

Data on the cost of moving to a less preferred site were not widely available; therefore, this analysis relies on an estimate for a single project where moving to a less preferred alternative site would result in an increase in construction costs of $650 million.[87] Annualized costs (at 7 percent over twenty years) are estimated at $32.5 million. The likelihood of re-siting as an outcome of the section 7 process for critical habitat is also unknown. We recognize potential impacts to LNG projects may occur as a result of designation, and that large uncertainties exist with respect to estimating these costs.

As stated above, this analysis assumes that all currently proposed projects with pending or approved preliminary permits are moved through to the construction phase, and undertake project modifications for green sturgeon. In the absence of specific information about the extent of the regulatory baseline for green sturgeon, project modification costs LNG projects are assumed to be attributable to green sturgeon critical habitat designation. Although some level of protection would be already expected to exist under the listing of the green sturgeon, this analysis is unable to separate those costs from critical habitat costs.

In the Lower Columbia River Estuary unit, listed salmon species are listed with critical habitat. In the Coos Bay unit, Oregon Coast coho salmon are present, but no critical habitat has been designated in marine units. Based on several past examples of formal consultations that considered green sturgeon, conservation measures for green sturgeon are frequently identified together with other salmonid species when they are present. That is, salmonid species and their associated critical habitats may provide a strong baseline protection for green sturgeon critical habitat where habitats coexist. As such, it is possible that few additional requirements could result from green sturgeon critical habitat designation than would have occurred with only salmon species being present. In an attempt to be conservative, i.e., more likely to overstate costs than understate costs, this analysis assumes that the likelihood of the proposed project in Coos Bay needing to undertake project modifications will be increased by 50 percent due to green sturgeon critical habitat, increasing expected costs by that amount. The analysis assumes that the likelihood of project modifications for projects in the Lower Columbia River Estuary are

[87] ABSG Consulting, LNG Receiving Terminal Offshore Oregon as an Alternative to the Land-Based Bradwood Facility, 2006.

increased by 20 percent. Appendix E provides a sensitivity analysis for this assumption, providing estimates assuming that green sturgeon critical habitat is responsible for the generation of all project modification costs for all projects.

3.4.5 SUMMARY OF ECONOMIC IMPACTS TO LNG PROJECTS

As discussed above, potential impacts on LNG terminals are subject to high levels of uncertainty for the following reasons:

- The number of future LNG projects likely to reach the construction stage within proposed critical habitat areas is speculative.
- Future management and required project modifications for LNG terminals are uncertain and could vary in scope from project to project.
- The cost of re-siting an LNG terminal is dependent on a number of factors, including the availability and quality of alternative sites.

Exhibit 3-8 below presents a summary of our findings.

EXHIBIT 3-8. SUMMARY OF ECONOMIC IMPACTS TO LNG PROJECTS

UNIT	DESCRIPTION	NUMBER OF AFFECTED PROJECTS[a]	PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)	
				LOW	HIGH
18	Coos Bay, OR	1	0.5	$0	$16,250,000
24a	Lower Columbia River Estuary, OR	3	0.2	$0	$19,500,000
24b	Lower Columbia River, OR	-		$0	$0
28	CA-Mexico Border to Monterey Bay, CA	4		$0	$130,000,000
29	Monterey Bay, CA to San Francisco Bay, CA	-		$0	$0
30	San Francisco Bay, CA to Humboldt Bay, CA	-		$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	-		$0	$0
32	Coos Bay, OR to Winchester Bay, OR	-		$0	$0
33	Winchester Bay, OR to Columbia River and Estuary, OR	-		$0	$0
34	Columbia River and Estuary to Willapa Bay, WA	-		$0	$0
35	Willapa Bay, WA to Grays Harbor, WA	-		$0	$0
36	Grays Harbor, WA to Cape Flattery, WA	-		$0	$0
37	Strait of Juan de Fuca to Rosario Strait, WA	-		$0	$0

UNIT	DESCRIPTION	NUMBER OF AFFECTED PROJECTS[a]	PROBABILITY SCORE	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)	
				LOW	HIGH
38	AK/Canada border to Yakutat Bay, AK	-		$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	4		$0	$130,000,000

Note:
[a] The number of affected projects assumes that all known projected projects are assumed to 1) move forward to the construction stage and 2) incur costs related to green sturgeon critical habitat conservation measures.

3.5 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON DESALINATION PLANTS

3.5.1 DESCRIPTION OF THREAT

NMFS identified desalination plants as a potential threat in two marine units along the coast of Southern California, as well as the San Pablo Bay Unit. According to NMFS, desalination plants may pose a threat to green sturgeon critical habitat through the discharge of hypersaline effluent that may affect water quality.

3.5.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

There are nine existing coastal desalination plants located within the study area (see Exhibit 3-9). It is likely that several of these plants are not currently operating. For example, the City of Morro Bay has a temporary emergency desalination plant that is not currently in operation.[88] Because water produced via desalination tends to be more expensive than water from other sources, the operating status of a plant is highly dependent on prevailing drought conditions and local water prices. When water is plentiful, desalination can be cost-prohibitive. However, as the price of water rises, desalination becomes a more viable source of drinking water, and desalination plants may be brought online. Information on the operating status for existing plants was not readily available for all plants in 2008.

Twenty additional desalination plants have been proposed but have not yet been constructed (see Exhibit 3-8). Generally, the proposed plants have greater capacities than existing plants, suggesting that these plants may produce a greater quantity of hypersaline effluent. Similar to LNG terminals and tidal/wave energy projects, it is unclear how many of these proposed projects may ultimately reach construction stage.

[88] California Coastal Commission, *Chapter Two: Coastal Desalination Projects in California,* accessed at: http://www.coastal.ca.gov/desalrpt/dchap2.html.

EXHIBIT 3-9. EXISTING AND PROPOSED DESALINATION PLANTS IN AFFECTED GREEN STURGEON CRITICAL HABITAT AREAS (AS OF MARCH 2008)

UNIT	PROJECT NAME	CAPACITY (GPD)
Existing		
10	Marin Municipal Water District Seawater Desalination Plant	15,000,000
28	Chevron Gaviota Oil & Gas Processing Plant	410,000
28	City of Morro Bay	830,000
28	City of Santa Barbara	Unknown
28	US Navy/San Nicholas Island	24,000
28	PG&E Diablo Canyon Power Plant	576,000
28	PG&E Morro Bay Power Plant	430,000
29	Monterey Bay Aquarium	40,000
29	PG&E Moss Landing Power Plant	480,000
Proposed		
28	Cambria Community Service District	500,000
28	Municipal Water District of Orange County	27,000,000
28	Poseidon Resources/ Huntington Beach	50,000,000
28	San Diego County Water Authority	Unknown
28	San Diego County Water Authority	50,000,000
28	San Diego County Water Authority	50,000,000
28	US Navy/San Diego	700,000
28	West Basin Municipal Water District	20,000,000
28	City of Buenaventura	Unknown
28	Long Beach 1	10,000,000
28	Long Beach 2	10,000,000
28	Los Angeles Department of Water & Power	10,000,000
29	City of Sand City	27,000
29	City of Santa Cruz	2,500,000
29	Marina Coast Water District	2,680,000
29	Monterey Bay Shores	20,000
29	Monterey Peninsula Water Management District	7,500,000
29	Ocean View Plaza/Monterey	5,000
29	Carmel Area Wastewater District	Unknown
29	Coastal Water Project	18,000,000

Source: California American Water, *Seawater Desalination: White Paper,* September 2004, accessed at: http://www.coastalwaterproject.com/pdf/WhitePaper_SeawaterDesalination.pdf on March 15, 2008.

3.5.3 REGULATORY BASELINE

The available consultation data upon which we based our analysis do not indicate that NMFS or the Fish and Wildlife Service has consulted on past desalination projects regarding impacts on listed marine species. Further, existing desalination plants do not appear to have implemented measures to manage the discharge of hypersaline effluent for human protection or otherwise, to date. Discharges from desalination plants are subject to Clean Water Act requirements, but because there is no past consultation history, it is not clear whether CWA requirements adequately address hypersaline effluent in marine waters for green sturgeon.

3.5.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON DESALINATION PLANTS

Under Clean Water Act requirements, desalination plants require Federal permits from USACE, EPA, or both. Therefore, these plants may become subject to section 7 consultation regarding green sturgeon. According to NOAA Fisheries, potential conservation efforts to mitigate desalination impacts are likely to include the treatment of hypersaline effluent to ensure that salinity levels are restored to normal values. The costs of treating hypersaline effluent or finding an alternate manner of brine disposal can vary widely across plants depending on plant capacity and design. Therefore, this analysis presents a range of possible impacts.

At the low end, this analysis assumes that the cost of reducing salinity levels will be minimal. For example, desalination plants may be co-located with power plants. If co-located, the effluent can be mixed with the power plants' wastewater to reduce salinity at minimal cost. Many power plants already choose to be co-located with power plants because co-location can result in construction and energy cost savings.[89]

At the high end, it assumes that desalination plants would utilize alternate methods of brine disposal. These alternate methods can include using injection wells, evaporation ponds, or crystallizers. The estimated costs of brine disposal using injection wells (the least cost alternative at approximately $0.55 per kilogallon) are presented in Exhibit 3-10.

EXHIBIT 3-10. ESTIMATED COSTS OF ALTERNATE METHOD OF BRINE DISPOSAL

UNIT	# OF PLANTS	CAPACITY (KGAL/YEAR)	ANNUAL COST	AVERAGE ANNUAL COST PER PLANT
10	1	5,475,000	$3,613,500	$3,613,500
28	18	84,121,550	$55,520,000	$3,084,000
29	10	11,406,980	$7,529,000	$753,000

Notes: Assumes brine is disposed in injection wells. Assumes, on average, a plant capacity of five million gallons per day and costs of $0.55 /kgal for alternative brine disposal.
Source: US Bureau of Reclamation, Zero Discharge Waste Brine Management for Desalination Plants, December 2002.

[89] Poseidon Resources, *The Role of Energy in US Large-Scale Seawater Desalination Development*, 2004. Accessed at: http://www.poseidonresources.com/Briefs/256,1,The Role of Energy in U.S. Large-Scale Seawater Desalination Development.

In the absence of specific information about the extent of the regulatory baseline for green sturgeon, project modification costs desalination projects are assumed to be attributable to green sturgeon critical habitat designation. Although some level of protection would be already expected to exist under the listing of the green sturgeon, this analysis is unable to separate those costs from critical habitat costs.

3.5.5 SUMMARY OF ECONOMIC IMPACTS TO DESALINATION PROJECTS

As discussed above, potential impacts on desalination plants are subject to high levels of uncertainty for the following reasons:

- The number of future desalination plants is speculative.
- Future management and required project modifications for desalination are uncertain and could vary depending on the location and size of the plant.

Exhibit 3-11 below presents a summary of our findings.

EXHIBIT 3-11. SUMMARY OF ECONOMIC IMPACTS TO DESALINATION PROJECTS BY UNIT

UNIT	DESCRIPTION	NUMBER OF AFFECTED PLANTS[a]		TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)	
		EXISTING	PROPOSED	LOW	HIGH
10	San Pablo Bay, CA	1	0	$0	$3,610,000
28	CA-Mexico Border to Monterey Bay, CA	6	12	$0	$55,500,000
29	Monterey Bay, CA to San Francisco Bay, CA	2	8	$0	$7,530,000

Note:
[a] The number of affected plants assumes that all potential desalination plants will move forward to the construction stage. At the high end, it further assumes that all desalination plants will undertake alternative brine disposal efforts to accommodate green sturgeon critical habitat concerns.

3.6 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON RESTORATION ACTIVITIES

3.6.1 DESCRIPTION OF THREAT

NMFS identifies restoration as a threat in 11 units in Northern and Central California. Restoration activities are efforts undertaken to restore habitat, and can include installing fish passage, instream barrier modification, bank stabilization, fish screening, and other water conservation measures. While these activities would be encouraged as long as they promote the conservation of the species, some special project modifications in the form of spatial and temporal restrictions may be required as a result of this designation.

3.6.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

The extent of past restoration activity is estimated using the CalFish database maintained by California Department of Fish and Game, which includes projects undertaken under the Anadromous Fish Restoration Program (AFRP) (see Exhibit 3-12). To the extent that

this database does not include restoration projects undertaken under separate efforts by other agencies or by private landowners, the amount of past restoration activities in some units may be underestimated. This estimate of past restoration activity is used as a basis for projecting the level of future restoration activity over 20 years.

EXHIBIT 3-12. PAST RESTORATION PROJECTS FOR ANADROMOUS FISH SPECIES BY UNIT (AS OF MARCH 2008)

UNIT	DESCRIPTION	NUMBER OF PAST PROJECTS (1987-2007)
2	Upper Sacramento River, CA	16
3	Lower Sacramento River, CA	47
4	Yolo Bypass, CA	0
5	Sutter Bypass, CA	0
6	Lower Feather River, CA	7
7	Lower Yuba River, CA	1
8	Sacramento-San Joaquin Delta, CA	78
9	Suisun Bay, CA	72
10	San Pablo Bay, CA	276
11	San Francisco Bay, CA	205
12	Tomales Bay, CA	213

Sources: CalFish, California Fish Passage Assessment Database. Accessed at http://dnn.calfish.org/calfish2/FishDataandMaps/tabid/87/DataDownloads/tabid/90/Default.aspx on March 19, 2008.

3.6.3 REGULATORY BASELINE

Passed in 1992 by Congress, the Central Valley Project Improvement Act (CVPIA) is an addendum to the Central Valley Project Act that promotes environmental protection and restoration within California's Central Valley. The CVPIA has two objectives: preserving fish and wildlife and their habitats, and increasing the benefits of the Central Valley Project by adding incentives to use agricultural water more efficiently. As part of this effort, CVPIA established a restoration fund of $50 million annually to be used to finance activities that enhance fish and wildlife and their habitat.

Specifically, the CVPIA requires the Secretary of the Interior to develop and implement "a program which makes all reasonable efforts to ensure that, by the year 2002, the natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a longterm basis, at levels not less than twice the average levels attained during the period of 1967- 1991" (Section 3406[b][1]). This program has already been implemented as the Anadromous Fish Restoration Program (AFRP). A coalition of fish experts from the Federal and state agencies, private industry and academia (AFRP Core

Group) have developed a working plan for restoring salmon and steelhead in the Central Valley. The working plan provides a platform upon which the participating agencies and public will build a final plan. Actions are recommended for each watershed; they cover a broad spectrum of habitat restoration activities, such as improving instream flows, maintaining adequate water temperatures, correcting fish passage problems at dams and diversions, and restoring spawning gravel and riparian habitat.

3.6.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON RESTORATION ACTIVITIES

The nature of future management of restoration activities is unclear; therefore, this analysis presents a range of possible impacts. At the low end, it is assumed that restoration projects benefit green sturgeon and its habitat; therefore, these projects would require little to no additional management.

At the high end, it assumes that some percentage of restoration projects may incur additional project modifications to protect green sturgeon critical habitat. In the absence of specific information about the extent of the regulatory baseline for green sturgeon, project modification costs for restoration projects are assumed to be increased by 10 percent due to green sturgeon concerns. Appendix E provides a sensitivity analysis for this assumption, providing estimates assuming that green sturgeon critical habitat is responsible for the generation of all restoration project costs.

In the absence of information about the specific nature and costs of these project modifications as well as the number of projects that may potentially be affected, this analysis develops an estimate of potential impacts based on the average cost of a restoration project, and then scales that cost based on the estimated level of baseline protections.

To develop the average cost of a restoration project, this analysis uses data contained in the Calfish database. According to Calfish, the average cost of restoration projects range from $15,000 (for project maintenance activities) to $487,000 (habitat acquisition and conservation easements). The average cost of nearly 3,000 Calfish restoration projects is approximately $135,000 (2007 dollars). Given that restoration efforts are broadly focused on anadromous fish and workplans have been developed for salmon and steelhead, this analysis assumes that green sturgeon critical habitat requirements could add approximately 10 percent to project costs.

3.6.5 SUMMARY OF ECONOMIC IMPACTS TO RESTORATION ACTIVITIES

As discussed above, potential impacts on restoration projects are subject to high levels of uncertainty for the following reasons:

- Future management and required project modifications for restoration of green sturgeon critical habitat are uncertain and could vary depending on the location of the project.

Exhibit 3-13 below presents a summary of our findings.

EXHIBIT 3-13. SUMMARY OF ECONOMIC IMPACTS TO RESTORATION ACTIVITIES BY UNIT

UNIT	DESCRIPTION	NUMBER OF AFFECTED PROJECTS[a]	PROBABILITY SCORE	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)	
				LOW	HIGH
2	Upper Sacramento River, CA	16	0.1	$0	$10,800
3	Lower Sacramento River, CA	47	0.1	$0	$31,700
4	Yolo Bypass, CA	0	0.1	$0	$0
5	Sutter Bypass, CA	0	0.1	$0	$0
6	Lower Feather River, CA	7	0.1	$0	$4,730
7	Lower Yuba River, CA	1	0.1	$0	$675
8	Sacramento-San Joaquin Delta, CA	78	0.1	$0	$52,700
9	Suisun Bay, CA	72	0.1	$0	$48,600
10	San Pablo Bay, CA	276	0.1	$0	$186,000
11	San Francisco Bay, CA	205	0.1	$0	$138,000
12	Tomales Bay, CA	213	0.1	$0	$144,000

Note:
[a] The number of affected projects assumes that future restoration projects over the next 20 years continue at the same rate as past restoration projects.

SECTION 4 | ACTIVITIES WITH UNQUANTIFIED ECONOMIC IMPACTS

4.1 INTRODUCTION

NMFS identified 15 categories of economic activity that may require special management to accommodate green sturgeon critical habitat. Of those 15 activities, three activities have impacts that are best expressed in qualitative terms due to significant regulatory uncertainty and data limitations. This section describes each of those economic activities in terms of its threat to green sturgeon, extent of occurrence within critical habitat, baseline elements that may provide protection to green sturgeon, and then discusses the scope of potential impacts qualitatively.

4.2 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON AQUACULTURE

4.2.1 DESCRIPTION OF THREAT

NMFS identified aquaculture, particularly oyster farming, as a potential threat to green sturgeon and its habitat in six units within the study area. These include: Tomales Bay, Humboldt Bay, Willapa Bay, Grays Harbor, Puget Sound, and the southern coast of California from the Mexican border to Monterey Bay.

According to the critical habitat rule, application of pesticides at aquaculture farms and the subsequent runoff has the potential to impact green sturgeon habitat by affecting water and sediment quality.

4.2.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

In California and Washington, aquaculture farming takes place on approximately 22,000 fresh and saltwater acres. In these two states, 312 farms generate approximately $162.8 million in sales on an annual basis.[90]

Oysters are one of Washington's main aquaculture products, generating $38.3 million in sales in 2005. The industry is concentrated primarily in Willapa Bay, Grays Harbor, and Puget Sound, all of which are located within the study area. In general, shellfish farming is a major component of the county economy in both Grays Harbor and Willapa Bay. For example, the shellfish industry is the largest private employer in Pacific County, employing more than 600 people.[91] California's aquaculture industry is more diverse with farms specializing in a wide range of products and located across the state. Exhibit 4-1 below summarizes the number of aquaculture farms located in each unit.

[90] U.S. Department of Agriculture. *2005 Census of Aquaculture.* October 2006. Accessed at: http://www.agcensus.usda.gov/Publications/2002/Aquaculture/AQUACEN.pdf on March 15, 2008.

[91] Public comments of the Pacific Coast Shellfish Growers Association, dated December 22, 2008.

EXHIBIT 4-1. AQUACULTURE FARMS BY UNIT

UNIT	DESCRIPTION	NUMBER OF FARMS
12	Tomales Bay, CA	3
15	Humboldt Bay, CA	1
25	Willapa Bay, WA *	46
26	Grays Harbor, WA *	46
27	Puget Sound, WA *	46
28	CA-Mexico Border to Monterey Bay, CA	8

Notes:

***** Data on the specific location of Washington aquaculture farms were not available. Therefore, this analysis assumed that Washington's oyster aquaculture farms were evenly divided between these three units.

Sources: U.S. Department of Agriculture, *2005 Census of Aquaculture.* October 2006, accessed at: http://www.agcensus.usda.gov/Publications/2002/Aquaculture/AQUACEN.pdf on March 15, 2008; California Department of Fish and Game, *Registered Aquaculturist Public Report,* March 2008, accessed at: http://www.nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=3265 on March 15, 2008; California Department of Fish and Game, M*arine Aquaculture,* July 2007, accessed at: http://www.dfg.ca.gov/mlpa/pdfs/agenda071007jh.pdf.

4.2.3 REGULATORY BASELINE

Aquaculture operations are subject to a variety of federal and state water quality standards, affording green sturgeon and its habitat a level of baseline protection. In addition, many of the critical habitat units are considered to contain essential fish habitat (EFH) for salmon as well as a variety of other fish species. However, with the exception of Humboldt Bay, NMFS has yet to recommend project modifications for aquaculture facilities in these units.

Humboldt Bay's primary aquaculture operation, Coast Seafoods, underwent section 7 consultation in November 2005. The consultation considered the effects of the project on Southern Oregon/Northern California Coast coho salmon, Northern California steelhead, and California Coastal Chinook salmon. As a result of this consultation, Coast Seafoods undertook a variety of conservation measures including agreeing not to "discharge feed, pesticides, or chemicals (including hormones and antibiotics) into marine waters."[92]

4.2.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON AQUACULTURE OPERATIONS

Aquaculture operations may become subject to section 7 consultation under the Clean Water Act. To date, there has been one section 7 consultation for green sturgeon on shellfish aquaculture operations. This consultation found that incidental take of listed species was not reasonably certain to occur, and did not contain any reasonable or

[92] National Marine Fisheries Service, Section 7 Consultation on Coast Seafoods Project, November 2005.

prudent measures for minimization of take.[93] Therefore, it is unclear what conservation efforts NMFS may recommend for the species. However, potential management measures for green sturgeon related to aquaculture activities could be similar to those recommended in the section 7 consultation for Coast Seafoods for salmon species. These include:[94]

- Terminating bottom culture;
- Removing bay-ray fencing on owned or leased tidelands;
- Ceasing to engage in dredging, hydraulic harvesting, "bed cleaning" by mechanical means, or any other activities with a hydraulic harvester;
- No discharge of feed, pesticides, or chemicals (including antibiotics and hormones) into marine waters; and
- No intentional deposit of shells or other material on the bay floor.

However, it is unclear the extent to which aquaculture operations may have already adopted these practices independent of the designation of critical habitat for the green sturgeon. For example, in many areas, pesticide use may already be prohibited due to other state and Federal regulations.

Public comments from the Pacific Coast Shellfish Growers Association suggest that aquaculture farms in the Willapa Bay and Grays Harbor units have not adopted these conservation measures. Specifically, many shellfish farming operations in these units use bottom culture, use a mechanical harvester, and apply the pesticide carbaryl.[95] Notably, the use of carbaryl is being phased out under a 2003 settlement agreement between the Washington Toxics Coalition, the Ad Hoc Coalition for Willapa Bay, and the Willapa Bay/Grays Harbor Oyster Growers Association. Under this agreement, aquaculture operations in Willapa Bay and Grays Harbor began reducing their use of carbaryl with a total phase-out planned for December 31, 2012, and are researching alternative methods of eradicating burrowing shrimp.[96] Nonetheless, the commenters believe that adopting the conservation measures outlined above would be "economically infeasible."

Given the different type of aquaculture practices and products in Washington, it is possible that NMFS would recommend different conservation efforts in these areas that would not conflict with their operations. The recent section 7 consultation on ongoing shellfish aquaculture operations in Washington state did not include any reasonable or prudent measures because incidental take of listed species was not reasonably certain to

[93] National Marine Fisheries Service, Endangered Species Act Section 7 Formal Programmatic Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Nationwide Permit 48 Activities in Washington State, April 28, 2009.

[94] Ibid.

[95] Public comments of the Pacific Coast Shellfish Growers Association, dated December 22, 2008.

[96] Washington Toxics Coalition, "Carbaryl Use in Willapa Bay and Grays Harbor to End," *Alternatives,* Vol. 22, No. 3. Accessed at: http://www.watoxics.org/files/newsletters/alternatives22-3. Public comments of the Washington Department of Fish and Wildlife, dated December 19, 2008.

occur.[97] Without previous section 7 consultation suggesting conservation measures, it is unclear what those measures might include. In addition, according to NMFS biologists, green sturgeon in Humboldt Bay are not generally found in areas where aquaculture is currently conducted. To the extent this is true for other units as well, impacts on aquaculture operations may be minimal.

Given the uncertainty regarding current management and what changes (if any) might be required, this analysis does not quantify impacts on aquaculture operations.

4.3 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON COMMERCIAL SHIPPING ACTIVITY

4.3.1 DESCRIPTION OF THREAT

NMFS identified commercial shipping as a threat to green sturgeon critical habitat in 12 units within the study area: the Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, San Francisco Bay, Humboldt Bay, Lower Columbia River estuary, Lower Columbia River, Grays Harbor, Puget Sound, and the two Alaska units. According to the U.S. Coast Guard, ballast water discharged from commercial ships is one of the largest pathways for the introduction and spread of aquatic nuisance species.[98] According to the critical habitat rule, the release of ballast water and associated impacts on water quality (and the potential introduction of non-native species), are considered to be a potential threat to green sturgeon critical habitat.

4.3.2 EXTENT OF ACTIVITY WITHIN CRITICAL HABITAT STUDY AREA

Between 1997 and 2005, the ports of Seattle and Tacoma (in the Puget Sound unit) were the third and forth largest West Coast ports in terms of import and export volume, behind Los Angeles and Long Beach, California. Total trade entering and leaving ports in Puget Sound in 2005 was 39.5 million metric tons. In contrast, the port at Grays Harbor, Aberdeen, traded 0.9 million metric tons in 2005, only two percent of that traded in nearby Puget Sound ports. Exhibit 4-2 summarizes U.S. waterborne foreign trade in metric tons (MTONs) for ports where commercial shipping is considered a threat to green sturgeon.

[97] National Marine Fisheries Service, Endangered Species Act Section 7 Formal Programmatic Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Nationwide Permit 48 Activities in Washington State, April 28, 2009.

[98] U.S. Coast Guard, Ballast Water Management Program, accessed at http://www.uscg.mil/hq/g-m/mso/bwm.htm on April 11, 2008.

EXHIBIT 4-2. U.S. WATERBORNE FOREIGN TRADE BY U.S. CUSTOM PORTS, 2001-2005, METRIC TONS

U.S. CUSTOM PORTS		2001	2002	2003	2004	2005
	Seattle, WA	13,547,624	12,099,867	12,575,622	16,439,240	19,836,198
	Tacoma, WA	11,960,539	11,931,507	14,113,190	16,629,221	18,945,454
	Everett, WA	360,074	405,691	355,599	429,583	528,527
	Olympia, WA	73,123	116,024	297,440	231,853	121,084
	Port Townsend, WA	54,090	50,546	152,389	41,442	83,057
Puget Sound (27)	*Subtotal*	*25,995,450*	*24,603,635*	*27,494,239*	*33,771,338*	*39,514,320*
	Oakland, CA	9,145,774	8,763,833	9,513,698	10,635,322	13,063,466
	Richmond, CA	8,743,877	8,557,507	10,428,132	4,861,126	4,178,074
	Redwood City, CA	741,209	825,292	1,184,873	1,600,156	1,467,494
	San Francisco, CA	4,609,077	4,339,228	3,703,401	12,050,345	8,382,572
San Francisco (11)	*Subtotal*	*23,239,937*	*22,485,860*	*24,830,104*	*29,146,950*	*27,091,606*
	Longview, WA	3,532,732	3,408,233	3,417,864	3,604,271	3,818,331
	Vancouver, WA	4,369,928	4,288,980	3,583,312	4,257,294	3,573,020
	Portland, OR	14,779,769	13,513,750	15,805,583	16,546,181	15,149,997
Lower Columbia River (24b)	*Subtotal*	*22,682,428*	*21,210,964*	*22,806,760*	*24,407,745*	*22,541,349*
	Anchorage, AK	6,685,446	6,349,005	6,459,258	6,902,991	5,559,977
	Kodiak, AK	166	23	1,194	3,108	5,724
	Valdez, AK	2,401	6,707	5,145	19,505	2,467
	Sand Point, AK	73,510	25,369	2,998	3,006	0
Yakutat Bay to Bering Sea (39)	*Subtotal*	*6,761,524*	*6,381,104*	*6,468,595*	*6,928,610*	*5,568,168*
	Stockton, CA	2,356,491	2,397,646	1,717,998	2,520,284	3,036,311
	San Joaquin River, CA	1,189,496	1,780,116	1,210,850	1,606,442	1,350,703
	Sacramento, CA	637,624	846,093	752,361	556,344	609,220
Sacramento-San Joaquin Delta (8)	*Subtotal*	*4,183,612*	*5,023,854*	*3,681,209*	*4,683,070*	*4,996,234*
	Martinez, CA	2,335,519	1,766,684	3,050,584	1,720,134	2,344,685
	Crockett, CA	454,104	512,594	383,437	147,961	178,243
Suisun Bay (9)	*Subtotal*	*2,789,623*	*2,279,278*	*3,434,022*	*1,868,095*	*2,522,928*
	Coos Bay, OR	1,237,504	1,242,733	1,407,978	1,411,054	1,598,141
Coos Bay (18)	*Subtotal*	*1,237,504*	*1,242,733*	*1,407,978*	*1,411,054*	*1,598,141*
	Carquinez Strait, CA	1,499,809	1,886,782	1,986,420	422,662	1,102,670
	Selby, CA	465,737	340,225	315,733	112,010	159,624
	San Pablo Bay, CA	0	0	0	82,080	41,738
San Pablo Bay (10)	*Subtotal*	*1,965,546*	*2,227,006*	*2,302,153*	*616,752*	*1,304,032*
	Aberdeen, WA	698,954	831,715	665,547	672,681	904,396
Grays Harbor (26)	*Subtotal*	*698,954*	*831,715*	*665,547*	*672,681*	*904,396*
	Eureka, CA	319,076	287,940	326,344	354,892	489,110
Humboldt Bay (15)	*Subtotal*	*319,076*	*287,940*	*326,344*	*354,892*	*489,110*

U.S. CUSTOM PORTS		2001	2002	2003	2004	2005
Lower Columbia River Estuary (24a)	*Astoria, OR*	*11,623*	*2,405*	*17,319*	*9,069*	*353,734*
	Subtotal	*11,623*	*2,405*	*17,319*	*9,069*	*353,734*
Alaska/Canada Border to Yakutat Bay (38)	Ketchikan, AK	n/a	n/a	n/a	82,798	109,086
	Skagway, AK	n/a	n/a	n/a	0	40,530
	Juneau, AK	n/a	n/a	n/a	28,287	11,947
	Petersburg, AK	n/a	n/a	n/a	0	7,998
	Wrangell, AK	n/a	n/a	n/a	0	1,660
	Subtotal	n/a	n/a	n/a	*111,085*	*171,220*

Source: U.S. Department of Transportation, Maritime Administration, Port Import Export Reporting Service (PIERS), collected from Vessel Manifests and Bills of Lading, Accessed at Http://www.marad.dot.gov/marad_statistics/index.html , January 2008.

4.3.3 REGULATORY BASELINE

In response to national concern, the National Invasive Species Act of 1996 (NISA) was enacted which reauthorized and amended the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. NISA required the Coast Guard to establish national voluntary ballast water management guidelines. If the guidelines were deemed inadequate, NISA directed the Coast Guard to convert them into a mandatory national program. Under the nationwide program which began in 1998, a self-policing program was established where ballast water management was voluntary for a period of 24 to 30 months for vessels over 300 gross tons. However, the Coast Guard found the rate of compliance to be inadequate, and vessel operators often failed to submit mandatory ballast water reports to the Coast Guard. The voluntary program became mandatory in 2004, and the Coast Guard may now impose a civil penalty of up to $27,500 per day or a Class C Felony charge for large ships headed to the U.S. (entering the Exclusive Economic Zone, or 200 nautical miles from shore) that fail to submit a ballast water management reporting form.[99]

In 2004, the State of Washington added ballast water management laws (Chapter 77.120 RCW), intended to complement the U.S. Coast Guard's efforts. In July 2007, a bill amending these laws became effective and increased the maximum penalties to $27,500 from $5,000.

To the extent that wastewater and sewage from commercial cruise ships are a concern for green sturgeon, Alaska has protective regulations on both the State and Federal level. In 2000, Congress passed Law Title XIV, "Certain Alaskan Cruise Ship Operations" with regulations following in 2001. This law prohibits discharge of "blackwater" into Alaska waters (roughly three nautical miles from shore, but including some "donut holes" within

[99] See 33 CFR 151. U.S. Coast Guard, Ballast Water Management Program, accessed at http://www.uscg.mil/hq/g-m/mso/bwm.htm on April 11, 2008. Note, the Coast Guard published a notice of proposed rulemaking regarding Standards for Living Organisms in Ships' Ballast Water Discharged in U.S. Waters on August 28, 2009. The notice of proposed rule-making is available at: http://edocket.access.gpo.gov/2009/pdf/E9-20312.pdf. Comments, Coast Guard, September 23, 2009.

the Alexander Archipelago) by large cruise ships (more than 500 passengers).[100] The Alaska Department of Environmental Conservation established its own Commercial Passenger Vessel Environmental Compliance Program in 2001. This program regulates large and small cruise ships (greater than 50 passengers), setting limits for both "graywater" and blackwater discharge, as well as other non-hazardous solid waste disposal.[101]

4.3.4 IMPACTS OF CRITICAL HABITAT DESIGNATION ON COMMERCIAL SHIPPING ACTIVITIES

As discussed above, discharge of ballast water by large vessels within the EEZ is regulated by the U.S. Coast Guard. The Coast Guard could initiate consultation with NMFS regarding issues related to green sturgeon if the agency suspects that ballast water discharge may affect green sturgeon critical habitat. Consultations related to this issue on any listed West Coast species were, however, absent from the available consultation record. As such, any modifications to Coast Guard regulations or ensuing changes to ballast water discharge requirements for commercial shipping activities are unknown at this time; therefore, this analysis does not attempt to quantify impacts.

4.4 ECONOMIC IMPACTS OF CRITICAL HABITAT DESIGNATION ON EFFORTS TO MANAGE NON-NATIVE SPECIES

Non-native species (including striped bass, carp, pike, and non-native vegetation) were identified as an activity requiring special management in 11 units. These units included: the Upper and Lower Sacramento River, the Lower Feather River, the Lower Yuba River, the Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, San Francisco Bay, Willapa Bay, Grays Harbor, and Puget Sound.

Potential impacts related to non-native species management are unclear. This analysis was unable to determine specifically how this threat would be alleviated for any unit (i.e., what type of special management might be required), or if a Federal nexus would be present for these types of projects. In addition, many efforts to prevent the introduction of non-native species or to remove non-native species may already be captured in discussions of impacts to restoration projects or commercial shipping. Therefore, this analysis does not quantify impacts associated with non-native species.

[100] "Donut holes" were areas greater than three nautical miles from shore but within Alexander Archipelago that in the past ships could discharge of raw sewage.

[101] Alaska Department of Environmental Compliance, Commercial Passenger Vessel Environmental Compliance Program, Program Summary presentation, October 13, 2006; Alaska Department of Environmental Compliance, Commercial Passenger Vessel Environmental Compliance Program, "Frequently Asked Questions," Accessed at http://www.dec.state.ak.us/water/cruise_ships/ on May 5, 2008.

SECTION 5 | SUMMARY OF RESULTS

5.1 SUMMARY OF RESULTS

This section presents seven exhibits that summarize the results of this analysis:

- Exhibits 5-1A and 5-1B present the level of economic activity by unit by threat. The metric used to estimate the level of activity varies by threat. For example, an approximate number of annual projects is used to estimate the level of dredging and in-water construction activity, while level of agricultural activity is estimated using the number of acres.
- Exhibit 5-2 presents the estimated annualized cost by activity. The "Range" column presents a per project cost estimate that has not been discounted. That per project cost is assumed to be spread evenly over the number of years listed in the "Timeframe" column, and then a present value and annualized value are calculated. For some activities, because the flow of impacts is assumed to be equal across years, the annualized cost is equal to the annual cost (the total divided by the number of years).
- These annualized impacts vary widely from $0 at the low end to an estimated annualized impact of $32.5 million per LNG project at the high end.
- Exhibits 5-3A and 5-3B present the probability score by unit by activity. The probability score is used to develop an estimate of the share of impacts that may be attributed to green sturgeon critical habitat. The scores vary both by activity and by unit depending on the level of baseline protection provided by Federal or state regulations as well as the presence of other listed species. The probability scores range from 0.1 for restoration projects to 1.0 for activities like bottom-trawl fisheries and LNG projects.
- Exhibits 5-4A and 5-4B present total estimated impacts by unit by activity. Exhibit 5-4A focuses on activities where management scenarios are more certain, and presents impacts based on the mid-range scenario. Exhibit 5-4B presents both the low and high-end scenarios for activities where management is more uncertain.
- Exhibit 5-5 presents total impacts summarized by unit under the low-end scenario. In this scenario, the impacts presented in Exhibit 5-4A are summed together with the low-end impacts from Exhibit 5-4B. In this scenario, the marine unit containing the coastal Alaskan waters northwest of Yakutat Bay had the highest annualized impacts at approximately $36.0 million. The marine unit from Willapa Bay to Grays Harbor had the lowest estimated impacts at approximately $0.
- Exhibit 5-6 presents total impacts summarized by unit under the high-end scenario. In this scenario, the impacts presented in Exhibit 5-4A are summed together with

the high-end impacts from Exhibit 5-4B. In this scenario, the marine unit containing the coastal Alaskan waters northwest of Yakutat Bay had the highest annualized impacts at approximately $310 million. Similar to the low-end scenario, the marine unit from Willapa Bay to Grays Harbor had the lowest estimated impacts at approximately $0.

- Exhibit 5-7 maps the total impacts by unit to provide an overview of the geographic distribution of the impacts.

EXHIBIT 5-1A. ACTIVITIES COUNT

UNIT NUMBER	SPECIFIC AREA	DREDGING	IN-WATER CONSTRUCTION OR ALTERATIONS	MINOR POINT SOURCE POLLUTION	MAJOR POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	DAMS	WATER DIVERSIONS	POWER PLANT
		METRIC							
		NUMBER OF USACE PROJECTS EXPECTED PER YEAR	NUMBER OF USACE PROJECTS EXPECTED PER YEAR	NUMBER OF FACILITIES	NUMBER OF FACILITIES	ACRES OF FARMLAND	NUMBER OF DAMS	NUMBER OF DIVERSIONS	NUMBER OF PLANTS
1	Elkhorn Slough, CA	2	0	0	0				1
2	Upper Sacramento River		4	10	5		33	45	
3	Lower Sacramento River	4	12	20	10	514,630	58	577	
4	Yolo Bypass	1		0	0	2,850	1	78	
5	Sutter Bypass		0	0	0	10,088	0	12	
6	Lower Feather River		1	5	5	226,193	16	201	
7	Lower Yuba River		0*	1	0	5,561	1	23	
8	Sacramento-San Joaquin Delta	5	27	10	9		7	2210	19
9	Suisun Bay	6	6	0	0				0
10	San Pablo Bay	12	3	15	12				7
11	San Francisco Bay	35	19	34	17				29
12	Tomales Bay		0	2	0			117	
13	Noyo Harbor	1	0	0	1				
14	Eel River		4	6	2				
15	Humboldt Bay	0	1	6	2				1
16	Klamath River		3	0	0		0		
17	Rogue River		1	2	0				
18	Coos Bay	1	2	21	3				
19	Winchester Bay		2	7	0				
20	Siuslaw River		1	8	0				
21	Alsea River	1	1	2	0			1	
22	Yaquina River	0	0	11	1				
23	Tillamook Bay	0	2	10	2				
24a	Lower Columbia River Estuary	1	77	30	2		21		
24b	Lower Columbia River	12	233	235	23		60		

UNIT NUMBER	SPECIFIC AREA	DREDGING	IN-WATER CONSTRUCTION OR ALTERATIONS	MINOR POINT SOURCE POLLUTION	MAJOR POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	DAMS	WATER DIVERSIONS	POWER PLANT
		METRIC							
		NUMBER OF USACE PROJECTS EXPECTED PER YEAR	NUMBER OF USACE PROJECTS EXPECTED PER YEAR	NUMBER OF FACILITIES	NUMBER OF FACILITIES	ACRES OF FARMLAND	NUMBER OF DAMS	NUMBER OF DIVERSIONS	NUMBER OF PLANTS
25	Willapa Bay	0	2	33	0				
26	Grays Harbor	0	0*	48	4				
27	Puget Sound	27	667	973	24				
28	US/Mexico Border to Monterey Bay	7	24	3	31				1
29	Monterey Bay to San Francisco Bay	0	0	0	8				1
30	San Francisco Bay to Humboldt Bay	0		1	0				0
31	Humboldt Bay to Coos Bay	3		2	3				0
32	Coos Bay to Winchester Bay	0							
33	Winchester Bay to Columbia R. Estuary	0		2	3				
34	Columbia R. Estuary to Willapa Bay	0							
35	Willapa Bay to Grays Harbor	0							
36	Grays Harbor to US/Canada Border	0		1	0				
37	Strait of Juan de Fuca	2		4	2				
38	Alaska/Canada Border to Yakutat Bay	0		0	0				
39	Coastal Alaska Waters northwest of Yakutat Bay	0		1	0				
40	Nehalem Bay	0	0	2	0				

Notes:

* Because an average was used to estimate the annual number of projects, these units are estimated to have an average number of projects between 0.1 and 0.33. Due to rounding, these units appear to have zero projects affected in a given year.

EXHIBIT 5-1B. ACTIVITIES COUNT (ACTIVITIES WITH HIGHLY UNCERTAIN IMPACTS)

UNIT NUMBER	SPECIFIC AREA	BOTTOM TRAWL FISHERIES	TIDAL ENERGY PROJECTS	LNG PROJECTS	DESALINATION PLANT	RESTORATION
		METRIC				
		ESTIMATED LANDING BY BOTTOM TRAWLERS, METRIC TONS OF LANDED NON-WHITING GROUNDFISH CATCH, 2007	NUMBER OF PROJECTS	NUMBER OF PROJECTS	NUMBER OF PLANTS	NUMBER OF PAST PROJECTS
1	Elkhorn Slough, CA					
2	Upper Sacramento River					16
3	Lower Sacramento River					47
4	Yolo Bypass					0
5	Sutter Bypass					0
6	Lower Feather River					7
7	Lower Yuba River					1
8	Sacramento-San Joaquin Delta					78
9	Suisun Bay					72
10	San Pablo Bay				1	276
11	San Francisco Bay		1			205
12	Tomales Bay		0			213
13	Noyo Harbor					
14	Eel River					
15	Humboldt Bay					
16	Klamath River					
17	Rogue River					
18	Coos Bay			1		
19	Winchester Bay					
20	Siuslaw River					
21	Alsea River					
22	Yaquina River					
23	Tillamook Bay					

UNIT NUMBER	SPECIFIC AREA	BOTTOM TRAWL FISHERIES	TIDAL ENERGY PROJECTS	LNG PROJECTS	DESALINATION PLANT	RESTORATION
		METRIC				
		ESTIMATED LANDING BY BOTTOM TRAWLERS, METRIC TONS OF LANDED NON-WHITING GROUNDFISH CATCH, 2007	NUMBER OF PROJECTS	NUMBER OF PROJECTS	NUMBER OF PLANTS	NUMBER OF PAST PROJECTS
24a	Lower Columbia River Estuary			3		
24b	Lower Columbia River			0		
25	Willapa Bay		1			
26	Grays Harbor					
27	Puget Sound		8			
28	US/Mexico Border to Monterey Bay	119,899	1	4	1	
29	Monterey Bay to San Francisco Bay	1,102,582	0	0	1	
30	San Francisco Bay to Humboldt Bay	1,229,332	5	0		
31	Humboldt Bay to Coos Bay	1,489,447	3	0		
32	Coos Bay to Winchester Bay	828,872	2	0		
33	Winchester Bay to Columbia R. Estuary	1,056,304	5	0		
34	Columbia R. Estuary to Willapa Bay	5,715,100	0	0		
35	Willapa Bay to Grays Harbor	0*	0	0		
36	Grays Harbor to US/Canada Border	4,567,242	1	0		
37	Strait of Juan de Fuca	0	0	0		
38	Alaska/Canada Border to Yakutat Bay		4	0		
39	Coastal Alaska Waters northwest of Yakutat Bay	229,813,998	5	4		
40	Nehalem Bay					

* Note, no port groups were identified within this unit. PacFin data query performed by C. Niles, WADFW, July 22, 2009.

EXHIBIT 5-2. ANNUALIZED COSTS BY ACTIVITY

ACTIVITY	COST CATEGORY	COST RANGE [1]	METRIC	TIMEFRAME (YEARS)	PRESENT VALUE (7% DISCOUNT RATE)	ANNUALIZED COSTS (7% DISCOUNT RATE)
Dredging	Low	$352,000	Per project	8	$262,737	$44,000
	Midpoint	$864,500			$645,273	$108,063
	High	$1,377,000			$1,027,810	$172,125
In-Water Construction	Low	$26,000	Per project	8	$19,407	$3,250
	Midpoint	$119,000			$88,823	$14,875
	High	$212,000			$158,239	$26,500
Pt and Non Point Source Compliance: Minor Facilities	Low	$0	Per facility	20	$0	$0
	Midpoint	$144,020			$15,258	$1,440
	High	$288,041			$30,515	$2,880
Pt and Non Point Source Compliance: Major Facilities	Low	See note 2 below	Per facility	20	$126,174	$11,910
	Midpoint				$166,561	$15,722
	High				$206,949	$19,535
Power Plants	Low	See note 2 below	Per plant	20	$126,174	$11,910
	Midpoint				$166,561	$15,722
	High				$206,949	$19,535
Dams	Low	$92,000	Per dam	20	$48,732	$4,600
	Midpoint	$2,146,000			$1,136,738	$107,300
	High	$4,200,000			$2,224,743	$210,000
Water Diversions	Low	$80,000	Per diversion	20	$42,376	$4,000
	Midpoint	$105,000			$55,619	$5,250
	High	$130,000			$68,861	$6,500
Agriculture- Pesticide Buffer Zones	Low	Varies by unit depending on crop acreage by county				$3,000-$358,000
	High					$38,000 to $3,700,000
LNG	Low	$0	Per project	20	$0	$0
	High	$650,000,000			$344,305,463	$32,500,000
Desalination	Low Unit 10	$0	Per unit based on plant capacity	20	$0	$0
	High Unit 10	$72,720,000			$19,140,735	$3,613,500
	Low Unit 28	$0			$0	$0
	High Unit 28	$1,110,404,460			$588,182,033	$55,520,223
	Low Unit 29	$0			$0	$0
	High Unit 29	$150,572,136			$79,758,168	$7,528,607

ACTIVITY	COST CATEGORY	COST RANGE [1]	METRIC	TIMEFRAME (YEARS)	PRESENT VALUE (7% DISCOUNT RATE)	ANNUALIZED COSTS (7% DISCOUNT RATE)
Restoration	Low	$0	Per project	20	$0	$0
	Midpoint	$67,500			$35,755	$3,375
	High	$135,000			$71,510	$6,750
Tidal/ Wave Energy	NA	$1,977,633	Per project	30	$818,018	$65,921
Bottom-Trawl Fisheries	Low	Varies by unit depending on catch revenue				$300-$3,600,000
	High					$1,600-$18,000,000

Notes:

(1.) The "Cost Range" column presents a per project cost estimate that has not been discounted. That per project cost is assumed to be spread evenly over the number of years listed in the "Timeframe" column, and then a present value and annualized value is calculated. For some activities, because the flow of impacts is assumed to be equal across years, the annualized cost is equal to the annual cost (the total divided by the number of years).

(2.) Cost estimates include between $5,200 and $34,000 annually for operations and maintenance and $421,500 for one-time capital expenses.

(3.) Dam estimates in this exhibit do not include outliers such as Red Bluff Diversion Dam or Daguerre Point Dam, which are included in total estimates.

EXHIBIT 5-3A. PROBABILITY SCORES

UNIT NUMBER	SPECIFIC AREA	DREDGING	IN-WATER CONSTRUCTION OR ALTERATIONS	POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	DAMS	WATER DIVERSIONS	POWER PLANTS
1	Elkhorn Slough, CA	1.0	1.0	0.2				0.2
2	Upper Sacramento River		0.2	0.1		0.2	0.2	
3	Lower Sacramento River	0.2	0.2	0.1	0.2	0.2	0.2	
4	Yolo Bypass			0.1	0.2	0.2	0.2	
5	Sutter Bypass		0.2	0.1	0.2	0.2	0.2	
6	Lower Feather River		0.2	0.1	0.2	0.2	0.2	
7	Lower Yuba River		0.2	0.1	0.2	0.2	0.2	
8	Sacramento-San Joaquin Delta	0.2	0.2	0.1		0.2	0.2	0.2
9	Suisun Bay	0.2	0.2	0.1				0.2
10	San Pablo Bay	0.2	0.2	0.1				0.2
11	San Francisco Bay	0.2	0.2	0.1				0.2
12	Tomales Bay		0.2	0.1	0.2		0.2	
13	Noyo Harbor	0.2	0.2	0.1				
14	Eel River			0.1				
15	Humboldt Bay	0.2	0.2	0.1	0.2			0.2
16	Klamath River			0.1		0.2		
17	Rogue River			0.2				
18	Coos Bay	0.5	0.5	0.1				
19	Winchester Bay			0.1				
20	Siuslaw River	0.2		0.1				
21	Alsea River	0.2		0.1			1.0	
22	Yaquina River	0.5	0.5	0.1				
23	Tillamook Bay	0.5	0.5	0.1				
24a	Lower Columbia River Estuary	0.2	0.2	0.1		0.2		
24b	Lower Columbia River	0.2	0.2	0.1		0.2		

UNIT NUMBER	SPECIFIC AREA	DREDGING	IN-WATER CONSTRUCTION OR ALTERATIONS	POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	DAMS	WATER DIVERSIONS	POWER PLANTS
25	Willapa Bay	1.0	1.0	0.2				
26	Grays Harbor	1.0	1.0	0.2				
27	Puget Sound	0.2	0.2	0.1				
28	US/Mexico Border to Monterey Bay	1.0	1.0	0.2				1.0
29	Monterey Bay to San Francisco Bay	1.0	1.0	0.2				1.0
30	San Francisco Bay to Humboldt Bay	1.0		0.2				1.0
31	Humboldt Bay to Coos Bay	1.0		0.2				1.0
32	Coos Bay to Winchester Bay	1.0						
33	Winchester Bay to Columbia R. Estuary	1.0						
34	Columbia R. Estuary to Willapa Bay	1.0						
35	Willapa Bay to Grays Harbor	1.0						
36	Grays Harbor to US/Canada Border	1.0		0.2				
37	Strait of Juan de Fuca	1.0	0.2	0.2				
38	Alaska/Canada Border to Yakutat Bay	1.0						
39	Coastal Alaska Waters northwest of Yakutat Bay	1.0						
40	Nehalem Bay	0.5	0.5	0.1				

0.2

0.2

EXHIBIT 5-3B. PROBABILITY SCORES

UNIT NUMBER	SPECIFIC AREA	BOTTOM TRAWL FISHERIES	TIDAL ENERGY PROJECTS	LNG PROJECTS	DESALINATION PLANT	RESTORATION
1	Elkhorn Slough, CA	1.0				
2	Upper Sacramento River					0.1
3	Lower Sacramento River					0.1
4	Yolo Bypass					0.1
5	Sutter Bypass					0.1
6	Lower Feather River					0.1
7	Lower Yuba River					0.1
8	Sacramento-San Joaquin Delta					0.1
9	Suisun Bay					0.1
10	San Pablo Bay				1.0	0.1
11	San Francisco Bay		0.5			0.1
12	Tomales Bay					0.1
13	Noyo Harbor					
14	Eel River					
15	Humboldt Bay					
16	Klamath River					
17	Rogue River					
18	Coos Bay			0.5		
19	Winchester Bay					
20	Siuslaw River					
21	Alsea River					
22	Yaquina River					
23	Tillamook Bay					
24a	Lower Columbia River Estuary			0.2		
24b	Lower Columbia River					

UNIT NUMBER	SPECIFIC AREA	BOTTOM TRAWL FISHERIES	TIDAL ENERGY PROJECTS	LNG PROJECTS	DESALINATION PLANT	RESTORATION
25	Willapa Bay		1.0			
26	Grays Harbor					
27	Puget Sound		0.5			
28	US/Mexico Border to Monterey Bay	1.0	1.0	1.0	1.0	
29	Monterey Bay to San Francisco Bay	1.0	1.0	1.0	1.0	
30	San Francisco Bay to Humboldt Bay	1.0	1.0	1.0		
31	Humboldt Bay to Coos Bay	1.0	1.0	1.0		
32	Coos Bay to Winchester Bay	1.0	1.0	1.0		
33	Winchester Bay to Columbia R. Estuary	1.0	1.0	1.0		
34	Columbia R. Estuary to Willapa Bay	1.0	1.0	1.0		
35	Willapa Bay to Grays Harbor	1.0	1.0	1.0		
36	Grays Harbor to US/Canada Border	1.0	1.0	1.0		
37	Strait of Juan de Fuca	1.0	1.0	1.0		
38	Alaska/Canada Border to Yakutat Bay		1.0	1.0		
39	Coastal Alaska Waters northwest of Yakutat Bay	1.0	1.0	1.0		
40	Nehalem Bay	1.0	1.0	1.0		

EXHIBIT 5-4A. TOTAL IMPACTS

UNIT NUMBER	SPECIFIC AREA	DREDGING	IN-WATER CONSTRUCTION OR ALTERATIONS	POINT SOURCE POLLUTION		AGRICULTURE PESTICIDE APPLICATION	DAMS	WATER DIVERSIONS	POWER PLANT
				MINOR	MAJOR				
1	Elkhorn Slough, CA	$216,125	$0	$0	$0				$3,144
2	Upper Sacramento River, CA		$11,900	$1,440	$7,860		$3,823,147	$47,250	
3	Lower Sacramento River, CA	$86,450	$35,700	$2,880	$15,720	$2,670,000	$1,244,680	$605,850	
4	Yolo Bypass, CA			$0	$0	$449,000	$21,460	$81,900	
5	Sutter Bypass, CA		$0	$0	$0	$0	$0	$12,600	
6	Lower Feather River, CA		$2,975	$720	$7,860	$1,470,000	$343,360	$211,050	
7	Lower Yuba River, CA		$298	$144	$0	$228,000	$351,835	$24,150	
8	Sacramento-San Joaquin Delta, CA	$108,063	$80,325	$1,440	$14,150		$150,220	$2,320,500	$59,744
9	Suisun Bay, CA	$133,998	$17,850	$0	$0				$0
10	San Pablo Bay, CA	$263,673	$9,917	$2,160	$18,900				$22,011
11	San Francisco Bay, CA	$747,793	$56,525	$4,900	$26,700				$91,189
12	Tomales Bay, CA		$0	$288	$0	$0		$122,850	
13	Noyo Harbor, CA	$21,613	$0	$0	$1,570				
14	Eel River, CA		$11,900	$864	$3,140				
15	Humboldt Bay, CA	$0	$2,975	$864	$3,140	$3,710			$3,257
16	Klamath River, CA		$8,925	$0	$0		$0		
17	Rogue River, OR		$1,488	$576	$0				
18	Coos Bay, OR	$54,031	$11,156	$3,020	$4,720				
19	Winchester Bay, OR		$11,156	$1,010	$0				
20	Siuslaw River, OR		$7,438	$1,150	$0				
21	Alsea River, OR		$3,719	$288	$0			$5,250	
22	Yaquina River, OR	$0	$0	$1,580	$1,580				
23	Tillamook Bay, OR	$0	$11,156	$1,440	$3,140				
24a	Lower Columbia River Estuary, OR/WA	$21,613	$229,075	$4,320	$3,140		$450,660		
24b	Lower Columbia River, OR/WA	$259,350	$693,175	$33,800	$36,200		$1,287,600		
25	Willapa Bay, WA	$0	$29,750	$9,510	$0				
26	Grays Harbor, WA	$0	$3,719	$13,800	$12,600				

UNIT NUMBER	SPECIFIC AREA	DREDGING	IN-WATER CONSTRUCTION OR ALTERATIONS	POINT SOURCE POLLUTION		AGRICULTURE PESTICIDE APPLICATION	DAMS	WATER DIVERSIONS	POWER PLANT
				MINOR	MAJOR				
27	Puget Sound, WA	$583,538	$1,984,325	$140,100	$37,700				
28	CA-Mexico Border to Monterey Bay, CA	$756,438	$357,000	$864	$97,500				$15,722
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$0	$0	$25,200				$15,722
30	San Francisco Bay, CA to Humboldt Bay, CA	$0		$288	$0				$0
31	Humboldt Bay, CA to Coos Bay, OR	$324,188		$576	$9,430				$0
32	Coos Bay, OR to Winchester Bay, OR	$0							
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0		$576	$9,430				
34	Columbia River and Estuary to Willapa Bay, WA	$0							
35	Willapa Bay, WA to Grays Harbor, WA	$0							
36	Grays Harbor, WA to Cape Flattery, WA	$0		$288	$0				
37	Strait of Juan de Fuca to Rosario Strait, WA	$216,125		$1,150	$6,290				
38	AK/Canada border to Yakutat Bay, AK	$0		$0	$0				
39	Coastal AK waters northwest of Yakutat Bay, AK	$0		$288	$0				
40	Nehalem Bay, OR	$0	$0	$288	$0				

Note:
(1.) All values reported are mid-impact values.

EXHIBIT 5-4B. TOTAL IMPACTS

UNIT NUMBER	SPECIFIC AREA	BOTTOM TRAWL FISHERIES		TIDAL ENERGY PROJECTS		LNG PROJECTS		DESALINATION PLANT		RESTORATION	
		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
1	Elkhorn Slough, CA										
2	Upper Sacramento River, CA									$0	$10,800
3	Lower Sacramento River, CA									$0	$31,725
4	Yolo Bypass, CA									$0	$0
5	Sutter Bypass, CA									$0	$0
6	Lower Feather River, CA									$0	$4,725
7	Lower Yuba River, CA									$0	$675
8	Sacramento-San Joaquin Delta, CA									$0	$52,650
9	Suisun Bay, CA									$0	$48,600
10	San Pablo Bay, CA							$0	$3,613,500	$0	$186,300
11	San Francisco Bay, CA			$32,961	$32,961					$0	$138,375
12	Tomales Bay, CA									$0	$143,775
13	Noyo Harbor, CA										
14	Eel River, CA										
15	Humboldt Bay, CA										
16	Klamath River, CA										
17	Rogue River, OR										
18	Coos Bay, OR					$0	$16,250,000				
19	Winchester Bay, OR										
20	Siuslaw River, OR										
21	Alsea River, OR										
22	Yaquina River, OR										
23	Tillamook Bay, OR										
24a	Lower Columbia River Estuary, OR/WA					$0	$19,500,000				
24b	Lower Columbia River, OR/WA										

UNIT NUMBER	SPECIFIC AREA	BOTTOM TRAWL FISHERIES		TIDAL ENERGY PROJECTS		LNG PROJECTS		DESALINATION PLANT		RESTORATION	
		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
25	Willapa Bay, WA			$68,289	$68,289						
26	Grays Harbor, WA										
27	Puget Sound, WA			$273,158	$273,158						
28	CA-Mexico Border to Monterey Bay, CA	$18,232	$91,162	$68,289	$68,289	$0	$130,000,000	$0	$55,520,223		
29	Monterey Bay, CA to San Francisco Bay, CA	$157,074	$785,371	$0	$0	$0	$0	$0	$7,528,607		
30	San Francisco Bay, CA to Humboldt Bay, CA	$178,727	$893,636	$341,447	$341,447	$0	$0				
31	Humboldt Bay, CA to Coos Bay, OR	$166,221	$831,106	$204,868	$204,868	$0	$0				
32	Coos Bay, OR to Winchester Bay, OR	$82,854	$414,268	$136,579	$135,579	$0	$0				
33	Winchester Bay, OR to Columbia River and Estuary, OR	$107,748	$538,742	$341,447	$341,447	$0	$0				
34	Columbia River and Estuary to Willapa Bay, WA	$541,636	$2,708,181	$0	$0	$0	$0				
35	Willapa Bay, WA to Grays Harbor, WA	$0	$0	$0	$0	$0	$0				
36	Grays Harbor, WA to Cape Flattery, WA	$397,828	$1,989,138	$68,289	$68,289	$0	$0				
37	Strait of Juan de Fuca to Rosario Strait, WA	$0	$0	$0	$0	$0	$0				
38	AK/Canada border to Yakutat Bay, AK			$273,158	$273,158	$0	$0				
39	Coastal AK waters northwest of Yakutat Bay, AK	$36,075,784	$180,378,921	$341,447	$341,447	$0	$130,000,000				
40	Nehalem Bay, OR										

EXHIBIT 5-5. RANKED IMPACTS (LOW SCENARIO)

UNIT NUMBER	SPECIFIC AREA	ANNUALIZED IMPACTS (7% DISCOUNT RATE)
39	Coastal AK waters northwest of Yakutat Bay, AK	$36,000,000
3	Lower Sacramento River, CA	$4,700,000
2	Upper Sacramento River, CA	$3,900,000
27	Puget Sound, WA	$3,000,000
8	Sacramento-San Joaquin Delta, CA	$2,700,000
24b	Lower Columbia River, OR/WA	$2,300,000
6	Lower Feather River, CA	$2,000,000
28	CA-Mexico Border to Monterey Bay, CA	$1,300,000
11	San Francisco Bay, CA	$970,000
24a	Lower Columbia River estuary, OR/WA	$710,000
31	Humboldt Bay, CA to Coos Bay, OR	$710,000
7	Lower Yuba River, CA	$600,000
4	Yolo Bypass, CA	$550,000
34	Columbia River and Estuary to Willapa Bay, WA	$540,000
30	San Francisco Bay, CA to Humboldt Bay, CA	$510,000
36	Grays Harbor, WA to Cape Flattery, WA	$470,000
33	Winchester Bay, OR to Columbia River and Estuary, OR	$460,000
10	San Pablo Bay, CA	$320,000
38	AK/Canada border to Yakutat Bay, AK	$270,000
1	Elkhorn Slough, CA	$220,000
37	Strait of Juan de Fuca to Rosario Strait, WA	$220,000
32	Coos Bay, OR to Winchester Bay, OR	$220,000
29	Monterey Bay, CA to San Francisco Bay, CA	$200,000
9	Suisun Bay, CA	$150,000
12	Tomales Bay, CA	$120,000
25	Willapa Bay, WA	$110,000
18	Coos Bay, OR	$73,000
26	Grays Harbor, WA	$31,000
13	Noyo Harbor, CA	$23,000
14	Eel River, CA	$16,000
23	Tillamook Bay, OR	$16,000
15	Humboldt Bay, CA	$14,000
5	Sutter Bypass, CA	$13,000
19	Winchester Bay, OR	$12,000
21	Alsea River, OR	$9,300
16	Klamath River, CA	$8,900
20	Siuslaw River, OR	$8,600
22	Yaquina River, OR	$3,300

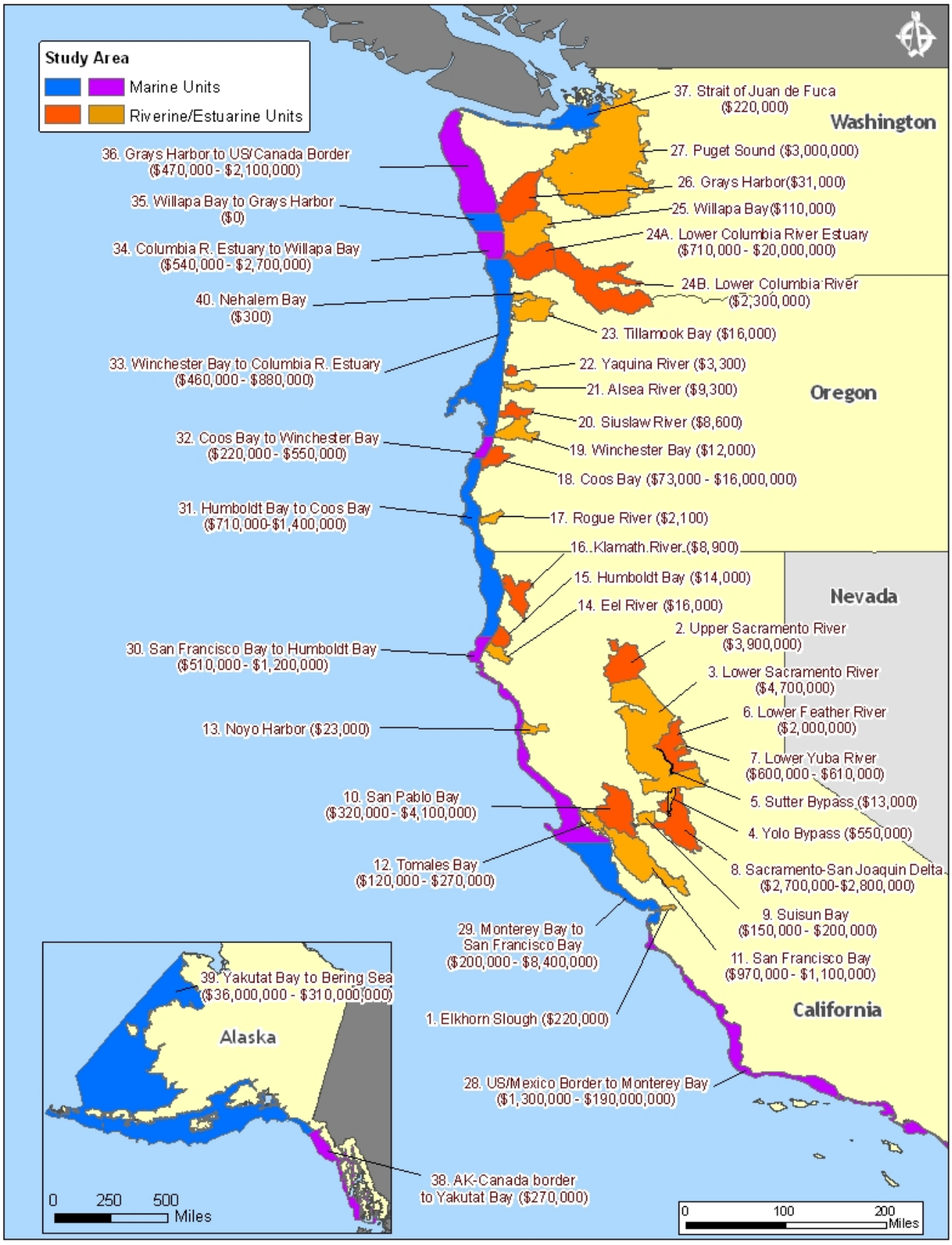
UNIT NUMBER	SPECIFIC AREA	ANNUALIZED IMPACTS (7% DISCOUNT RATE)
17	Rogue River, OR	$2,100
40	Nehalem Bay, OR	$300
35	Willapa Bay, WA to Grays Harbor, WA	$0

EXHIBIT 5-6. RANKED IMPACTS (HIGH SCENARIO)

UNIT NUMBER	SPECIFIC AREA	ANNUALIZED IMPACTS (7% DISCOUNT RATE)
39	Coastal AK waters northwest of Yakutat Bay, AK	$310,000,000
28	CA-Mexico Border to Monterey Bay, CA	$190,000,000
24a	Lower Columbia River estuary, OR/WA	$20,000,000
18	Coos Bay, OR	$16,000,000
29	Monterey Bay, CA to San Francisco Bay, CA	$8,400,000
3	Lower Sacramento River, CA	$4,700,000
10	San Pablo Bay, CA	$4,100,000
2	Upper Sacramento River, CA	$3,900,000
27	Puget Sound, WA	$3,000,000
8	Sacramento-San Joaquin Delta, CA	$2,800,000
34	Columbia River and Estuary to Willapa Bay, WA	$2,700,000
24b	Lower Columbia River, OR/WA	$2,300,000
36	Grays Harbor, WA to Cape Flattery, WA	$2,100,000
6	Lower Feather River, CA	$2,000,000
31	Humboldt Bay, CA to Coos Bay, OR	$1,400,000
30	San Francisco Bay, CA to Humboldt Bay, CA	$1,200,000
11	San Francisco Bay, CA	$1,100,000
33	Winchester Bay, OR to Columbia River and Estuary, OR	$880,000
12	Tomales Bay, CA	$270,000
9	Suisun Bay, CA	$200,000
7	Lower Yuba River, CA	$610,000
4	Yolo Bypass, CA	$550,000
32	Coos Bay, OR to Winchester Bay, OR	$550,000
38	AK/Canada border to Yakutat Bay, AK	$270,000
1	Elkhorn Slough, CA	$220,000
37	Strait of Juan de Fuca to Rosario Strait, WA	$220,000
25	Willapa Bay, WA	$110,000
26	Grays Harbor, WA	$31,000
13	Noyo Harbor, CA	$23,000

UNIT NUMBER	SPECIFIC AREA	ANNUALIZED IMPACTS (7% DISCOUNT RATE)
14	Eel River, CA	$16,000
23	Tillamook Bay, OR	$16,000
15	Humboldt Bay, CA	$14,000
5	Sutter Bypass, CA	$13,000
19	Winchester Bay, OR	$12,000
21	Alsea River, OR	$9,300
16	Klamath River, CA	$8,900
20	Siuslaw River, OR	$8,600
22	Yaquina River, OR	$3,300
17	Rogue River, OR	$2,100
40	Nehalem Bay, OR	$300
35	Willapa Bay, WA to Grays Harbor, WA	$0

EXHIBIT 5-7. GEOGRAPHIC DISTRIBUTION OF ANNUALIZED IMPACTS BY UNIT



REFERENCES

16 U.S.C. 1532.

33 CFR 151, U.S. Coast Guard. Ballast Water Management Program, accessed at http://www.uscg.mil/hq/g-m/mso/bwm.htm on April 11, 2008.

ABSG Consulting. *LNG Receiving Terminal Offshore Oregon as an Alternative to the Land-Based Bradwood Facility*. 2006.

Alaska Department of Environmental Compliance, Commercial Passenger Vessel Environmental Compliance Program. *Program Summary Presentation*. October 13, 2006.

Alaska Department of Environmental Compliance, Commercial Passenger Vessel Environmental Compliance Program. "Frequently Asked Questions." Accessed at http://www.dec.state.ak.us/water/cruise_ships/ on May 5, 2008.

Alaska Fisheries Science Center. *Walleye Pollock Research*. Accessed at: http://www.afsc.noaa.gov/species/pollock.php.

CalFish. *California Fish Passage Assessment Database*. Accessed at http://dnn.calfish.org/calfish2/FishDataandMaps/tabid/87/DataDownloads/tabid/90/Default.aspx on March 19, 2008.

CalFish. *Fish Barrier Data.* Accessed at: http://www.calfish.org/ on August 21, 2007.

CalFish, California Fish Passage Assessment Database Project, 2006

California American Water. *Seawater Desalination: White Paper.* September 2004. Accessed at: http://www.coastalwaterproject.com/pdf/WhitePaper_SeawaterDesalination.pdf on March 15, 2008.

California Coastal Commission. *Chapter Two: Coastal Desalination Projects in California.* Accessed at: http://www.coastal.ca.gov/desalrpt/dchap2.html.

California Department of Conservation. Farmland Mapping & Monitoring Program (FMMP). Year 2006 GIS data downloaded from ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/2006.

California Department of Fish and Game. *Marine Aquaculture.* July 2007. Accessed at: http://www.dfg.ca.gov/mlpa/pdfs/agenda071007jh.pdf.

California Department of Fish and Game. *Registered Aquaculturist Public Report.* March 2008. Accessed at: http://www.nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=3265 on March 15, 2008.

California Department of Fish and Game, Fisheries Restoration Grant Program. *Fish Screen Projects Funded by the California Department of Fish and Game Fisheries Restoration Grant Program*. February 2007.

California Department of Pesticide Regulation, Endangered Species Project Salmonid Habitat Locations in California, Accessed at http://www.cdpr.ca.gov/docs/endspec/salmonid.htm on July 20, 2009.

California Energy Commission. *California Statewide Power Plants*. Accessed at: http://www.energy.ca.gov on March 19, 2008.

California Energy Commission. California Statewide Plants map. Accessed at: http://www.energy.ca.gov. Last accessed on April 20, 2008.

California Energy Commission. *West Coast LNG Projects and Proposals.* March 2008. Accessed at: http://www.energy.ca.gov.

California Energy Commission, *Developing Wave Energy in Coastal California: Potential Socio-Economic and Environmental Effects,* November 2008. Accessed at: http://www.energy.ca.gov/2008publications/CEC-500-2008-083/CEC-500-2008-083.PDF.

Churchwell, Roger. *Sturgeon Passage Study*. Department of Water Resources, Division of Environmental Services/Fish Facilities Section, Presentation at Green Sturgeon Workshop. June 2006.

Comments, Coast Guard, September 23, 2009.

Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon. Science Applications International Corporation. Reston, VA. 2003. EPA No. 68-C-99-252.

Environmental Work Windows' Short Term Solutions Working Group. Data provided by NMFS, San Francisco Office, May 6, 2008.

Federal Energy Regulatory Commission. *Issued Hydrokinetic Permits.* Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.asp on March 19, 2008.

Federal Energy Regulatory Commission. *Pending Hydrokinetic Permits.* Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-pending.asp on March 19, 2008.

Federal Energy Regulatory Commission, final Environmental Impact Statement (EIS) for the construction and operation of the Bradwood Landing Project, June 6, 2008. Accessed at: http://www.ferc.gov/industries/lng/enviro/eis/2008/06-06-08-eis.asp.

Federal Energy Regulatory Commission. *Preliminary Draft Environmental Assessment: Makah Bay Offshore Wave Energy Pilot Project.* October 2006.

Gramlich, Edward M. *A Guide to Benefit-Cost Analysis (2nd Ed.)*. Prospect Heights, Illinois: Waveland Press, Inc. 1990.

National Association of State Fire Marshals. *Liquefied Natural Gas: An Overview of the LNG Industry for Fire Marshals and Emergency Responders.* 2005.

National Marine Fisheries, Southwest Region, Conference and Biological Opinion on the Red Bluff Pumping Plant Project, and its effect on endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead, their respective critical habitats, and the southern distinct population segment of North American green sturgeon, March 5, 2009.

National Marine Fisheries Service, Endangered Species Act Section 7 Formal Programmatic Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Nationwide Permit 48 Activities in Washington State, April 28, 2009.

National Marine Fisheries, Silver Springs, MD Office, Endangered Species Act Section 7 Formal Consultation on EPA's proposed registration of pesticide products containing the active ingredients carbaryl, carbofuran, and methomyl on 28 listed Pacific salmonids, April 30, 2009.

National Marine Fisheries Service, *2009 Biological Opinion on the California's Central Valley Water Project*, June 3, 2009. Accessed at: http://swr.nmfs.noaa.gov/ocap/2009_OCAP_Powerpoint_060309.pdf on July 1, 2009.

National Marine Fisheries. 2008. National Marine Fisheries Service endangered species act section 7 consultation: Environmental Protection Agency registration of pesticides containing chlorpyrifos, diazinon, and malathion. Biological Opinion. Silver Spring, MD, U.S. Department of Commerce: 482.

National Marine Fisheries. *Final Groundfish Essential Fish Habitat (EFH) Environmental Impact Statement*. Accessed at http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/NEPA-Documents/EFH-Final-EIS.cfm on April 15, 2008.

National Marine Fisheries, Southwest Region, Biological Opinion on the Mountain House Wastewater Treatment Plant (MHWWTP) expansion project in San Joaquin County, California, and its effects on Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, green sturgeon, and designated critical habitat for Central Valley steelhead, September 1, 2006.

National Marine Fisheries, Biological Opinion, Southwest Region, Biological Opinion on the proposed Airport Road Bridge Replacement Project located near the City of Anderson, Shasta County, California, and its effect on endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead, their respective critical habitats, and the southern distinct population segment of North American green sturgeon, January 6, 2006.

National Marine Fisheries. *NOAA Designates Extensive Area Off West Coast as Essential Fish Habitat*. March 8, 2006.

National Marine Fisheries. *Comments on construction activities under FERC Preliminary Permit for the Tacoma Narrows Tidal Energy Project (FERC No. 12612).* November 3, 2006.

National Marine Fisheries. *Comments on San Francisco Bay Tidal Energy Project (FERC No. 12585).* August 12, 2005.

National Marine Fisheries. *Final Economic Analysis of Critical Habitat Designation for 12 West Coast Salmon and Steelhead ESUs.* August 2005.

National Marine Fisheries. *Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs*. August 2005.

National Marine Fisheries. *Section 7 Consultation on Coast Seafoods Project*. November 2005.

National Marine Fisheries, Northwest Region. *Pacific Coast Groundfish Fishery Management Plan Essential Fish Habitat Designation and Minimization of Adverse Impacts: Final Environmental Impact Statement*. December 2005.

National Marine Fisheries, Northwest Region. *Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Potlatch Pulp and Paper Mill, Lewiston, Idaho, National Pollution Discharge Elimination System (NPDES) Permit No.: ID-000116-3 for the discharge of effluents into the Snake River, Nez Perce County, Idaho and Asotin County, WA (1 Project*). April 2, 2004.

National Marine Fisheries. *Section 7 Consultation on the Port of St. Helens Industrial Outfall and Portland General Electric Power Plant, Port Westward Industrial Park, Columbia River, Columbia County, Oregon (Corps No. 200200448)*. August 1, 2003.

North Pacific Fishery Management Council. *Fishery Management Plan for Groundfish in the Gulf of Alaska*. January 2008.

Oregon Department of Fish and Wildlife. *Oregon Fish Passage Barriers*. Accessed at http://rainbow.dfw.state.or.us/nrimp/information/fishbarrierdata.htm on February 20, 2007.

Pacific Fisheries Information Network (PacFIN). "2007: PFMC Groundfish Management Team Reports," "All W-O-C Species Rpt: 2007 Commercial Landed Catch: Metric-tons, Revenue, and Price-per-pound;" "NPFMC Area Report: Groundfish Landed-catch (Metric tons) for 2007 for all Gears". Accessed at http://www.psmfc.org/pacfin/data.html on March 19, 2008.

Pacific Fisheries Management Council. *The Pacific Coast Groundfish Fishery Management Plan*. Accessed at http://www.pcouncil.org/groundfish/gffmp.html on April 15, 2008.

Personal communication with Merrick Burden. Groundfish Staff Officer, Pacific Fisheries Management Council, March 25, 2008.

Personal communication with NMFS, July 17, 2008.

Personal communication with NMFS biologist, Sacramento Field Office, March 10, 2008.

Personal communication with NMFS, Anchorage Office, May 5, 2008.

Personal communication with NMFS, Sacramento Office, on March 10, 2008.

Personal Communication with Sustainable Fisheries Division, Northwest Regional Office, NMFS, on March 24, 2008.

Personal communications with NMFS Biologists, Arcata Field Office, NMFS, March 10, 2008.

Port Import Export Reporting Service (PIERS). *Vessel Manifests and Bills of Lading*. Accessed at: http://www.marad.dot.gov/MARAD_statistics/index.html on March 19, 2008.

Public comments of Berkeley Economic Consulting, "Comments on the Economic Analysis of the Impacts of Designating Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon," Prepared for the Bay Planning Coalition, December 22, 2008.

Public comments of Bruce McIntosh, the Oregon Department of Fish and Wildlife on December 29, 2008.

Public comments of the California Farm Bureau Federation, dated November 7, 2008.

Public comments of Laurie H Suda, Chief, Environmental Section B, San Francisco District, U.S. Army Corps of Engineers, December 19, 2008.

Public comments of Oregon Department of Fish and Wildlife dated December 29, 2008.

Public comments of the Pacific Coast Shellfish Growers Association, dated December 22, 2008.

Public comments of Phil Anderson, Department of Fish and Wildlife, State of Washington, December 19, 2008.

Public comments of Rod Moore, West Coast Seafood Processors Association, October 23, 2008.

Public comments of Tehama-Colusa Canal Authority, December 22, 2008, and Public Comment, State Water Contractors and San Luis & Delta-Mendota Water Authority, December 22, 2008.

Public comments of the Yuba County Water Agency, dated December 18, 2008.

Revised Code of Washington (RCW) (Sections 77.57.010; 77.57.020; 77.57.030; and 77.57.040). Accessed at: http://apps.leg.wa.gov/RCW/default.aspx. Last accessed on November 7, 2007.

San Francisco Bay Conservation and Development Commission. *Dredging by Area*. Accessed at: http://www.bcdc.ca.gov/pdf/Dredging/D_EWW.xls.

Silverstein, Ken. "Social Compacts and LNG Development," *EnergyBiz Insider*. January 30, 2008.

State of Washington Puget Sound Water Quality Action Team. *Puget Sound Water Quality Management Plan*. Adopted December 14, 2000.

U.S. Army Corps of Engineers. *Navigation Data Center, U.S. Waterway Data - Dredging Information System*. Published 2000. Accessed at <ftp://ftp.crrel.usace.army.mil/iwr/ndc/dredging/data/, 2005.

U.S. Army Corps of Engineers. San Francisco, Los Angeles, Seattle and Portland Regional Offices. RAMS databases of Section 404 permit issuances. Received 2005.

U.S. Bureau of Economic Analysis. *National Economic Accounts, National Income and Product Accounts Table*. 2008.

U.S. Coast Guard. *Ballast Water Management Program.* Accessed at: http://www.uscg.mil/hq/g-m/mso/bwm.htm on April 11, 2008.

U.S. Department of Agriculture. *2005 Census of Aquaculture.* October 2006. Accessed at: http://www.agcensus.usda.gov/Publications/2002/Aquaculture/AQUACEN.pdf on March 15, 2008.

U.S. Department of Transportation, Maritime Administration, Port Import Export Reporting Service (PIERS), collected from Vessel Manifests and Bills of Lading, Accessed at Http://www.marad.dot.gov/marad_statistics/index.html , January 2008.

U.S. Environmental Protection Agency. *Guidelines for Preparing Economic Analyses, EPA 240-R-00-003*. September 2000. Accessed at: http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

U.S. Environmental Protection Agency, Department of the Interior, and the Department of Commerce, *Memorandum of Agreement Between the Environmental Protection Agency, Fish and Wildlife Service and National Marine Fisheries Service Regarding Enhanced Coordination Under the Clean Water Act and Endangered Species Act; Notice*, Federal Register Vol. 66, No. 36, February 22, 2001.

U.S. Fish and Wildlife Service. "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at http://endangered.fws.gov/hcp/.

U.S. Office of Management and Budget, "Circular A-4." September 17, 2003. Available at: http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

U.S. Army Corps of Engineers. *U.S. Waterway Data: Dredging Information System*. U.S. Army Corps of Engineers CEIWR-NDC, Navigation Data Center, Alexandria, VA. 2002.

Washington Department of Fish and Wildlife. *(WDFW) Fish Passage Barrier Inventory Database*. Received from Brian Benson, Science Division, Habitat Program on January 09, 2007.

Washington Toxics Coalition, *et al.* v. EPA. C01-0132 (W.D. WA), 22 January 2004.

Washington Toxics Coalition, "Carbaryl Use in Willapa Bay and Grays Harbor to End," *Alternatives*, Vol. 22, No. 3. Accessed at: http://www.watoxics.org/files/newsletters/alternatives22-3. Public comments of the Washington Department of Fish and Wildlife, dated December 19, 2008.

Written communication from Allan Creamer, Federal Energy Regulatory Commission on August 21, 2009.

Written communication from Bernie Kepshire, Fish Screening State Coordinator, Oregon Department of Fish and Wildlife, January 23, 2007.

Written communication with C. Niles, WADFW, July 22, 2009.

Zerbe, R., and D. Dively. *Benefit Cost Analysis in Theory and Practice*. New York: HarperCollins. 1994.

APPENDIX A | SUMMARY OF POTENTIAL THREATS TO GREEN STURGEON CRITICAL HABITAT

The appendix presents by unit the economic activities that may require special management to accommodate green sturgeon critical habitat as identified by NOAA (see Exhibit A-1).

EXHIBIT A-1. SUMMARY OF POTENTIAL THREATS TO GREEN STURGEON CRITICAL HABITAT

UNIT	DESCRIPTION	DREDGING	IN-WATER CONSTRUCTION OR ALTERATIONS	POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS	WATER DIVERSIONS	NON-NATIVE SPECIES	RESTORATION	COMMERCIAL SHIPPING	POWER PLANT	DESALINATION PLANT	TIDAL ENERGY PROJECTS	AQUACULTURE	LNG PROJECTS
1	Elkhorn Slough, CA	Y	Y	Y								Y				
2	Upper Sacramento River		Y	Y			Y	Y	Y							
3	Lower Sacramento River	Y	Y	Y	Y		Y	Y	Y							
4	Yolo Bypass				Y											
5	Sutter Bypass				Y											
6	Lower Feather River		Y	Y	Y		Y	Y	Y							
7	Lower Yuba River			Y	Y		Y	Y	Y							
8	Sacramento-San Joaquin Delta	Y	Y	Y				Y	Y	Y		Y				
9	Suisun Bay	Y	Y	Y					Y	Y	Y	Y				
10	San Pablo Bay	Y	Y	Y					Y	Y	Y	Y	Y			
11	San Francisco Bay	Y	Y	Y					Y	Y	Y	Y		Y		
12	Tomales Bay			Y				Y		Y					Y	
13	Noyo Harbor	Y	Y	Y												
14	Eel River			Y												
15	Humboldt Bay	Y	Y	Y								Y			Y	
16	Klamath River	Y		Y			Y									
17	Rogue River		Y	Y												
18	Coos Bay	Y		Y												Y
19	Winchester Bay			Y												
20	Siuslaw River	Y		Y												
21	Alsea River			Y				Y								
22	Yaquina River	Y	Y	Y												
23	Tillamook Bay	Y	Y	Y												
24a	Lower Columbia River Estuary	Y	Y	Y			Y									Y

UNIT	DESCRIPTION	DREDGING	IN-WATER CONSTRUCTION OR ALTERATIONS	POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS	WATER DIVERSIONS	NON-NATIVE SPECIES	RESTORATION	COMMERCIAL SHIPPING	POWER PLANT	DESALINATION PLANT	TIDAL ENERGY PROJECTS	AQUACULTURE	LNG PROJECTS
24b	Lower Columbia River	Y	Y	Y			Y									
25	Willapa Bay	Y	Y	Y					Y					Y	Y	
26	Grays Harbor	Y	Y	Y					Y		Y				Y	
27	Puget Sound	Y	Y	Y					Y		Y			Y	Y	
28	US/Mexico Border to Monterey Bay	Y	Y	Y		Y						Y	Y	Y	Y	Y
29	Monterey Bay to San Francisco Bay	Y	Y	Y		Y						Y	Y	Y		Y
30	San Francisco Bay to Humboldt Bay	Y		Y		Y						Y		Y		Y
31	Humboldt Bay to Coos Bay	Y		Y		Y						Y		Y		Y
32	Coos Bay to Winchester Bay	Y				Y								Y		Y
33	Winchester Bay to Columbia R. Estuary	Y		Y		Y								Y		Y
34	Columbia R. Estuary to Willapa Bay	Y				Y								Y		Y
35	Willapa Bay to Grays Harbor	Y				Y								Y		Y
36	Grays Harbor to US/Canada Border	Y		Y		Y								Y		Y
37	Strait of Juan de Fuca	Y		Y		Y								Y		Y
38	Alaska/Canada Border to Yakutat Bay	Y		Y							Y			Y		Y
39	Costal Alaska Waters northwest of Yakutat Bay	Y		Y		Y					Y			Y		Y
40	Nehalem Bay, OR	Y	Y	Y												

APPENDIX B | LAWS AND REGULATIONS THAT MAY PROVIDE BASELINE PROTECTION FOR GREEN STURGEON

CLEAN WATER ACT (33 U.S.C. 1251 ET SEQ. 1987)

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States. It gives the Environmental Protection Agency (EPA) the authority to implement pollution control programs such as setting wastewater standards for industry. The CWA also continued requirements to set water quality standards for all contaminants in surface waters.

Pursuant to Section 404 of the CWA, it is unlawful for any person to dredge, dispose off dredge material, or discharge a pollutant from a point source into navigable waters, unless a permit is obtained from the U.S. Army Corps of Engineers (USACE). As part of pollution prevention activities, the USACE may limit activities in waterways through the Section 404 permitting process, independent of green sturgeon concerns. These reductions in pollution may benefit green sturgeon critical habitat.

Pursuant to Section 402 of the CWA and under the National Pollutant Discharge Elimination System (NPDES) program, EPA sets pollutant-specific limits on the point source discharges for major industries and provides permits to individual point sources that apply to these limits. Under the water quality standards program, EPA, in collaboration with States, establishes water quality criteria to regulate ambient concentrations of pollutants in surface waters.

Under section 401 of the CWA, all applicants for a Federal license or permit to conduct activity that may result in discharge to navigable waters are required to submit a State certification to the licensing or permitting agency. For example, the 1995 Bay-Delta Water Quality Control Plan and Water Right Decision 1641 incorporates objectives such as providing water for fish and wildlife, including anadromous fish. Costs associated with this and other existing water control plans are considered baseline protection in this analysis.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT REAUTHORIZATION ACT 2006

This law signed by the President in January, 2007, amends the older Magnuson-Stevens Fishery Conservation and Management Act (as amended through 1996) that included provision for the description of essential fish habitat in fishery management plans and consideration of actions to ensure the conservation and enhancement of habitat. The newer Magnuson-Stevens Reauthorization Act mandates the use of annual catch limits and accountability measures to end overfishing, provides for widespread market-based fishery management through limited access programs, and calls for increased

international cooperation. This act may provide protection to green sturgeon by imposition of stringent measures to prevent fishing of green sturgeon, and improve conditions by encouraging market based conservation strategies.

NATIONAL FOREST MANAGEMENT ACT (16 USC §§ 1600-1614 1976)

This Act requires assessment of forest lands, development of a management program based on multiple-use, sustained-yield principles, and implementation of a resource management plan for each unit of the National Forest System. The Act may provide protection to green sturgeon within National Forests, primarily through its authorization of the Northwest Forest Plan (NWFP) and PACFISH. NWFP and PACFISH provide numerous protections for anadromous fish species related to Federal lands management activities (The NWFP and PACFISH are discussed in more detail below).

NORTHWEST FOREST PLAN (1994)

The Northwest Forest Plan is a Federal interagency cooperative program that is intended to provide a coordinated management direction for the lands administered by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM). The Northwest Forest Plan defines Standards and Guidelines (S&Gs) for forest use throughout the 24 million acres of Federal lands in its planning area (the range of the Northern spotted owl, Western Oregon, Western Washington, and Northwestern California). Specifically, the NWFP provides S&Gs for management of timber, roads, grazing, recreation, minerals, fire/fuels management, fish and wildlife management, general land management, riparian area management, watershed and habitat restoration, and research activities on USFS and BLM lands. To accomplish its goals, the NWFP defines seven land allocation categories, including “matrix lands,” areas where the majority of timber is to be taken, and Riparian Reserves and Key Watersheds, where distances from rivers are set within which many activities are restricted. The Aquatic Conservation Strategy (ACS) component of the plan specifically provides for fishery habitat, protection, and restoration. One of the most important substantive protective measures implemented through the Plan are riparian reserves. These are buffered strips of land that, depending on stream class and type of watershed, range from 300 feet on perennial streams to 50 feet on ephemeral streams.

PACFISH (INTERIM STRATEGIES FOR MANAGING ANADROMOUS FISH-PRODUCING WATERSHEDS) (1995)

The USFS and the BLM are developing an ecosystem-based, aquatic habitat and riparian-area management strategy (commonly referred to as "PACFISH") that addresses Federally-managed, anadromous fish watersheds in eastern Oregon, Washington, Idaho, and portions of California (areas outside the Northwest Forest Plan). The strategy is being developed in response to significant declines in naturally-reproducing salmonid stocks, including steelhead, and widespread degradation of anadromous fish habitat east of the Cascade mountain range. Like the Northwest Forest Plan, PACFISH is an attempt to provide a consistent approach for maintaining and restoring aquatic and riparian habitat conditions which, in turn, are expected to promote the sustained natural production of anadromous fish. Presently, an interim strategy has been instituted to halt degradation to

fish habitat and to ensure that future opportunities for habitat restoration are not foregone while comprehensive studies are completed for longer-term management strategies. Like the NWFP, PACFISH provides guidelines for timber, roads, grazing, recreation, minerals, fire/fuels management, lands, riparian area, watershed and habitat restoration, and fisheries and wildlife restoration. Standards and guidelines under PACFISH are nearly identical to those in the NWFP.

FEDERAL POWER ACT (16 U.S.C. § 800 1920, AS AMENDED)

The Federal Power Act (FPA) was promulgated to establish the Federal Energy Regulatory Commission (FERC) to oversee non-Federal hydropower generation. The FERC is an independent Federal agency governing approximately 2,500 licenses for non-Federal hydropower facilities, has responsibility for national energy regulatory issues.

This Act may provide protection to green sturgeon habitat from hydropower activities. Section 10(j) of the Federal Power Act (FPA) was promulgated to ensure that FERC considers both power and non-power resources during the licensing process. More specifically, section 18 of the FPA states that FERC shall require the construction, operation, and maintenance by a licensee at its own expense of a fishway if prescribed by the Secretaries of Interior (delegated to the Fish and Wildlife Service) and Commerce (NOAA).

FISH AND WILDLIFE COORDINATION ACT (16 U.S.C.§§ 661-666 1934, AS AMENDED)

This law provides that, whenever the waters or channels of a body of water are modified by a department or agency of the U.S. government, the department or agency must first consult with the U.S. Fish and Wildlife Service and with the head of the agency exercising administration over the wildlife resources of the State where modification will occur with a view to the conservation of wildlife resources.

The purpose of this Act is to ensure that fish and wildlife resources are equally considered with other resources during the planning of water resources development projects by authorizing FWS to provide assistance to Federal and State agencies in protecting game species and studying the effects of pollution on wildlife. This Act may offer protection to green sturgeon habitat by requiring consultation concerning the species with FWS for all instream activities with a Federal nexus.

RIVERS AND HARBORS ACT (33 USC §§ 401 ET SEQ. 1938)

The Rivers and Harbors Act (RHA) places Federal improvements of rivers, harbors and other waterways under the jurisdiction of the Department of the Army, USACE and requires that all improvements include due regard for wildlife conservation.

This Act may provide protection to the green sturgeon critical habitat related to in-stream construction activities. Under sections 9 and 10 of the RHA, the USACE is authorized to regulate the construction of any structure or work within navigable waterways. This includes, for example, bridges and docks.

NATIONAL ENVIRONMENTAL POLICY ACT (42 USC §§ 4321-4345 1969)

The National Environmental Policy Act (NEPA) requires that all Federal agencies conduct a detailed environmental impact statement (EIS) in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment.

The NEPA process may provide protection to the green sturgeon critical habitat for activities that have Federal involvement, if alternatives are considered and selected that are less harmful to green sturgeon critical habitat than other alternatives.

WILDERNESS ACT (16 USC §§ 1131-1136 1964)

The Wilderness Act established the National Wilderness Preservation System. With a few exceptions, no commercial enterprise or permanent road is allowed within a wilderness area. Temporary roads, motor vehicles, motorized equipment, landing of aircraft, structures and installations are only allowed for administration of the area. Measures may be taken to control fire, insects and disease. Prospecting for mineral or other resources, if carried on in a manner compatible with the preservation of wilderness, is allowed.

The Wilderness Act may offer protections to West Coast salmon and steelhead by limiting land disturbing activities in Wilderness Areas in National Forests. Human activity in wilderness areas is likely to be greatly reduced when compared to non-wilderness areas, which is likely to benefit green sturgeon and its habitat.

THE SIKES ACT IMPROVEMENTS ACT (16 USC §670 1997)

The Sikes Act Improvement Act (SAIA) requires military installations to prepare and implement an Integrated Natural Resources Management Plan (INRMP). The purpose of the INRMP is to provide for:

- The conservation and rehabilitation of natural resources on military installations;
- The sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping, and nonconsumptive uses; and
- Subject to safety requirements and military security, public access to military installations to facilitate the use of the resources.

INRMPs developed in accordance with SAIA may provide protection to green sturgeon critical habitat on military lands.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) (CALIFORNIA NATURAL RESOURCES CODE §15065(A))

CEQA is a California State statute that requires State and local agencies (known as “lead agencies”) to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. Projects carried out by Federal agencies are not subject to CEQA provisions. CEQA instructs the lead agency (typically a county or city community development or planning department in the case of land development projects) to examine impacts from a broad perspective, taking into account the value of

species' habitats that may be impacted by the project in an Environmental Impact Report (EIR). The lead agency must determine which, if any, project impacts are potentially significant and, for any such impacts identified, whether feasible mitigation measures or feasible alternatives will reduce the impacts to a level less than significant. It is within the power of a lead agency to decide that negative impacts are acceptable in light of economic, social, or other benefits generated by the project.

CENTRAL VALLEY PROJECT IMPROVEMENT ACT

Passed in 1992 by Congress, the Central Valley Project Improvement Act (CVPIA) is an addendum to the Central Valley Project Act that promotes environmental protection and restoration within California's Central Valley. The CVPIA has two objectives: preserving fish and wildlife and their habitats, and increasing the benefits of the Central Valley Project by adding incentives to use agricultural water more efficiently. To accomplish these objectives, the CVPIA allows contractors to participate in water markets, changes the pricing structure for water contractors, creates a restoration fund to finance activities that enhance fish and wildlife and their habitat, and allocates water for environmental uses. Specific provisions of the CVPIA that potentially benefit green sturgeon (and which have already been initiated) include: dedication of 800,000 acre-feet of CVPIA yield for fish and wildlife; release of pulsed flows to increase survival of migrating anadromous fish, and installation of fish screens at water diversions. The CVPIA also places limitations on water contracting and establishes a restoration fund of 50 million dollars annually.

More specifically, the CVPIA requires the Secretary of the Interior to develop and implement "a program which makes all reasonable efforts to ensure that, by the year 2002, the natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a longterm basis, at levels not less than twice the average levels attained during the period of 1967- 1991" (Section 3406[b][1]). This program is already in progress; it is known as the Anadromous Fish Restoration Program (AFRP). A coalition of fish experts from the Federal and state agencies, private industry and academia (AFRP Core Group) has developed a working plan for restoring salmon and steelhead in the Central Valley. The working plan provides a platform upon which the participating agencies and public will build a final plan. Actions are recommended for each watershed; they cover a broad spectrum of habitat restoration activities, such as improving instream flows, maintaining adequate water temperatures, correcting fish passage problems at dams and diversions, and restoring spawning gravel and riparian habitat. Further details on the recommended actions may be found in the Working Paper on Restoration Needs: Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California.

CALFED AND THE ENVIRONMENTAL WATER ACCOUNT

To address the long-term resource needs of the Central Valley, U.S. Bureau of Reclamation (BOR), the California Department of Water Resources, and other Federal and state agencies have initiated the California Bay-Delta Authority (CALFED) Program.

This long-term planning effort established by legislation enacted in 2002 is designed to develop a comprehensive water management and ecosystem restoration plan for the Central Valley. A key component of CALFED's Water Management Strategy, the Environmental Water Account (EWA) was created to address two problems: declining fish populations and unreliable water supplies. Its purpose is to better protect fish by making it possible to modify water project operations in the Bay-Delta and still meet the needs of water users.

The EWA buys water from willing sellers or diverts surplus water when safe for fish, then banks, stores, transfers and releases it as needed to protect fish and compensate water users. For example, EWA managers might coordinate with water project operators to curtail pumping at specific times to avoid harming fish, and then provide water to cities and farms at a later time as compensation.

FOR THE SAKE OF THE SALMON

This 1994 regional initiative by Federal, state, local, and tribal governments, and private and public organizations is intended to provide overall coordination and direction in protecting and restoring salmon throughout the Pacific Northwest. It is a proactive framework designed to identify solutions to salmon protection problems that are often beyond the scope of a single authority. It focuses on a four-part strategy which includes the following components:

- Identify and seek to modify public and private policies that contribute to the decline of the salmon and determine the means by which essential activities can be made less harmful to ecosystems;
- Take immediate steps to protect remaining healthy habitat;
- Improve the efficiency and cost effectiveness of government activities that protect and restore the health and productivity of salmon habitat; and,
- Encourage a conservation and stewardship ethic toward our natural environment in government, public, and private decision making.

LONG-TERM MANAGEMENT STRATEGY (LTMS) FOR THE PLACEMENT OF DREDGED MATERIAL IN THE SAN FRANCISCO BAY REGION

The LTMS is a multi-agency effort on the part of the USACE, EPA, NOAA and others to eliminate unnecessary dredging and maintain in an economically and environmentally sound manner those channels necessary for navigation in San Francisco Bay and Estuary. The LTMS also establishes dredging windows for salmon and other aquatic species. These seasonal limitations on dredging are intended to accommodate salmon spawning.

ESA - SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON RECOVERY PLAN AND SECTION 7 CONSULTATIONS

The flow of the upper Sacramento River is regulated by the Shasta and Keswick dams and flow augmentation is managed through a Trinity River diversion, all of which are owned and operated by the BOR. The BOR generally operates the Shasta and Trinity

divisions of the Central Valley Project (CVP) in accord with a CVP Operations Criteria and Plan and the winter-run chinook biological opinion for operation of the CVP and State Water Project (SWP) for the State of California. Many requirements in this and other winter-run chinook biological opinions should directly benefit green sturgeon critical habitat in the Sacramento River and Sacramento-San Joaquin Delta, by increasing flows, stabilizing ramping rates, and improving water temperatures, passage past dams and diversions, and water quality.

MITCHELL ACT

The NMFS administers the Mitchell Act passed by Congress in 1938 (and amended in 1946) for the purpose of providing for the conservation of the fisheries resources of the Columbia River. The Columbia River Fisheries Development Program (CRFDP) was established to coordinate activities authorized under the Mitchell Act. As such, the CRFDP is a cooperative effort between NMFS, the FWS, and the fisheries agencies of Oregon, Washington, and Idaho. In addition to funding the operation and maintenance of artificial propagation facilities, the CRFDP funds activities relating to stream improvements, such as fishway development, irrigation diversion screening, and stream clearing. Under the CRFDP, over 850 screens have been constructed to prevent fish mortality at irrigation diversions. The majority of these are in the Salmon River basin in Idaho and on eastern Oregon Columbia River tributaries. The CRFDP currently provides the majority of funding for multi-agency, cooperative, accelerated programs of screen construction, rehabilitation, and replacement. The program's goal was to have all irrigation diversions which impact anadromous salmonids in the Columbia River basin screened by 2002.

PRINCIPLES FOR AGREEMENT ON BAY-DELTA STANDARDS BETWEEN THE STATE OF CALIFORNIA AND THE FEDERAL GOVERNMENT

On December 15, 1994, the Federal government, the State of California, water users, and environmental advocates signed a three-year agreement on new protections for the San Francisco Bay and Delta entitled Principles for Agreement on Bay-Delta Standards Between the state of California and the Federal Government (Principles). Several measures under the Principles should improve habitat conditions for green sturgeon, in particular for juveniles rearing and migrating through the Sacramento-San Joaquin Delta. Increased outflow in the Delta from February through June will likely improve green sturgeon rearing habitat in the Delta. Closures of the Delta Cross Channel gates on the Sacramento River should reduce the diversion of juvenile green sturgeon into the central Delta and direct them away from the SWP and CVP pumping plants towards more suitable rearing habitat on the north and west side of the Delta. Water export restrictions in the spring may also provide benefits for juvenile fish in the Delta.

In addition to the protections afforded by modification of CVP and SWP operations, the Principles established a program, know as Category III, to develop, fund, and implement nonflow related fish and wildlife protection measures in the Central Valley. The Category III program has initiated a number of actions that are likely to benefit green sturgeon

including the installation of fish screens on several previously unscreened water diversions.

THE COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN FOR THE SAN FRANCISCO BAY-DELTA ESTUARY

The Comprehensive Conservation and Management Plan for the San Francisco Bay-Delta Estuary helps to restore and maintain the estuary's water quality and natural resources. This plan is jointly sponsored by the EPA and the State of California, and is considered to be a blueprint for restoring and maintaining the chemical, physical, and biological integrity of the Bay and Delta. Many of the recommended actions may improve rearing and migratory conditions for green sturgeon by improving water quality and flows and restoring riparian habitat, shallow water areas, and tidal slough habitats.

THE KLAMATH ACT

On October 27, 1986, Congress passed the Klamath Act (PL 99-552), authorizing a 20-year-long Federal-State cooperative Klamath River Basin Conservation Area Restoration Program for rebuilding of river's fish resources. The Act created a 14-member Klamath River Basin Fisheries Task Force and directed the U.S. Secretary of Interior to cooperate with the Task Force in creating and implementing the Klamath River Basin Conservation Area Fishery Restoration Program. In 1991, the Task Force developed a Long Range Plan for the Klamath River Basin Conservation Area Restoration Program. The Plan is intended to give initial guidance to the Task Force in its long-range direction in accomplishing the restoration of Klamath basin anadromous fisheries which include: restore, by the year 2006, the biological productivity of the Klamath River basin in order to provide for viable commercial and recreational ocean fisheries and in-river tribal trusts and recreational fisheries; support for the Klamath Fishery Management Council in development of harvest regulation recommendations that would provide for viable fisheries and escapements; recommendations to Congress, state legislatures, and local governments on the actions each should take to protect the fish and their habitats in the basin; inform the public about the value of anadromous fish to the Klamath River region and gain their support for the Restoration Program; and promote cooperative relationships between lawful users of the basin's land and water resources and those who are primarily concerned with the implementation of the Restoration Plan and Program. The Task Force members are appointed by (and represent) the Governors of California and Oregon; the U.S. Secretaries of Interior, Commerce, and Agriculture; the California counties of Del Norte, Humboldt, Siskiyou and Trinity; Hoopa Valley, Karuk and Yurok tribal fishers and anglers and commercial fishers. The Act also created an 11-member Klamath Fishery Management Council to "establish a comprehensive long-term plan and policy... for the management of the in-river and ocean harvesting that affects or may affect Klamath and Trinity River basin anadromous salmon populations." The Council is composed of essentially the same interests as the Task Force, except that the four county representatives hold seats only on the Task Force.

SALMON, STEELHEAD TROUT, AND ANADROMOUS FISHERIES PROGRAM ACT (SENATE BILL 2261)

In 1988, the California State legislature passed the Salmon, Steelhead Trout, and Anadromous Fisheries Restoration Act (Chapter 1545/88/Senate Bill 2261), which established the long-term goal of doubling anadromous fish populations from their 1988 abundance levels by the end of the century. This Act precipitated several plans for restoring Central Valley anadromous fisheries populations and their habitat: the Central Valley Salmon and Steelhead Restoration and Enhancement Plan, and Restoring Central Valley Streams. In general, these planning documents have outlined efforts to restore chinook salmon populations. Restoration activities currently being implemented as a result of these plans and California Senate Bill 1086 (described below) include: a pilot pumping project to improve fish passage at Red Bluff Diversion Dam, installing water temperature control devices at Shasta dam and Whiskeytown reservoir, correcting fish passage problems on several Sacramento River tributaries, and acquiring riparian woodland areas along Butte Creek and the Sacramento River.

As part of the Salmon, Steelhead Trout, and Anadromous Fisheries Program, the Steelhead Management and Restoration Project was also established in 1991. The CDFG has produced a draft plan which outlines management activities for the restoration and maintenance of California's steelhead populations. In the Central Valley, the CDFG's focus for steelhead restoration is on recovering wild populations and restoring hatchery-maintained runs. As an example, the draft plan outlines measures for the Sacramento River including correcting fish passage and screening problems, pollution from agricultural drainage and heavy metal pollution from the Iron Mountain Mine Superfund Site. Within the Sacramento River system, the plan recommends improved flows in the lower reaches by exchanging groundwater for surface flows. A monitoring program has also recently been established to assess adult steelhead numbers in Mill and Deer creeks. In addition, the CDFG plan recommends temperature and flow regimes for the Yuba River; adequate minimum flows, flow fluctuation standards, and water temperatures in the American River as well as storage levels in Folsom Reservoir. The CDFG has developed several other fishery management plans for Central Valley streams including: the Lower Yuba River fishery management plan, the Lower Mokelumne River Fisheries Management Plan, and the Steelhead Restoration Plan for the American River.

KEENE-NIELSEN FISHERIES RESTORATION ACT OF 1985

This Act states that California intends to make reasonable efforts to prevent further declines in fish and wildlife, restore fish and wildlife to historic levels where possible, and enhance fish and wildlife resources where possible. Just over $15 million were initially authorized in approved legislation, however, only $11.3 million were actually appropriated between 1985 and 1987. The Act was reworded through 1990 legislation to closely tie expenditures from this account to projects called for under the Salmon, Steelhead Trout, and Anadromous Fisheries Program Act of 1988. However, the legislation provided no funding to the Keene-Nielsen account, nor have the budgets of subsequent governors.

CALIFORNIA SENATE BILL 1086

The State of California passed Senate Bill 1086 in 1986, calling for a management plan to protect, restore, and enhance the fish and riparian habitat and associated wildlife of the upper Sacramento River. In response to this legislation, the Resources Agency of California prepared the Upper Sacramento River Fishery and Riparian Habitat Management Plan. This plan recommends a variety of habitat restoration measures, including improving spawning gravel, water quality, and passage at dams and diversions. Senate Bill 1086 appropriated $250,000 to prepare this management plan and to develop an inventory of riparian lands.

CAL TRANS ENVIRONMENTAL ENHANCEMENT AND MITIGATION PROGRAM

This program was established by the enactment of the Transportation Blueprint Legislation of 1989. This legislation provided for the annual allocation of $10 million that will be distributed through the California Resources Agency to FY 2000-2001. The program provides grants to local, state and Federal agencies and nonprofit entities to mitigate the environmental impact of modified or new public transportation facilities. Eligible projects for funding include the acquisition, restoration or enhancement of resource lands to mitigate the loss of, or the detriment to, resource lands lying within or near the right-of-way acquired for proposed transportation improvements. Resource lands include natural areas, wetlands, forests, woodlands, meadows, streams, or other areas containing fish or wildlife habitat.

CALIFORNIA WILD AND SCENIC RIVERS ACT

This Act declares that water is generally not available for appropriation by diversion from or storage in a designated Wild and Scenic River, unless approved by an initiative of the voters or a two-thirds vote of the California Legislature. Recently, Mill and Deer creeks (Sacramento River tributaries) have been proposed for inclusion in the State and National Wild and Scenic River Acts.

AGREEMENT BETWEEN THE DEPARTMENT OF WATER RESOURCES AND THE DEPARTMENT OF FISH AND GAME TO OFFSET DIRECT FISH LOSSES IN RELATION TO THE HARVEY O. BANKS DELTA PUMPING PLANTS (DWR FOUR PUMPS AGREEMENT)

The CDFG and the California Department of Water Resources (DWR) entered into an agreement in 1986 to offset the direct losses of striped bass, chinook salmon and steelhead by the diversion of water by the Harvey O. Banks Delta Pumping Plant. Projects funded under this agreement which may benefit green sturgeon include spawning gravel restoration projects on the Sacramento, Merced and Tuolumne rivers and Mill Creek, and installation of fish screens in Suisun Marsh sloughs.

SAN JOAQUIN RIVER MANAGEMENT PROGRAM ADVISORY COUNCIL

This Council is charged by the legislature to develop the San Joaquin River Management Program, which is intended to identify actions that can be taken to benefit legitimate uses of the San Joaquin River system. The program objectives are to develop compatible solutions to water supply, water quality, flood protection, fisheries, wildlife habitat and

recreation needs. The study area covers the river from Friant Dam downstream through the South Delta Water Agency. Actions resulting from implementation of this management program have the potential to benefit green sturgeon.

COLUMBIA RIVER FISH MANAGEMENT PLAN

In keeping with an existing court order, the states of Oregon and Washington must work with tribal and Federal authorities to rebuild weak runs and achieve fair sharing of the available salmon harvest between Native American and non-Native American fisheries. Major points of the plan include the commitment to rebuild upriver spring and summer chinook salmon runs to levels that would restore fisheries, management of harvests to insure that wild salmon runs continue to rebuild, and management of inriver and ocean fisheries to ensure fair sharing between Native American and non-Native American. The plan also provides for a flexible and dynamic management approach, as well as for the creation of a basin-wide Production Advisory Committee to coordinate joint development of subbasin plans that will address habitat protection, fish propagation, and harvest.

NORTHWEST POWER PLANNING COUNCIL - STRATEGY FOR SALMON

The Northwest Power Planning Council was established by Congress to develop a plan to protect and enhance the Columbia basin's fish and wildlife and a regional power plan that provides a reliable, low-cost electricity supply. The goal of the plan is to double salmon production in the Columbia River basin and to accomplish this with no appreciable risk to the biological diversity of fish populations. The plan calls for improved passage and screening at Columbia and Snake River dams, predator reductions in the Columbia and Snake Rivers, downstream barging of juvenile salmonids past Columbia River dams, improvement of harvest and hatchery practices to protect wild salmonids, and protection and restoration of fish habitat within the Columbia River basin. The plan also calls for the evaluation of adverse economic effects of salmon recovery and identification of sources of funds to mitigate the adverse effects.

OTHER STATUTES AND REGULATIONS THAT APPLY TO LAND USE ACTIVITIES

While the following statutes and regulations may apply to lands and waters that fall within green sturgeon habitat areas, they are unlikely to provide significant baseline protections and are not considered in the analysis.

- *Fish and Wildlife Conservation Act (16 USC §§ 2901-2911 1980, as amended)* – The FWCA encourages States to develop, revise and implement, in consultation with Federal, State, local and regional agencies, a plan for the conservation of fish and wildlife, particularly species indigenous to the State.
- *Fisheries Restoration and Irrigation Mitigation Act (16 USC § 777 2000)* - The FRIMA directs the Secretary of Interior, in consultation with the heads of other appropriate agencies, to develop and implement projects to mitigate impacts to fisheries resulting from the construction and operation of water diversions by local government entities (including soil and water conservation districts) in the Pacific Ocean drainage area.

- *Water Resources Development Act (33 USC §§ 2201-2330 1986, as amended)* - WRDA authorizes the construction or study of USACE projects and outlines environmental assessment and mitigation requirements.
- *Anadromous Fish Conservation Act (16 USC §§ 757 et seq. 1965)* - The AFCA authorizes the Secretary of the Interior to enter into agreements with States and other non-Federal interests to conserve, develop and enhance the anadromous fish resources of the U.S.
- *Wild and Scenic Rivers Act (16 USC §§ 1271-1287 2001)* - WSRA authorizes the creation of the National Wilderness Preservation System and prohibits extractive activities on specific lands.
- *North American Wetland Conservation Act (16 USC § 4401 et seq. 1989)* - NAWCA encourages partnerships among public agencies and other interests to protect, enhance, restore and manage an appropriate distribution and diversity of wetland ecosystems and other habitats for migratory birds and other fish and wildlife.
- *Federal Land Policy and Management Act (43 USC §§ 1701-1782 1976)* – This Act requires the Bureau of Land Management to employ a land planning process that is based on multiple use and sustained yield principles.
- *Executive Order 11988 and 11990 (1977)* – These Executive Orders require, to the extent possible, prevention of long and short term adverse impacts associated with the occupancy and modification of floodplains and prevention of direct or indirect support of floodplain development wherever there is a practicable alternative.
- *Coastal Zone Management Act (16 USC §§ 1451 et seq. 1972)* - CZMA establishes an extensive Federal grant program to encourage coastal States to develop and implement coastal zone management programs to provide for protection of natural resources, including wetlands, flood plains, estuaries, beaches, dunes, barrier islands, coral reefs, and fish and wildlife and their habitat.
- *Action Plan for the Restoration of the South Fork Trinity River Watershed and its Fisheries.* This action plan was completed for the BOR and Trinity River Task Force in 1994. The plan describes the factors presently limiting anadromous fish restoration, reviews past research and monitoring activities, and lists actions necessary to restore the South Fork Trinity River basin and its anadromous fishes.
- *Trout and Steelhead Conservation and Management Planning Act of 1979*. This Act declares that it is a policy of the State of California to establish and maintain wild trout and steelhead stocks in suitable waters of the state and establishes angling regulations designed to maintain wild trout and steelhead through natural production.

- *California Endangered Species Act (California Fish and Game Code §§ 2050, et seq.)* - The CESA parallels the main provisions of the Federal Endangered Species Act and is administered by the California Department of Fish and Game (DFG). CESA prohibits the "taking" (the California Fish and Game Code defines "take" as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill") of listed species except as otherwise provided in State law. The CESA also applies the take prohibitions to species petitioned for listing ("candidate species").
- *Z'berg-Nejedly Forest Practice Act of 1973 (Cal. Pub. Res. Code §§ 4511 - 4628)* - Also referred to as the California Forest Practice Act, this act regulates all timber harvesting in California on all non-federal land. CDF oversees enforcement of California's forest practice regulations. Under the Forest Practice Act, Timber Harvesting Plans (THPs) are submitted to CDF for commercial timber harvesting on all non-federal timberlands. The Act requires that all private forest land be replanted within five years and that a certain number of dead trees be left in harvest areas for birds and animals that need them.

APPENDIX C | FINAL REGULATORY FLEXIBILITY ANALYSIS

This analysis considers the extent to which the potential economic impacts associated with the designation of critical habitat for the Southern distinct population segment of North American green sturgeon (Southern DPS of green sturgeon) could be borne by small businesses. The analysis presented is conducted pursuant to the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996. Information for this analysis was gathered from the Small Business Administration (SBA), U.S. Census Bureau, and Dun & Bradstreet, Inc.

INTRODUCTION

First enacted in 1980, the RFA was designed to ensure that the government considers the potential for its regulations to unduly inhibit the ability of small entities to compete. The goals of the RFA include increasing the government's awareness of the impact of regulations on small entities and to encourage agencies to exercise flexibility to provide regulatory relief to small entities.

When a Federal agency proposes regulations, the RFA requires the agency to prepare and make available for public comment an analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small government jurisdictions).[102] For this rulemaking, this analysis takes the form of a final regulatory flexibility analysis (FRFA). Under 5 U.S.C., Section 604(a) of the RFA, an FRFA is required to contain:

i. A succinct statement of the need for, and objectives of, the rule;

ii. A summary of the significant issues raised by the public comments in response to the initial regulatory flexibility analysis, a summary of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments;

iii. A description of and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available;

iv. A description of the projected reporting, recordkeeping and other compliance requirements of the rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; and

v. A description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of

[102] 5 U.S.C. 601 et seq.

applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected.

NEEDS AND OBJECTIVES OF THE RULE

NOAA's National Marine Fisheries Service (NMFS) determined that the Southern DPS of green sturgeon is likely to become endangered in the foreseeable future throughout all or a significant portion of its range and listed the species as threatened under the Endangered Species Act (ESA) on April 7, 2006 (71 FR 17757).

Section 4(b)(2) of the ESA requires NOAA to designate critical habitat for threatened and endangered species "on the basis of the best scientific data available and after taking into consideration the economic impact, impact on national security, and any other relevant impact, of specifying any particular area as critical habitat." The ESA defines critical habitat under Section 3(5)(A) as:

> "(i) the specific areas within the geographical area occupied by the species, at the time it is listed…, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
>
> (ii) specific areas outside the geographical area occupied by the species at the time it is listed…upon a determination by the Secretary that such areas are essential for the conservation of the species."

A SUMMARY OF THE SIGNIFICANT ISSUES RAISED BY THE PUBLIC COMMENTS

Issue : One commenter asked how the lost revenue figures estimated in the small business analysis related to the estimated impacts calculated in the rest of the economic analysis. In addition, the commenter specifically requested that the small business analysis provide information about the potential revenue losses for farmers as a share of their total revenues. *(Tehama-Colusa Canal Authority)*

Response: The estimated lost revenues per small business included in the Final Regulatory Flexibility Analysis are calculated by taking the mid-range scenario impacts presented in Chapters 3 through 5 of the FEA, and then dividing by the estimated number of small entities by activity by unit, as presented in Exhibit C-3. Average net cash farm income of operations per farm (ignoring government payments) in the study area ($147,000, average for affected counties) are now included in the analysis for context.

DESCRIPTION AND ESTIMATE OF THE NUMBER OF SMALL ENTITIES TO WHICH THE RULE APPLIES

DEFINITION OF A SMALL ENTITY

Three types of small entities are defined in the RFA:

i. **Small Business.** Section 601(3) of the RFA defines a small business as having the same meaning as a small business concern under section 3 of the Small Business Act. This includes any firm that is independently owned and operated and is not dominant in its field of operation. The U.S. Small Business Administration (SBA) has developed size standards to carry out the purposes of the Small Business Act, and those size standards can be found in 13 CFR 121.201. The size standards are matched to North American Industry Classification System (NAICS) industries. The SBA definition of a small business applies to a firm's parent company and all affiliates as a single entity.

ii. **Small Governmental Jurisdiction.** Section 601(5) defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with a population of less than 50,000. Special districts may include those servicing irrigation, ports, parks and recreation, sanitation, drainage, soil and water conservation, road assessment, etc. Most tribal governments will also meet this standard. When counties have populations greater than 50,000, those municipalities of fewer than 50,000 can be identified using population reports. Other types of small government entities are not as easily identified under this standard, as they are not typically classified by population.

iii. **Small Organization.** Section 601(4) defines a small organization as any not-for-profit enterprise that is independently owned and operated and not dominant in its field. Small organizations may include private hospitals, educational institutions, irrigation districts, public utilities, agricultural co-ops, etc. Depending upon state laws, it may be difficult to distinguish whether a small entity is a government or non-profit entity. For example, a water supply entity may be a cooperative owned by its members in one case and in another a publicly chartered small government with the assets owned publicly and officers elected at the same elections as other public officials.

DESCRIPTION OF ECONOMIC ACTIVITIES FOR WHICH IMPACTS ARE MOST LIKELY

Any activity conducted by a small entity that affects the habitat or habitat features essential to green sturgeon has the potential to be affected by the critical habitat designation. As described in the main text of this analysis, NMFS identified 15 categories of economic activity as potentially requiring modification to avoid destruction or adverse modification of green sturgeon critical habitat. These "activities" include the operation of some facilities, such as water diversions, where special management of operations may be required for green sturgeon. The following are the economic activities assessed in this FRFA:

i. Dredging
ii. In-water construction
iii. NPDES permit activities
iv. Agriculture
v. Bottom trawl fisheries
vi. Dams
vii. Water diversions
viii. Restoration
ix. Commercial shipping
x. Power plants
xi. Desalination plants
xii. Tidal/wave energy projects
xiii. Liquefied natural gas (LNG) projects
xiv. Aquaculture
xv. Non-native species management

As discussed earlier in this report, a great deal of uncertainty exists with regard to how potentially regulated entities will attempt to avoid to avoid the destruction or adverse modification of critical habitat. This is caused by two factors: relatively little data exist on green sturgeon abundance and behavior, and NMFS has a short history of managing for green sturgeon. In addition, the habitat for green sturgeon overlaps nearly entirely with habitat for salmon and steelhead species. While baseline protections are expected to be afforded due to listing-related conservation measures, and on behalf of salmon and steelhead species, the economic analysis estimates the incremental impacts resulting specifically from the critical habitat designation.

This FRFA estimates the potential number of businesses that may be affected by this rule, and the average annualized impact per entity for a given unit and activity type. Specifically, based on an examination of the North American Industry Classification System (NAICS), this analysis classifies the potentially affected economic activities into industry sectors and provides an estimate of the number of small businesses affected in each sector based on the applicable NAICS codes. Exhibit C-1 presents a list of the major relevant activities and descriptions of the industry sectors involved in those activities, including NAICS codes, and the SBA thresholds for determining whether a business is small.

This FRFA does not consider impacts to small business for all activities for which potential impacts are projected in the economic analysis. The reasons are detailed below:

- As discussed in Section 3, impacts to entities involved in liquefied natural gas (LNG) facility development are uncertain. Most potentially affected LNG projects identified in Section 3 are still in the proposal stage, and may not

survive to the production stage. Even so, it appears that due to the nature of the project type, few of the entities applying for these permits are likely to be small entities.

- Similar to LNG projects, impacts to tidal and wave energy projects are uncertain, as many of these projects are in the early planning process, and NOAA has yet to address them specifically with regard to green sturgeon. While a small number of these projects may involve small entities such as universities, who become involved in the research and development end of these projects, it appears that few of these projects will be undertaken by small entities.
- Desalination plants are often co-located with power plants. As above, impacts to desalination plants are uncertain, and a large number of projected projects exist only in the planning stages. Most of entities directly regulated by this rule appear unlikely to be small entities, though in some cases, it is possible that small jurisdictions, such as County governments, may be responsible for these projects.
- Most restoration projects are typically undertaken by state and local governmental agencies, impacts to small businesses, although not specifically known, are expected to be minor.
- This FRFA does not attempt to estimate impacts to small businesses involved in aquaculture, commercial shipping, and non-native species removal activities, as economic impacts to those activities were not quantified.

Impacts to small businesses involved in the remaining eight activities (i.e., dredging, in-water construction, point and non point source pollution, agriculture, dams, water diversions, bottom trawl fisheries, and power plants) are discussed below.

EXHIBIT C-1. MAJOR RELEVANT ACTIVITIES AND A DESCRIPTION OF THE INDUSTRY SECTORS ENGAGED IN THOSE ACTIVITIES

MAJOR RELEVANT ACTIVITY	DESCRIPTION OF INCLUDED INDUSTRY SECTORS	NAICS CODE	SBA SIZE STANDARD
Bottom Trawl Fisheries	**Fishing** Industries in this sector harvest fish from their natural habitats and are dependent upon a continued supply of the natural resource. The harvesting of fish is the predominant economic activity of this sector and it usually requires specialized vessels that, by the nature of their size, configuration and equipment, are not suitable for any other type of production, such as transportation.	114111 114112 114119	$4 million average annual receipts
Crop Production	**Crop Production (Oilseed and Grain Farming, Vegetable and Melon Farming, Fruit and Tree Nut Farming)** This industry group comprises establishments primarily engaged in 1) growing oilseed and/or grain crops and/or producing oilseed and grain seeds; 2) growing root and tuber crops (except sugar beets and peanuts) or edible plants and/or producing root and tuber or edible plant seeds; or 3) growing fruit and/or tree nut crops.	1111 1112 1113	$750,000 average annual receipts
Power Plants	**Electric Power Generation, Transmission and Distribution** This industry group comprises establishments primarily engaged in generating, transmitting, and/or distributing electric power. Establishments in this industry group may perform one or more of the following activities: (1) operate generation facilities that produce electric energy; (2) operate transmission systems that convey the electricity from the generation facility to the distribution system; and (3) operate distribution systems that convey electric power received from the generation facility or the transmission system to the final consumer.	221111 221112 221113 221119 221121 221122	4 million megawatts for the preceding year[1]
	Natural Gas Distribution This industry comprises: (1) establishments primarily engaged in operating gas distribution systems (e.g., mains, meters); (2) establishments known as gas marketers that buy gas from the well and sell it to a distribution system; (3) establishments known as gas brokers or agents that arrange the sale of gas over gas distribution systems operated by others; and (4) establishments primarily engaged in transmitting and distributing gas to final consumers.	221210	500 employees
Dams and Water Diversions	**Water Supply and Irrigation Systems** This industry comprises establishments primarily engaged in operating water treatment plants and/or operating water supply systems. The water supply annual receipts system may include pumping stations, aqueducts, and/or distribution mains. The water may be used for drinking, irrigation, or other uses.	221310	$6.5 million average annual receipts
In-water Construction & Dredging	**Construction Sand and Gravel Mining** This industry comprises establishments primarily engaged in one or more of the following: (1) operating commercial grade (i.e., construction) sand and gravel pits; (2) dredging for commercial grade sand and gravel; and (3) washing, screening, or otherwise preparing commercial grade sand and gravel.	212321	500 employees
	Water and Sewer Line and Related Structures Construction This industry comprises establishments primarily engaged in the construction of water and sewer lines, mains, pumping stations, treatment plants and storage tanks.	237110	$31 million average annual receipts
	Oil and Gas Pipeline and Related Structures Construction This industry comprises establishments primarily engaged in the construction of oil and gas lines, mains, refineries, and storage tanks.	237120	
	Power and Communication Line and Related Structures Construction This industry comprises establishments primarily engaged in the construction of power lines and towers, power plants, and radio, television, and telecommunications transmitting/receiving towers.	237130	

MAJOR RELEVANT ACTIVITY	DESCRIPTION OF INCLUDED INDUSTRY SECTORS	NAICS CODE	SBA SIZE STANDARD
	Highway, Street and Bridge Construction This industry comprises establishments primarily engaged in the construction of highways (including elevated), streets, roads, airport runways, public sidewalks, or bridges. The work performed may include new work, reconstruction, rehabilitation, and repairs.	237310	
	Other Heavy and Civil Engineering Construction This industry comprises establishments primarily engaged in heavy and engineering construction projects (excluding highway, street, bridge, and distribution line construction).	237990	
	Marinas This industry comprises establishments engaged in operating docking and/or storage facilities for pleasure craft owners, with or without one or more related activities, such as retailing fuel and marine supplies; and repairing, maintaining, or renting pleasure boats.	713930	$6.5 million average annual receipts
Point Source Pollution	**Food Manufacturing** Industries in this sector transform livestock and agricultural products into products for intermediate or final consumption. The industry groups are distinguished by the raw materials (generally of animal or vegetable origin) processed into food products.	311	500 employees
	Wood Product Manufacturing Industries in this sector manufacture wood products, such as lumber, plywood, veneers, wood containers, wood flooring, wood trusses, manufactured homes (i.e., mobile home), and prefabricated wood buildings.	321	500 employees
	Paper and Pulp Mills This industry comprises establishments primarily engaged in manufacturing paper and/or pulp.	322	750 employees
	Sewage Treatment Facilities This industry comprises establishments primarily engaged in operating sewer systems or sewage treatment facilities that collect, treat, and dispose of waste.	221320	$6.5 million average annual receipts

Note:
(1) All entities in the Electric Services Sectors are assumed to be small entities. Consequently, the number for small entities in these sectors represent an upper bound estimate. The number of small entities in the hydroelectric power generation and electrical services industries is unknown because of the unavailability of data related to small business thresholds. For both of these industry sectors the SBA defines a firm as "small" if, including its affiliates, it is primarily engaged in the generation, transmission, and/or distribution of electric energy for sale, and its total electric output for the preceding fiscal year did not exceed 4 million megawatt hours. It was not possible to locate a source that provides this information for all regulated entities within these sectors.

ESTIMATE OF THE NUMBER OF SMALL ENTITIES TO WHICH THE RULE WILL APPLY

Approach for Estimating the Number of Small Entities

The specific areas considered for designation as critical habitat, and hence the action area for this rule, spans from southern California to Alaska. NMFS identified watershed units defined by the U.S. Geological Service as "hydrologic units" that most closely overlap the study areas for the rule.[103] Section 1 shows the distribution of the hydrologic units which define the extent of the study area of this FRFA. Although the affected areas include marine areas off the coast (Units 28-39 in this report), the small business analysis is focused on land based areas where most economic activities occur and which could be affected by the critical habitat rule.[104] The study areas as defined by the hydrologic units are wholly contained within the regions mapped in Exhibit 2.

Ideally, this analysis would directly identify the number of small entities that are located within hydrologic units that fall within the action area for the rule. However, it is not possible to directly determine the number of firms in each industry sector within the hydrologic units because business activity data is maintained at the county level. Therefore, this analysis first identified small entities in counties that overlap with the hydrologic units within the action area, then estimated the number of small entities within the study area using the following method:

- In order to estimate the number of county businesses located within the study area for the critical habitat rule, this analysis assumes that business locations are distributed geographically in the same way that population is distributed. That is, more densely populated areas will contain proportionally more businesses than less populated areas.
- The number of people residing in the hydrologic units was estimated by summing up the population of all census blocks that are contained within the hydrologic unit.[105, 106]
- The ratio of the population within the study area to the total population of the county is used to estimate the proportion of total and small business entities that may be affected by the critical habitat rule. Thus, this analysis uses

[103] Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to twelve digits based on the six levels of classification in the hydrologic unit system. NMFS determined the smallest practical hydrologic unit to analyze is that designated by a fifth field code (referred to as a fifth field HUC or HUC5). For Alaska, since reliable fifth field code watershed data are not available, fourth field code watersheds were used instead.

[104] Because commercial shipping operations occur, in most cases, offshore, tracking the locations of small entities using Dun and Bradstreet databases is problematic. Supplemental information on the number of potentially affected entities within the fishing industry is presented in Exhibit C-7.

[105] 2000 Census of Population and Housing.

[106] In case of partial containment of a census block, the ratio of the contained and total area of the block was used to estimate the block population residing within the hydrologic unit. The population that resides within each county included in the study area is generated by summing up the population estimates across all hydrologic units that the county intersects with.

population distribution as a proxy for the distribution of small entities in a county.

- Note that for any economic activity, the number of small entities was estimated only for those critical habitat units where a threat due to the activity was identified by NMFS.

After determining the number of small entities, this analysis estimates the impact per entity for each unit and industry sector. The following steps allow such an estimation:

- Total impact for every unit and activity type is determined based on the results presented earlier in this report (see Executive Summary);
- The proportion of businesses that are small is calculated for every unit for every activity type;
- The impact to small businesses for every unit and activity type is estimated by multiplying the total impacts estimated for all businesses with the proportion of businesses that are determined to be small;
- The average impact per small businesses for every unit and activity type is estimated by taking the ratio of the estimated impact to the total number of small businesses estimated for that unit and activity type.

DISCUSSION OF RESULTS

The list of counties, industry sectors (identified by NAICS codes), and the SBA-specified small business size thresholds (Exhibit C-1) was used to search the D&B Duns Market Identifiers (File 516) database.[107] The File 516 database is produced by Dun & Bradstreet, Inc. and contains for every county basic company data on U.S. business establishment locations, including public, private, and government organizations. The database search identified within each county the total number of entities and the number of small entities for each industry sector that may be affected by the critical habitat rule.

An estimate of the total number of small entities that could be potentially affected by the rule is summarized in Exhibits C-2, C-3 and C-4. Based on GIS analysis of the overlay of the study area with the administrative boundaries of states and counties, it was determined that small businesses in 94 counties may be affected by this rule. The states of California, Alaska, Washington, and Oregon respectively include 36, 23, 19, and 16 of these counties. About 56 percent of the population of these counties resides in the study area defined for this analysis.

There are a total of 14,851 small businesses involved in activities most likely to be affected by the critical habitat rule.[108] Of these 10,398 (70 percent) of these small businesses are located in California, 3,070 (21 percent) in Washington, 776 in Oregon,

[107] NAICS codes can be accessed from the US Census Bureau website: http://www.census.gov/epcd/www/naics.html. Last accessed on November 6, 2007.

[108] This is based on the assumption that all small businesses counted across units and activity types are separate entities. However, it is likely that a particular small business may appear multiple times as being affected by conservation measures for multiple units and activity types. Hence, total small business estimates across units and activity types are likely to be overestimated.

and 607 in Alaska. Thus, a majority of the impacts is expected to be concentrated in California. Los Angeles County in California has the maximum number (2,022) of the estimated small affected businesses. Orange County in California and King County in Washington contain more than 1,000 small businesses that may be affected by this rule. Santa Clara and Alameda counties of California, both containing in excess of 650 affected small businesses, are the other of the top-five counties containing small businesses potentially impacted by the critical habitat designation.

Exhibit C-3 presents the distribution of small businesses by unit by county. Exhibit C-4 sums this information, and presents the total number of small businesses by unit. The study area for Unit 27 (Puget Sound, WA) and Unit 11 (San Francisco Bay, CA) contain 2,369 and 2,539 small entities respectively. Efforts associated with Unit 28 that extends from the California-Mexico border to Monterey Bay, CA and the Unit 3 (Lower Sacramento River) are expected to impact 4,988 and 1,484 small entities, respectively. Unit 24b (Lower Columbia River) is the fifth highest impact generating unit and is expected to potentially affect 728 small entities.

Small businesses receiving National Pollutant Discharge Elimination System (NPDES) permits represent the largest number (8,497) of the potentially affected small entities. This group includes the manufacturing sector (e.g., food processing units, paper and pulp mills or sewage treatment plants). Another 947 small businesses involved in crop agriculture are also expected to be affected by the critical habitat rule, partially due to the risk of pesticides that may drain from crop lands into waters where green sturgeon are found. Thus, water quality concerns are expected to be the reason that 50 percent of the small entities will be affected. As identified in the critical habitat rule, States and the Environmental Protection Agency (EPA) have already established acceptable levels of contaminants in waterways. Entities are already required to obtain the National Pollutant Discharge Elimination System (NPDES) permits to discharge contaminants. In cases where NPDES permits are not required, monitoring and compliance with the clean water standards set by the EPA and the States may be required to avoid the destruction or adverse modification of critical habitat for green sturgeon.

Apart from water pollution, the potential for small businesses engaged in in-water construction and dredging activities to be affected by this rule is also relatively high with 4,281 small entities identified within the study area for these activity types. Impacts due to the rest of the activity types are estimated to affect approximately 19 percent of all small businesses.

Exhibit C-5 estimates for every activity type the proportion of businesses that are small within a unit. As can be seen, the proportion of businesses that are small in most units and for most activity types are above 80 percent. Thus, for the considered activity types, most businesses in the study area can be considered to be small.

Exhibit C-6 combines annualized cost estimates from previous sections of this report and information from Exhibit C-5 to estimate the total annualized impacts that may be borne by small entities by activity and by unit.

Exhibit C-7 combines information from Exhibits C-4 and C-6 to generate for every unit and activity type the potential annualized impact to a typical small business. As explained

above, this estimate is generated by taking the ratio of total impact to small businesses and the total number of small businesses estimated; the total impact to small businesses is estimated as a product of the total impacts to all businesses as estimated earlier in this report, and the corresponding estimate for the proportion of businesses that are small, as presented in Exhibit C-4.

As discussed above based on information from Exhibit C-4, Units 11 and 28 were most heavily impacted, if the criteria selected for impact was the total number of small businesses affected for a unit. However, as Exhibit C-7 indicates, if per small entity annualized impacts are considered, Unit 39 would be affected most heavily (assuming higher end impacts), followed by Units 46 (Grays Harbor to Cape Flattery), 34 (Lower Columbia River to Willapa Bay), 7 (Lower Yuba River), 30 (San Francisco Bay to Humboldt Bay), respectively.

Evaluation of Alternatives

In accordance with the requirements of the RFA (as amended by SBREFA, 1996) this analysis considered various alternatives to the critical habitat designation for the green sturgeon. The alternative of not designating critical habitat for the green sturgeon was considered and rejected because such an approach does not meet the legal requirements of the ESA. The alternative of proposing the designation of all potential critical habitat areas (i.e., no areas excluded) also was considered and rejected because, for several areas, the economic benefits of exclusion outweighed the benefits of inclusion, and NMFS did not determine that exclusion of these areas would significantly impede conservation of the species or result in extinction of the species.

An alternative to designating critical habitat within all 41 units is the designation of critical habitat within a subset of these units. This approach would help to reduce the number of small businesses potentially affected. The extent to which the economic impact to small entities would be reduced depends on how many, and which, units would be excluded.

EXHIBIT C-2. ESTIMATED NUMBER OF REGULATED ENTITIES BY UNIT AND COUNTY

UNIT	STATE	COUNTY	TOTAL COUNTY POPULATION	POPULATION WITHIN STUDY AREA	% COUNTY POPULATION WITHIN STUDY AREA	ALL REGULATED ENTITIES IN COUNTY	REGULATED SMALL ENTITIES IN COUNTY	ALL REGULATED ENTITIES IN STUDY AREA	REGULATED SMALL ENTITIES IN STUDY AREA
1	California	Monterey	419,850	12,532	3.0%	528	403	9	9
1	California	San Benito	58,990	1,035	1.8%	118	99	3	3
2	California	Shasta	171,170	125,961	73.6%	239	216	150	134
2	California	Tehama	57,825	28,208	48.8%	189	167	37	32
3	California	Butte	210,072	110,726	52.7%	506	451	261	233
3	California	Colusa	19,632	18,498	94.2%	185	162	173	152
3	California	El Dorado	167,761	10	0.0%	210	202	4	4
3	California	Glenn	26,852	14,759	55.0%	200	185	112	103
3	California	Placer	285,895	132,087	46.2%	319	296	142	131
3	California	Sacramento	1,311,915	649,629	49.5%	809	710	384	335
3	California	Solano	416,892	156	0.0%	291	245	4	4
3	California	Sutter	83,047	3,051	3.7%	361	314	14	13
3	California	Tehama	57,825	24,384	42.2%	189	167	81	71
3	California	Yolo	182,025	153,516	84.3%	368	308	309	260
4	California	Sacramento	1,311,915	1	0.0%	809	710	2	2
4	California	Solano	416,892	194	0.0%	291	245	2	2
4	California	Sutter	83,047	1	0.0%	361	314	2	2
4	California	Yolo	182,025	2,702	1.5%	368	308	6	4
5	California	Sutter	83,047	149	0.2%	361	314	3	3
6	California	Butte	210,072	40,402	19.2%	506	451	96	86
6	California	Placer	285,895	13,488	4.7%	319	296	17	15
6	California	Sutter	83,047	79,691	96.0%	361	314	340	295
6	California	Yolo	182,025	4	0.0%	368	308	4	4
6	California	Yuba	61,455	30,467	49.6%	129	114	63	55
7	California	Yuba	61,455	12,822	20.9%	129	114	27	24
8	California	Alameda	1,504,099	59	0.0%	1000	848	4	4
8	California	Contra Costa	1,004,109	183,223	18.2%	661	596	108	99
8	California	Sacramento	1,311,915	65,160	5.0%	809	710	36	33

UNIT	STATE	COUNTY	TOTAL COUNTY POPULATION	POPULATION WITHIN STUDY AREA	% COUNTY POPULATION WITHIN STUDY AREA	ALL REGULATED ENTITIES IN COUNTY	REGULATED SMALL ENTITIES IN COUNTY	ALL REGULATED ENTITIES IN STUDY AREA	REGULATED SMALL ENTITIES IN STUDY AREA
8	California	San Joaquin	615,261	227,138	36.9%	987	817	148	114
8	California	Solano	416,892	2,477	0.6%	291	245	4	4
8	California	Stanislaus	483,719	1	0.0%	859	756	4	4
8	California	Yolo	182,025	24,962	13.7%	368	308	22	19
9	California	Contra Costa	1,004,109	816	0.1%	661	596	3	3
9	California	Solano	416,892	12,399	3.0%	291	245	8	7
10	California	Alameda	1,504,099	1,545	0.1%	1000	848	3	3
10	California	Contra Costa	1,004,109	176,902	17.6%	661	596	99	89
10	California	Marin	250,384	83,727	33.4%	251	232	71	67
10	California	Napa	130,384	126,071	96.7%	504	451	137	130
10	California	Solano	416,892	111,492	26.7%	291	245	62	52
10	California	Sonoma	479,807	114,834	23.9%	901	816	109	100
11	California	Alameda	1,504,099	1,319,178	87.7%	1000	848	804	681
11	California	Contra Costa	1,004,109	104,934	10.5%	661	596	59	53
11	California	Marin	250,384	153,458	61.3%	251	232	129	121
11	California	San Francisco	790,796	632,283	80.0%	558	496	402	355
11	California	San Mateo	719,179	607,711	84.5%	475	420	351	308
11	California	Santa Clara	1,725,207	1,233,884	71.5%	1303	1158	788	704
11	California	Santa Cruz	261,552	12	0.0%	435	370	3	3
11	California	Stanislaus	483,719	1	0.0%	859	756	3	3
12	California	Marin	250,384	8,464	3.4%	251	232	10	10
12	California	Sonoma	479,807	343	0.1%	901	816	4	4
13	California	Mendocino	88,345	13,934	15.8%	254	227	19	17
14	California	Humboldt	127,438	19,152	15.0%	195	183	23	21
15	California	Humboldt	127,438	68,079	53.4%	195	183	94	87
16	California	Del Norte	27,638	1,060	3.8%	33	29	3	3
16	California	Humboldt	127,438	1,538	1.2%	195	183	4	4
16	California	Siskiyou	44,249	1	0.0%	112	100	3	3
17	Oregon	Curry	21,477	1,899	8.8%	62	57	4	3
18	Oregon	Coos	62,461	38,675	61.9%	133	121	57	50
19	Oregon	Douglas	101,397	5,297	5.2%	178	161	8	7

UNIT	STATE	COUNTY	TOTAL COUNTY POPULATION	POPULATION WITHIN STUDY AREA	% COUNTY POPULATION WITHIN STUDY AREA	ALL REGULATED ENTITIES IN COUNTY	REGULATED SMALL ENTITIES IN COUNTY	ALL REGULATED ENTITIES IN STUDY AREA	REGULATED SMALL ENTITIES IN STUDY AREA
19	Oregon	Lane	329,954	64	0.0%	448	395	2	2
20	Oregon	Douglas	101,397	5	0.0%	178	161	2	2
20	Oregon	Lane	329,954	10,918	3.3%	448	395	13	11
21	Oregon	Benton	78,824	368	0.5%	101	90	3	3
21	Oregon	Lincoln	44,537	4,035	9.1%	104	93	7	6
22	Oregon	Lincoln	44,537	7,054	15.8%	104	93	10	9
23	Oregon	Tillamook	24,641	13,321	54.1%	85	80	33	31
23	Oregon	Washington	482,527	270	0.1%	462	419	2	2
23	Oregon	Yamhill	88,995	122	0.1%	222	201	2	2
24a	Oregon	Clatsop	35,762	15,637	43.7%	79	65	28	22
24a	Oregon	Columbia	45,434	540	1.2%	84	74	3	3
24a	Washington	Lewis	70,245	47	0.1%	140	125	3	3
24a	Washington	Pacific	20,975	2,462	11.7%	78	73	6	6
24a	Washington	Wahkiakum	3,869	2,607	67.4%	13	13	6	6
24b	Oregon	Clackamas	354,262	1,178	0.3%	483	447	3	3
24b	Oregon	Columbia	45,434	28,021	61.7%	660	569	391	332
24b	Oregon	Hood River	21,017	1	0.0%	462	419	5	4
24b	Oregon	Multnomah	675,545	478,045	70.8%	84	74	47	41
24b	Oregon	Washington	482,527	4,157	0.9%	391	348	231	204
24b	Washington	Clark	374,076	266,047	71.1%	119	98	39	32
24b	Washington	Cowlitz	94,838	36,762	38.8%	140	125	3	3
24b	Washington	Lewis	70,245	112	0.2%	13	13	3	3
24b	Washington	Skamania	10,167	1,248	12.3%	186	167	3	3
24b	Washington	Wahkiakum	3,869	1,207	31.2%	19	18	3	2
25	Washington	Grays Harbor	68,006	1,321	1.9%	174	158	3	3
25	Washington	Lewis	70,245	53	0.1%	140	125	2	2
25	Washington	Pacific	20,975	18,101	86.3%	78	73	33	29
25	Washington	Wahkiakum	3,869	41	1.1%	13	13	2	2
26	Washington	Grays Harbor	68,006	45,369	66.7%	174	158	75	65
26	Washington	Jefferson	27,268	2	0.0%	64	62	2	2
26	Washington	Mason	51,031	2	0.0%	100	95	2	2

UNIT	STATE	COUNTY	TOTAL COUNTY POPULATION	POPULATION WITHIN STUDY AREA	% COUNTY POPULATION WITHIN STUDY AREA	ALL REGULATED ENTITIES IN COUNTY	REGULATED SMALL ENTITIES IN COUNTY	ALL REGULATED ENTITIES IN STUDY AREA	REGULATED SMALL ENTITIES IN STUDY AREA
26	Washington	Pacific	20,975	130	0.6%	78	73	2	2
27	Washington	Clallam	66,290	186	0.3%	140	131	2	2
27	Washington	Grays Harbor	68,006	13	0.0%	174	158	2	2
27	Washington	Island	75,372	67,350	89.4%	110	110	62	62
27	Washington	Jefferson	27,268	20,008	73.4%	64	62	33	31
27	Washington	King	1,785,118	1,515,690	84.9%	1704	1517	1194	1051
27	Washington	Kitsap	238,287	212,864	89.3%	225	216	162	155
27	Washington	Mason	51,031	45,459	89.1%	100	95	64	60
27	Washington	Pierce	739,370	657,451	88.9%	607	544	449	398
27	Washington	Skagit	108,144	84,679	78.3%	233	207	121	109
27	Washington	Snohomish	644,405	536,400	83.2%	605	562	409	379
27	Washington	Thurston	217,877	171,063	78.5%	225	203	133	117
27	Washington	Whatcom	177,912	1,528	0.9%	331	293	3	3
28	California	Los Angeles	9,873,548	4,375,447	44.3%	6031	5344	2483	2202
28	California	Monterey	419,850	23,880	5.7%	528	403	17	16
28	California	Orange	2,986,914	2,064,565	69.1%	2125	1878	1363	1210
28	California	Riverside	1,717,828	2,579	0.2%	1293	1120	3	3
28	California	San Diego	2,956,812	960,626	32.5%	1947	1771	534	490
28	California	San Luis Obispo	258,203	169,606	65.7%	483	443	160	148
28	California	Santa Barbara	408,558	383,573	93.9%	438	378	217	197
28	California	Ventura	794,662	323,525	40.7%	841	735	211	193
29	California	Monterey	419,850	239,223	57.0%	528	403	154	137
29	California	San Benito	58,990	1,667	2.8%	118	99	4	3
29	California	San Francisco	790,796	342,648	43.3%	558	496	219	193
29	California	San Mateo	719,179	111,098	15.4%	475	420	67	59
29	California	Santa Clara	1,725,207	150	0.0%	1303	1158	3	3
29	California	Santa Cruz	261,552	260,029	99.4%	435	370	245	211
30	California	Humboldt	127,438	18,552	14.6%	195	183	25	24
30	California	Marin	250,384	7,032	2.8%	251	232	8	8
30	California	Mendocino	88,345	30,557	34.6%	254	227	44	41
30	California	Sonoma	479,807	42,986	9.0%	901	816	42	39

UNIT	STATE	COUNTY	TOTAL COUNTY POPULATION	POPULATION WITHIN STUDY AREA	% COUNTY POPULATION WITHIN STUDY AREA	ALL REGULATED ENTITIES IN COUNTY	REGULATED SMALL ENTITIES IN COUNTY	ALL REGULATED ENTITIES IN STUDY AREA	REGULATED SMALL ENTITIES IN STUDY AREA
31	California	Del Norte	27,638	24,725	89.5%	33	29	29	25
31	California	Humboldt	127,438	90,823	71.3%	195	183	119	111
31	California	Siskiyou	44,249	1	0.0%	112	100	4	4
31	Oregon	Coos	62,461	14,129	22.6%	133	121	24	21
31	Oregon	Curry	21,477	18,279	85.1%	62	57	40	35
31	Oregon	Josephine	78,701	5	0.0%	118	113	3	3
32	Oregon	Coos	62,461	41,435	66.3%	133	121	28	28
32	Oregon	Douglas	101,397	358	0.4%	178	161	2	2
33	Oregon	Benton	78,824	368	0.5%	101	90	2	2
33	Oregon	Clatsop	35,762	10,912	30.5%	79	65	23	19
33	Oregon	Douglas	101,397	4,503	4.4%	178	161	8	7
33	Oregon	Lane	329,954	12,460	3.8%	448	395	15	13
33	Oregon	Lincoln	44,537	40,063	90.0%	104	93	77	68
33	Oregon	Polk	64,983	38	0.1%	109	97	2	2
33	Oregon	Tillamook	24,641	11,145	45.2%	85	80	31	29
33	Oregon	Yamhill	88,995	461	0.5%	222	201	3	3
34	Oregon	Clatsop	35,762	301	0.8%	79	65	2	2
34	Washington	Pacific	20,975	7,102	33.9%	78	73	12	12
34	Washington	Wahkiakum	3,869	7	0.2%	13	13	2	2
35	Washington	Grays Harbor	68,006	7,389	10.9%	174	158	7	7
35	Washington	Lewis	70,245	53	0.1%	140	125	1	1
35	Washington	Pacific	20,975	2,215	10.6%	78	73	4	4
36	Washington	Clallam	66,290	2,216	3.3%	140	131	6	5
36	Washington	Grays Harbor	68,006	9,277	13.6%	174	158	20	18
36	Washington	Jefferson	27,268	454	1.7%	64	62	3	3
37	Washington	Clallam	66,290	58,062	87.6%	140	131	99	91
37	Washington	Island	75,372	56,130	74.5%	110	110	55	55
37	Washington	Jefferson	27,268	21,667	79.5%	64	62	43	42
37	Washington	San Juan	15,465	8,427	54.5%	76	74	35	34
37	Washington	Skagit	108,144	36,895	34.1%	233	207	62	57
37	Washington	Whatcom	177,912	1,528	0.9%	331	293	4	4

UNIT	STATE	COUNTY	TOTAL COUNTY POPULATION	POPULATION WITHIN STUDY AREA	% COUNTY POPULATION WITHIN STUDY AREA	ALL REGULATED ENTITIES IN COUNTY	REGULATED SMALL ENTITIES IN COUNTY	ALL REGULATED ENTITIES IN STUDY AREA	REGULATED SMALL ENTITIES IN STUDY AREA
38	Alaska	Haines	2,428	2,424	99.8%	9	9	7	7
38	Alaska	Juneau	31,207	31,207	100.0%	0	0	0	0
38	Alaska	Ketchikan Gateway	13,793	12,023	87.2%	29	25	24	20
38	Alaska	Prince of Wales-Outer Ketchikan	6,052	4,979	82.3%	17	16	12	11
38	Alaska	Sitka	8,789	7,379	84.0%	0	0	0	0
38	Alaska	Skagway-Hoonah-Angoon	3,458	3,348	96.8%	15	14	11	10
38	Alaska	Wrangell-Petersburg	6,686	5,686	85.0%	48	44	20	16
38	Alaska	Yakutat	803	517	64.4%	0	0	0	0
39	Alaska	Aleutians East	2,658	2,606	98.0%	18	13	13	8
39	Alaska	Aleutians West	5,469	4,303	78.7%	12	6	9	4
39	Alaska	Anchorage	269,026	269,026	100.0%	271	257	234	225
39	Alaska	Bethel	16,683	14,801	88.7%	0	0	0	0
39	Alaska	Bristol Bay	1,326	1,322	99.7%	26	19	22	15
39	Alaska	Dillingham	5,110	4,427	86.6%	15	11	14	10
39	Alaska	Kenai Peninsula	51,231	51,085	99.7%	129	120	119	111
39	Alaska	Kodiak Island	14,131	13,315	94.2%	55	45	51	41
39	Alaska	Lake and Peninsula	1,783	1,335	74.9%	0	0	0	0
39	Alaska	Matanuska-Susitna	64,393	61,572	95.6%	112	108	94	91
39	Alaska	Nome	9,204	6,696	72.8%	10	10	4	4
39	Alaska	Northwest Arctic	7,478	49	0.7%	5	5	2	2
39	Alaska	Valdez-Cordova	10,226	6,858	67.1%	50	45	31	28
39	Alaska	Wade Hampton	7,227	5,989	82.9%	2	2	1	1
39	Alaska	Yakutat	803	268	33.4%	0	0	0	0
39	Alaska	Yukon-Koyukuk	6,445	91	1.4%	15	15	3	3
40	Oregon	Tillamook	24,641	2,396	9.7%	85	80	7	6
			Total	**21,399,993**				**16,676**	**14,851**

EXHIBIT C-3. ESTIMATED NUMBER OF REGULATED ENTITIES THAT ARE SMALL (BY UNIT, COUNTY AND ACTIVITY TYPE)

UNIT	STATE	COUNTY	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
1	California	Monterey	3	5				1	**9**
1	California	San Benito	1	1				1	**3**
2	California	Shasta	70	42			22		**134**
2	California	Tehama	12	11			9		**32**
3	California	Butte	36	39	147		11		**233**
3	California	Colusa	10	14	116		12		**152**
3	California	El Dorado	1	1	1		1		**4**
3	California	Glenn	7	9	82		5		**103**
3	California	Placer	53	52	16		10		**131**
3	California	Sacramento	112	154	43		26		**335**
3	California	Solano	1	1	1		1		**4**
3	California	Sutter	1	2	9		1		**13**
3	California	Tehama	11	10	42		8		**71**
3	California	Yolo	43	54	155		8		**260**
4	California	Sacramento		1	1				**2**
4	California	Solano		1	1				**2**
4	California	Sutter		1	1				**2**
4	California	Yolo		1	3				**4**
5	California	Sutter	1	1	1				**3**
6	California	Butte	13	15	54		4		**86**
6	California	Placer	6	6	2		1		**15**
6	California	Sutter	24	33	219		19		**295**
6	California	Yolo	1	1	1		1		**4**
6	California	Yuba	8	11	31		5		**55**
7	California	Yuba	4	5	13		2		**24**

UNIT	STATE	COUNTY	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
8	California	Alameda	1	1			1	1	**4**
8	California	Contra Costa	42	44			6	7	**99**
8	California	Sacramento	12	16			3	2	**33**
8	California	San Joaquin	31	64			11	8	**114**
8	California	Solano	1	1			1	1	**4**
8	California	Stanislaus	1	1			1	1	**4**
8	California	Yolo	7	9			2	1	**19**
9	California	Contra Costa	1	1				1	**3**
9	California	Solano	3	3				1	**7**
10	California	Alameda	1	1				1	**3**
10	California	Contra Costa	40	42				7	**89**
10	California	Marin	21	43				3	**67**
10	California	Napa	45	82				3	**130**
10	California	Solano	25	23				4	**52**
10	California	Sonoma	31	64				5	**100**
11	California	Alameda	163	482				36	**681**
11	California	Contra Costa	24	25				4	**53**
11	California	Marin	38	78				5	**121**
11	California	San Francisco	70	249				36	**355**
11	California	San Mateo	74	223				11	**308**
11	California	Santa Clara	154	348				202	**704**
11	California	Santa Cruz	1	1				1	**3**
11	California	Stanislaus	1	1				1	**3**
12	California	Marin	3	5	1		1		**10**
12	California	Sonoma	1	1	1		1		**4**
13	California	Mendocino	6	11					**17**
14	California	Humboldt	7	14					**21**

UNIT	STATE	COUNTY	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
15	California	Humboldt	25	50	6			6	**87**
16	California	Del Norte	1	1			1		**3**
16	California	Humboldt	1	2			1		**4**
16	California	Siskiyou	1	1			1		**3**
17	Oregon	Curry	1	2					**3**
18	Oregon	Coos	22	28					**50**
19	Oregon	Douglas	3	4					**7**
19	Oregon	Lane	1	1					**2**
20	Oregon	Douglas	1	1					**2**
20	Oregon	Lane	4	7					**11**
21	Oregon	Benton	1	1			1		**3**
21	Oregon	Lincoln	3	2			1		**6**
22	Oregon	Lincoln	5	4					**9**
23	Oregon	Tillamook	15	16					**31**
23	Oregon	Washington	1	1					**2**
23	Oregon	Yamhill	1	1					**2**
24a	Oregon	Clatsop	7	12			3		**22**
24a	Oregon	Columbia	1	1			1		**3**
24a	Washington	Lewis	1	1			1		**3**
24a	Washington	Pacific	1	4			1		**6**
24a	Washington	Wahkiakum	1	5			0		**6**
24b	Oregon	Clackamas	1	1			1		**3**
24b	Oregon	Columbia	99	219			14		**332**
24b	Oregon	Hood River	1	2			1		**4**
24b	Oregon	Multnomah	13	19			9		**41**
24b	Oregon	Washington	82	116			6		**204**
24b	Washington	Clark	16	15			1		**32**

UNIT	STATE	COUNTY	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
24b	Washington	Cowlitz	1	1			1		**3**
24b	Washington	Lewis	1	2			0		**3**
24b	Washington	Skamania	1	1			1		**3**
24b	Washington	Wahkiakum	1	1			0		**2**
25	Washington	Grays Harbor	1	2					**3**
25	Washington	Lewis	1	1					**2**
25	Washington	Pacific	5	24					**29**
25	Washington	Wahkiakum	1	1					**2**
26	Washington	Grays Harbor	21	44					**65**
26	Washington	Jefferson	1	1					**2**
26	Washington	Mason	1	1					**2**
26	Washington	Pacific	1	1					**2**
27	Washington	Clallam	1	1					**2**
27	Washington	Grays Harbor	1	1					**2**
27	Washington	Island	25	37					**62**
27	Washington	Jefferson	13	18					**31**
27	Washington	King	327	724					**1051**
27	Washington	Kitsap	70	85					**155**
27	Washington	Mason	23	37					**60**
27	Washington	Pierce	178	220					**398**
27	Washington	Skagit	47	62					**109**
27	Washington	Snohomish	138	241					**379**
27	Washington	Thurston	48	69					**117**
27	Washington	Whatcom	1	2					**3**
28	California	Los Angeles	407	1706		7		82	**2202**
28	California	Monterey	5	9		1		1	**16**
28	California	Orange	322	791		5		92	**1210**

UNIT	STATE	COUNTY	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
28	California	Riverside	1	1		0		1	**3**
28	California	San Diego	168	285		6		31	**490**
28	California	San Luis Obispo	70	70		4		4	**148**
28	California	Santa Barbara	65	123		3		6	**197**
28	California	Ventura	76	106		2		9	**193**
29	California	Monterey	42	82		7		6	**137**
29	California	San Benito	1	1		0		1	**3**
29	California	San Francisco	38	135		0		20	**193**
29	California	San Mateo	14	41		2		2	**59**
29	California	Santa Clara	1	1		0		1	**3**
29	California	Santa Cruz	63	140		1		7	**211**
30	California	Humboldt	7	14		1		2	**24**
30	California	Marin	2	4		1		1	**8**
30	California	Mendocino	13	24		2		2	**41**
30	California	Sonoma	12	24		1		2	**39**
31	California	Del Norte	7	13		4		1	**25**
31	California	Humboldt	33	66		4		8	**111**
31	California	Siskiyou	1	1		1		1	**4**
31	Oregon	Coos	8	10		2		1	**21**
31	Oregon	Curry	8	18		6		3	**35**
31	Oregon	Josephine	1	1		0		1	**3**
32	Oregon	Coos	24			4			**28**
32	Oregon	Douglas	1			1			**2**
33	Oregon	Benton	1	1		0			**2**
33	Oregon	Clatsop	5	9		5			**19**
33	Oregon	Douglas	3	3		1			**7**
33	Oregon	Lane	4	8		1			**13**

UNIT	STATE	COUNTY	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
33	Oregon	Lincoln	25	20		23			**68**
33	Oregon	Polk	1	1		0			**2**
33	Oregon	Tillamook	13	13		3			**29**
33	Oregon	Yamhill	1	1		1			**3**
34	Oregon	Clatsop	1			1			**2**
34	Washington	Pacific	2			10			**12**
34	Washington	Wahkiakum	1			1			**2**
35	Washington	Grays Harbor	4			3			**7**
35	Washington	Lewis	1			0			**1**
35	Washington	Pacific	1			3			**4**
36	Washington	Clallam	2	2		1			**5**
36	Washington	Grays Harbor	5	9		4			**18**
36	Washington	Jefferson	1	1		1			**3**
37	Washington	Clallam	38	47		6			**91**
37	Washington	Island	21	31		3			**55**
37	Washington	Jefferson	14	20		8			**42**
37	Washington	San Juan	11	20		3			**34**
37	Washington	Skagit	21	27		9			**57**
37	Washington	Whatcom	1	2		1			**4**
38	Alaska	Haines	2	5					**7**
38	Alaska	Juneau	0	0					**0**
38	Alaska	Ketchikan Gateway	10	10					**20**
38	Alaska	Prince of Wales-Outer Ketchikan	5	6					**11**
38	Alaska	Sitka	0	0					**0**
38	Alaska	Skagway-Hoonah-Angoon	3	7					**10**

UNIT	STATE	COUNTY	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
38	Alaska	Wrangell-Petersburg	8	8					**16**
38	Alaska	Yakutat	0	0					**0**
39	Alaska	Aleutians East	1	0		7			**8**
39	Alaska	Aleutians West	0	2		2			**4**
39	Alaska	Anchorage	115	87		23			**225**
39	Alaska	Bethel	0	0		0			**0**
39	Alaska	Bristol Bay	9	5		1			**15**
39	Alaska	Dillingham	4	1		5			**10**
39	Alaska	Kenai Peninsula	38	35		38			**111**
39	Alaska	Kodiak Island	6	8		27			**41**
39	Alaska	Lake and Peninsula	0	0		0			**0**
39	Alaska	Matanuska-Susitna	58	28		5			**91**
39	Alaska	Nome	3	1		0			**4**
39	Alaska	Northwest Arctic	1	1		0			**2**
39	Alaska	Valdez-Cordova	8	9		11			**28**
39	Alaska	Wade Hampton	0	1		0			**1**
39	Alaska	Yakutat	0	0		0			**0**
39	Alaska	Yukon-Koyukuk	1	1		1			**3**
40	Oregon	Tillamook	3	3					**6**
		Total	**4,281**	**8,497**	**947**	**273**	**218**	**635**	**14,851**

EXHIBIT C-4. ESTIMATED NUMBER OF REGULATED ENTITIES THAT ARE SMALL (BY UNIT AND ACTIVITY TYPE)

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES[a]	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
1	Elkhorn Slough, CA	4	6	0	0	0	2	**12**
2	Upper Sacramento River, CA	82	53	0	0	31	0	**166**
3	Lower Sacramento River, CA	275	336	612	0	83	0	**1,306**
4	Yolo Bypass, CA	0	4	6	0	0	0	**10**
5	Sutter Bypass, CA	1	1	1	0	0	0	**3**
6	Lower Feather River, CA	52	66	307	0	30	0	**455**
7	Lower Yuba River, CA	4	5	13	0	2	0	**24**
8	Sacramento-San Joaquin Delta, CA	95	136	0	0	25	21	**277**
9	Suisun Bay, CA	4	4	0	0	0	2	**10**
10	San Pablo Bay, CA	163	255	0	0	0	23	**441**
11	San Francisco Bay, CA	525	1,407	0	0	0	296	**2,228**
12	Tomales Bay, CA	4	6	2	0	2	0	**14**
13	Noyo Harbor, CA	6	11	0	0	0	0	**17**
14	Eel River, CA	7	14	0	0	0	0	**21**
15	Humboldt Bay, CA	25	50	6	0	0	6	**87**
16	Klamath River, CA	3	4	0	0	3	0	**10**
17	Rogue River, OR	1	2	0	0	0	0	**3**
18	Coos Bay, OR	22	28	0	0	0	0	**50**
19	Winchester Bay, OR	4	5	0	0	0	0	**9**
20	Siuslaw River, OR	5	8	0	0	0	0	**13**
21	Alsea River, OR	4	3	0	0	2	0	**9**
22	Yaquina River, OR	5	4	0	0	0	0	**9**
23	Tillamook Bay, OR	17	18	0	0	0	0	**35**
24a	Lower Columbia River Estuary, OR/WA	11	23	0	0	6	0	**40**
24b	Lower Columbia River, OR/WA	216	377	0	0	34	0	**627**
25	Willapa Bay, WA	8	28	0	0	0	0	**36**
26	Grays Harbor, WA	24	47	0	0	0	0	**71**
27	Puget Sound, WA	872	1,497	0	0	0	0	**2,369**

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES[a]	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
28	CA-Mexico Border to Monterey Bay, CA	1,114	3,091	0	28	0	226	**4,459**
29	Monterey Bay, CA to San Francisco Bay, CA	159	400	0	10	0	37	**606**
30	San Francisco Bay, CA to Humboldt Bay, CA	34	66	0	5	0	7	**112**
31	Humboldt Bay, CA to Coos Bay, OR	58	109	0	17	0	15	**199**
32	Coos Bay, OR to Winchester Bay, OR	25	0	0	5	0	0	**30**
33	Winchester Bay, OR to Columbia River and Estuary, OR	53	56	0	34	0	0	**143**
34	Columbia River and Estuary to Willapa Bay, WA	4	0	0	12	0	0	**16**
35	Willapa Bay, WA to Grays Harbor, WA	6	0	0	6	0	0	**12**
36	Grays Harbor, WA to Cape Flattery, WA	8	12	0	6	0	0	**26**
37	Strait of Juan de Fuca to Rosario Strait, WA	106	147	0	30	0	0	**283**
38	AK/Canada border to Yakutat Bay, AK	28	36	0	0	0	0	**64**
39	Coastal AK waters northwest of Yakutat Bay, AK	244	179	0	120	0	0	**543**
40	Nehalem Bay, OR	3	3	0	0	0	0	**6**
	Total	**4,281**	**8,497**	**947**	**273**	**218**	**635**	**14,851**

[a] While nearly all industries potentially affected by the proposed rule are land-based, the commercial fishing industry is not. Because its operations occur, in most cases, offshore, tracking the locations of small entities using Dun and Bradstreet databases is problematic. Exhibit C-7 presents some supplemental data on fishing entities.

EXHIBIT C-5. PROPORTION OF BUSINESSES THAT ARE CLASSIFIED AS SMALL (BY UNIT AND ACTIVITY TYPE)

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
1	Elkhorn Slough, CA	100%	100%				100%	**100.0%**
2	Upper Sacramento River, CA	96%	75%			100%		**88.8%**
3	Lower Sacramento River, CA	96%	81%	88%		94%		**88.0%**
4	Yolo Bypass, CA		80%	86%				**83.3%**
5	Sutter Bypass, CA	100%	100%	100%				**100.0%**
6	Lower Feather River, CA	96%	78%	88%		94%		**87.5%**
7	Lower Yuba River, CA	100%	83%	87%		100%		**88.9%**
8	Sacramento-San Joaquin Delta, CA	94%	77%			96%	95%	**85.0%**
9	Suisun Bay, CA	100%	80%				100%	**90.9%**
10	San Pablo Bay, CA	97%	89%				92%	**91.7%**
11	San Francisco Bay, CA	95%	84%				97%	**87.8%**
12	Tomales Bay, CA	100%	100%	100%		100%		**100.0%**
13	Noyo Harbor, CA	86%	92%					**89.5%**
14	Eel River, CA	100%	88%					**91.3%**
15	Humboldt Bay, CA	100%	89%	86%			100%	**92.6%**
16	Klamath River, CA	100%	100%			100%		**100.0%**
17	Rogue River, OR	100%	67%					**75.0%**
18	Coos Bay, OR	100%	80%					**87.7%**
19	Winchester Bay, OR	100%	83%					**90.0%**
20	Siuslaw River, OR	100%	80%					**86.7%**
21	Alsea River, OR	100%	75%			100%		**90.0%**
22	Yaquina River, OR	100%	80%					**90.0%**
23	Tillamook Bay, OR	100%	90%					**94.6%**
24a	Lower Columbia River Estuary, OR/WA	92%	82%			100%		**87.0%**
24b	Lower Columbia River, OR/WA	94%	81%			97%		**86.1%**
25	Willapa Bay, WA	100%	88%					**90.0%**
26	Grays Harbor, WA	96%	84%					**87.7%**
27	Puget Sound, WA	94%	88%					**89.9%**

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION	BOTTOM TRAWL FISHERIES	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL
28	CA-Mexico Border to Monterey Bay, CA	94%	88%		97%		89%	**89.4%**
29	Monterey Bay, CA to San Francisco Bay, CA	93%	85%		100%		97%	**87.6%**
30	San Francisco Bay, CA to Humboldt Bay, CA	97%	92%		100%		100%	**94.1%**
31	Humboldt Bay, CA to Coos Bay, OR	97%	87%		100%		88%	**90.9%**
32	Coos Bay, OR to Winchester Bay, OR	100%			100%			**100.0%**
33	Winchester Bay, OR to Columbia River and Estuary, OR	95%	79%		100%			**88.8%**
34	Columbia River and Estuary to Willapa Bay, WA	100%			100%			**100.0%**
35	Willapa Bay, WA to Grays Harbor, WA	100%			100%			**100.0%**
36	Grays Harbor, WA to Cape Flattery, WA	100%	80%		100%			**89.7%**
37	Strait of Juan de Fuca to Rosario Strait, WA	99%	91%		100%			**95.0%**
38	AK/Canada border to Yakutat Bay, AK	97%	80%					**86.5%**
39	Coastal AK waters northwest of Yakutat Bay, AK	97%	80%		99%			**91.0%**
40	Nehalem Bay, OR	100%	75%					**85.7%**
	Total	**95%**	**86%**	**88%**	**99%**	**96%**	**94%**	**89.1%**

EXHIBIT C-6. TOTAL ESTIMATED ANNUALIZED IMPACTS BORNE BY SMALL ENTITIES BY UNIT AND ACTIVITY TYPE

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL (LOW)	TOTAL (HIGH)
1	Elkhorn Slough, CA	$216,000	$0				$3,260	$219,000	$219,000
2	Upper Sacramento River, CA	$11,500	$7,190			$3,870,000		$3,890,000	$3,890,000
3	Lower Sacramento River, CA	$117,000	$15,600	$2,350,000		$1,750,000		$4,230,000	$4,230,000
4	Yolo Bypass, CA		$0	$385,000				$385,000	$385,000
5	Sutter Bypass, CA	$0	$0	$0				$0	$0
6	Lower Feather River, CA	$2,860	$6,900	$1,290,000		$520,000		$1,820,000	$1,820,000
7	Lower Yuba River, CA	$298	$124	$198,000		$376,000		$574,000	$574,000
8	Sacramento-San Joaquin Delta, CA	$177,000	$12,400			$2,380,000	$59,100	$2,620,000	$2,620,000
9	Suisun Bay, CA	$152,000	$0				$0	$152,000	$152,000
10	San Pablo Bay, CA	$265,000	$19,300				$21,000	$306,000	$306,000
11	San Francisco Bay, CA	$765,000	$27,400				$91,400	$884,000	$884,000
12	Tomales Bay, CA	$0	$298	$0		$123,000		$123,000	$123,000
13	Noyo Harbor, CA	$18,500	$1,490					$20,000	$20,000
14	Eel River, CA	$11,900	$3,630					$15,500	$15,500
15	Humboldt Bay, CA	$2,980	$3,710	$3,180			$3,260	$13,100	$13,100
16	Klamath River, CA	$8,930	$0			$0		$8,930	$8,930
17	Rogue River, OR	$1,490	$398					$1,890	$1,890
18	Coos Bay, OR	$65,200	$6,420					$71,600	$71,600
19	Winchester Bay, OR	$11,200	$870					$12,000	$12,000
20	Siuslaw River, OR	$7,440	$955					$8,390	$8,390
21	Alsea River, OR	$3,720	$224			$5,250		$9,190	$9,190
22	Yaquina River, OR	$0	$2,620					$2,620	$2,620

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL (LOW)	TOTAL (HIGH)
23	Tillamook Bay, OR	$11,200	$4,270					$15,400	$15,400
24a	Lower Columbia River Estuary, OR/WA	$230,000	$6,350			$451,000		$687,000	$687,000
24b	Lower Columbia River, OR/WA	$895,000	$59,100			$1,250,000		$2,200,000	$2,200,000
25	Willapa Bay, WA	$29,800	$8,620					$38,400	$38,400
26	Grays Harbor, WA	$3,570	$23,000					$26,500	$26,500
27	Puget Sound, WA	$2,420,000	$161,000					$2,580,000	$2,580,000
28	CA-Mexico Border to Monterey Bay, CA	$1,050,000	$89,400		$17,600 to $88,000		$14,500	$1,170,000	$1,240,000
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$22,000		$157,000 to $785,000		$15,900	$195,000	$823,000
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$274		$179,000 to $894,000			$179,000	$894,000
31	Humboldt Bay, CA to Coos Bay, OR	$313,000	$9,040		$166,000 to $831,000			$489,000	$1,150,000
32	Coos Bay, OR to Winchester Bay, OR	$0			$82,900 to $414,000	$0		$82,900	$414,000
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0	$8,180		$108,000 to $539,000	$0		$116,000	$547,000
34	Columbia River and Estuary to Willapa Bay, WA	$0			$542,000 to $2,710,000			$542,000	$2,710,000
35	Willapa Bay, WA to Grays Harbor, WA	$0			$0			$0	$0
36	Grays Harbor, WA to Cape Flattery, WA	$0	$239		$398,000 to $1,990,000			$398,000	$1,990,000

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL (LOW)	TOTAL (HIGH)
37	Strait of Juan de Fuca to Rosario Strait, WA	$214,000	$7,040		$0			$221,000	$221,000
38	AK/Canada border to Yakutat Bay, AK	$0	$0					$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	$0	$237		$35,800,000 to $179,000,000			$35,800,000	$179,000,000
40	Nehalem Bay, OR	$0	$224					$224	$224
	Total	**$7,010,000**	**$509,000**	**$4,230,000**	**$37,400,000 to $187,000,000**	**$10,700,000**	**$208,000**	**$60,100,000**	**$210,000,000**

[a] Average net cash farm income of operations for affected crop types for affected counties in critical habitat areas is approximately $147,000 (2007$). National Agricultural Statistics Service, 2002 Census of Agriculture.

[b] Per entity estimates rely on the Dun and Bradstreet data for fishing entities in affected counties. While nearly all industries potentially affected by the proposed rule are land-based, the commercial fishing industry is not. Because its operations occur, in most cases, offshore, tracking the locations of small entities using Dun and Bradstreet databases is problematic. Exhibit C-8 presents some supplemental data on fishing entities. Public comments from ODFW include estimates of variable expenses for productive large trawlers in the study area. The Fisheries Economic Assessment Model (FEAM) estimates that average annual gross income for productive larger trawlers is $268,683. Public comments of Bruce McIntosh, the Oregon Department of Fish and Wildlife on December 29, 2008.

EXHIBIT C-7. ESTIMATED ANNUALIZED IMPACTS PER SMALL ENTITY BY UNIT AND ACTIVITY TYPE

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS
1	Elkhorn Slough, CA	$54,031	$0				$1,572
2	Upper Sacramento River, CA	$140	$131			$124,852	
3	Lower Sacramento River, CA	$426	$45	$3,844		$21,029	
4	Yolo Bypass, CA		$0	$64,134			
5	Sutter Bypass, CA	$0	$0	$0			
6	Lower Feather River, CA	$55	$101	$4,206		$17,325	
7	Lower Yuba River, CA	$74	$24	$15,213		$187,993	
8	Sacramento-San Joaquin Delta, CA	$1,865	$88			$95,028	$2,716
9	Suisun Bay, CA	$37,962	$0				
10	San Pablo Bay, CA	$1,629	$73				
11	San Francisco Bay, CA	$1,457	$19				
12	Tomales Bay, CA	$0	$48	$0		$61,425	
13	Noyo Harbor, CA	$3,088	$131				
14	Eel River, CA	$1,700	$251			$0	
15	Humboldt Bay, CA	$119	$72	$529		$880	$1,265
16	Klamath River, CA	$2,975	$0			$0 $298	
17	Rogue River, OR	$1,488	$192				
18	Coos Bay, OR	$2,963	$221				
19	Winchester Bay, OR	$2,789	$168				
20	Siuslaw River, OR	$1,488	$115				
21	Alsea River, OR	$930	$72			$2,625	
22	Yaquina River, OR	$0	$631				
23	Tillamook Bay, OR	$656	$229				
24a	Lower Columbia River Estuary, OR/WA	$20,891	$267			$75,110	
24b	Lower Columbia River, OR/WA	$4,141	$151			$36,789	
25	Willapa Bay, WA	$3,719	$297				
26	Grays Harbor, WA	$149	$471				
27	Puget Sound, WA	$2,779	$104				
28	CA-Mexico Border to Monterey Bay, CA	$940	$28		$630 - $3,100		$62

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$53		$16,000 - $79,000		
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$4		$36,000 - $180,000		
31	Humboldt Bay, CA to Coos Bay, OR	$5,403	$80		$9,800 - $49,000		
32	Coos Bay, OR to Winchester Bay, OR	$0			$17,000 - $83,000	$414	
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0	$141		$3,200 - $16,000		
34	Columbia River and Estuary to Willapa Bay, WA	$0			$45,000 – $230,000	$0 $0	
35	Willapa Bay, WA to Grays Harbor, WA	$0			$0		
36	Grays Harbor, WA to Cape Flattery, WA	$0	$19		$66,000 - $330,000		
37	Strait of Juan de Fuca to Rosario Strait, WA	$2,020	$46		$0		
38	AK/Canada border to Yakutat Bay, AK	$0	$0				
39	Coastal AK waters northwest of Yakutat Bay, AK	$0	$1		$300,000 - $1,500,000		
40	Nehalem Bay, OR	$0	$72				

[a] Average net cash farm income of operations for affected crop types for affected counties in critical habitat areas is approximately $147,000 (2007$). National Agricultural Statistics Service, 2002 Census of Agriculture.

[b] Per entity estimates rely on the Dun and Bradstreet data for fishing entities in affected counties. While nearly all industries potentially affected by the proposed rule are land-based, the commercial fishing industry is not. Because its operations occur, in most cases, offshore, tracking the locations of small entities using Dun and Bradstreet databases is problematic. Exhibit C-8 presents some supplemental data on fishing entities. Public comments from ODFW include estimates of variable expenses for productive large trawlers in the study area. The Fisheries Economic Assessment Model (FEAM) estimates that average annual gross income for productive larger trawlers is $268,683. Public comments of Bruce McIntosh, the Oregon Department of Fish and Wildlife on December 29, 2008.

Caveats

The following bullets describe potential caveats to this analysis:

- While nearly all industries potentially affected by the critical habitat rule are land-based, the commercial fishing industry is not. Because its operations occur, in most cases, offshore, tracking the locations of small entities using Dun and Bradstreet databases is problematic. As such, this analysis includes the following supplemental data regarding the number of potentially affected entities within the fishing industry. This data was unavailable at the county level. Exhibit C-8 presents data on the number of potentially affected fishing vessels by fishery and state, where possible.

EXHIBIT C-8. NUMBER OF POTENTIALLY AFFECTED ENTITIES BY COMMERCIAL FISHERY, BY STATE[1]

FISHERY	REGULATORY AUTHORITY	CALIFORNIA	OREGON	WASHINGTON	TOTAL
Groundfish[1]	Federal	471	268	135	874
White Sturgeon[1,2]	State	--	N/A	N/A	N/A
Salmon & Steelhead[1,2]	State	682	736	409	1,827
	TOTAL:	**1,153**	**1,004**	**544**	**2,701**

Notes:
1. Review of the West Coast Commercial Fishing Industry in 2004, Pacific States Marine Fisheries Commission. Prepared by the Research Group for the Pacific States Marine Fisheries Commission, September 2006. Vessel counts include home port vessels as well as out-of-state vessels making landings in each state. The study notes that tracking individual vessels for mobility between fisheries was difficult, and thus vessel counts are not exact.
2. Commercial sturgeon, salmon and steelhead fisheries in the Columbia River basin are managed collectively as the Columbia River Gillnet fishery and are managed under the terms of the Columbia River Fish Management Plan (CRFMP). The number of potentially affected entities includes approximately 315 licenses issued in the Columbia River Gillnet fishery for 2004.

- The SBA definition of a small business applies to a firm's parent company and all affiliates as a single entity.[109] However, because complete ownership and affiliation information was unavailable for the firms in each hydrologic unit, some firms may have been incorrectly identified as small businesses. Consequently, it is possible that this analysis overestimates the number of small entities that will be regulated under the action.

DESCRIPTION OF REPORTING, RECORDKEEPING, AND OTHER COMPLIANCE REQUIREMENTS

Compliance requirements are estimated above. The rule does not directly mandate "reporting" or "record keeping" within the meaning of the Paperwork Reduction Act. No person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

[109] The SBA's "general principles of affiliation" are set forth in regulations at 13 CFR 121.103.

DESCRIPTION OF THE STEPS TAKEN TO MINIMIZE THE SIGNIFICANT ECONOMIC IMPACT ON SMALL ENTITIES

In accordance with the requirements of the RFA (as amended by SBREFA, 1996) this analysis considered various alternatives to the proposed critical habitat designation for the green sturgeon. The alternative of not designating critical habitat for the green sturgeon was considered and rejected because such an approach does not meet the legal requirements of the ESA. The alternative of designating all potential critical habitat areas (i.e., no areas excluded) also was considered and rejected because, for several areas, the economic benefits of exclusion outweighed the benefits of inclusion, and NMFS did not determine that exclusion of these areas would significantly impede conservation of the species or result in extinction of the species.

An alternative to designating critical habitat within all 41 units is the designation of critical habitat within a subset of these units. This approach would help to reduce the number of small entities potentially affected. Under section 4(b)(2) of the ESA, NMFS must consider the economic impacts, impacts to national security, and other relevant impacts of designating any particular area as critical habitat. NMFS has the discretion to exclude an area from designation as critical habitat if the benefits of exclusion (i.e., the impacts that would be avoided if an area were excluded from the designation) outweigh the benefits of designation (i.e., the conservation benefits to the Southern DPS if an area were designated), so long as exclusion of the area will not result in extinction of the species. Exclusion under section 4(b)(2) of the ESA of one or more of the 41 units considered for designation would reduce the potential effects on small entities. The extent to which the economic impact to small entities would be reduced depends on how many, and which, units would be excluded. The determination of which units and how many to exclude depends on NMFS' ESA 4(b)(2) analysis, which is conducted for each unit and described in detail in the ESA 4(b)(2) analysis report.[110] It is estimated that the exclusions as recommended in the ESA 4(b)(2) analysis report will result in reductions in annualized impacts per small entity. NMFS selected this alternative because it results in a critical habitat designation that provides for the conservation of the Southern DPS, reduces impacts on small entities, and meets the requirements under the ESA and our joint NMFS-USFWS regulations concerning critical habitat.

[110] NMFS. 2009. Designation of critical habitat for the Southern Distinct Population Segment of green sturgeon: ESA section 4(b)(2) report. Prepared by the National Marine Fisheries Service, Southwest Region, Long Beach, CA. 25 pp.

APPENDIX D | ENERGY IMPACTS ANALYSIS

INTRODUCTION

Pursuant to Executive Order No. 13211, "Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use," issued May 18, 2001, Federal agencies must prepare and submit a "Statement of Energy Effect" for all "significant energy actions." The purpose of this requirement is to ensure that all Federal agencies "appropriately weight and consider the effects of the Federal Government's regulations on the supply, distribution, and use of energy."[111]

The Office of Management and Budget provides guidance for implementing this Executive Order, outlining nine outcomes that may constitute "a significant adverse effect" when compared with the regulatory action under consideration:

- Reductions in crude oil supply in excess of 10,000 barrels per day (bbls);
- Reductions in fuel production in excess of 4,000 barrels per day;
- Reductions in coal production in excess of 5 million tons per year;
- Reductions in natural gas production in excess of 25 million Mcf per year;
- Reductions in electricity production in excess of 1 billion kilowatts-hours per year or in excess of 500 megawatts of installed capacity;
- Increases in energy use required by the regulatory action that exceed the thresholds above;
- Increases in the cost of energy production in excess of one percent;
- Increases in the cost of energy distribution in excess of one percent; or
- Other similarly adverse outcomes.[112]

Of these, the most relevant criteria to this analysis are potential changes in natural gas and electricity production, as well as changes in the cost of energy production. Possible energy impacts may occur as the result of requested project modifications to hydropower dams, tidal and wave energy projects, and LNG facilities. The following sections describe the potential for these impacts in greater detail.

[111] Memorandum For Heads of Executive Department Agencies, and Independent Regulatory Agencies, Guidance for Implementing E.O. 13211, M-01-27, Office of Management and Budget, July 13, 2001, http://www.whitehouse.gov/omb/memoranda/m01-27.html.

[112] Ibid.

TIDAL/WAVE ENERGY PROJECTS

As discussed in Section 3.3.5, the number of future tidal and wave energy projects that will be constructed within critical habitat is unknown. Currently there are no actively-generating wave or tidal energy projects located within the study area. However, as described in Section 3.3, 36 projects have applied to the Federal Energy Regulatory Commission (FERC) for preliminary permits to investigate the feasibility of project development within the study area.[113]

Future management and required project modifications for green sturgeon critical habitat related to tidal and wave energy projects are uncertain and could vary widely in scope from project to project. Moreover, because the proposed projects are still in the preliminary stages, the potential impact of possible sturgeon conservation efforts on the project's energy production and the associated cost of that energy are unclear.

As shown in Exhibit D-1, proposed tidal and wave energy projects within the study area have a combined production capacity of 1.9 million kilowatts, or 1,926 megawatts. If the potential cost of green sturgeon conservation results in *all* projects not being constructed, then reductions in electricity production in excess of the 500 megawatts of installed capacity threshold are possible. However, this represents a worst case scenario.

It is more likely that any additional cost of green sturgeon conservation efforts would be passed on to the consumer in the form of slightly higher energy prices. That said, any increase in energy prices as a result of green sturgeon conservation would have to be balanced against changes in energy price caused by the development of these projects. That is, the construction of tidal and wave energy projects may result in a general reduction in energy prices in affected areas. Without information about the effect of the tidal and wave projects on future electricity prices and more specific information about recommended conservation measures for green sturgeon, this analysis is unable to forecast potential energy impacts resulting from changes to tidal and wave energy projects.

[113] Federal Energy Regulatory Commission. *Issued Hydrokinetic Permits.* Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.asp on March 19, 2008. Federal Energy Regulatory Commission. *Pending Hydrokinetic Permits.* Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-pending.asp on March 19, 2008.

EXHIBIT D-1. SUMMARY OF CAPACITY AT PROPOSED TIDAL/WAVE ENERGY PROJECTS

UNIT	UNIT NAME	PROJECT #	CLASSIFICATION	CAPACITY (KW)
Issued Preliminary Permits				
11	San Francisco Bay, CA	P-12585	Tidal -- Current	10,000
25	Willapa Bay, WA	P-12729	Tidal -- Current	2,000
27	Puget Sound, WA	P-12690	Tidal -- Current	221,000
		P-12687	Tidal -- Current	2,800
		P-12698	Tidal -- Current	3,500
		P-12688	Tidal -- Current	Unknown
		P-12692	Tidal -- Current	5,300
		P-12691	Tidal -- Current	Unknown
		P-12689	Tidal -- Current	8,300
		P-12612	Tidal -- Current	Unknown
30	San Francisco Bay to Humboldt Bay, CA	P-12753	Wave	Unknown
31	Humboldt Bay, CA to Coos Bay, OR	P-12752	Wave	Unknown
32	Coos Bay, OR to Winchester Bay, OR	P-12743	Wave	3,000
		P-12749	Wave	100,000
33	Winchester Bay, OR to Columbia River and Estuary, OR	P-12713	Wave	50,000
38	AK/Canada border to Yakutat Bay, AK	P-12731	Tidal -- Current	2,000
		P-12696	Tidal -- Current	Unknown
		P-12697	Tidal -- Current	Unknown
		P-12695	Tidal -- Current	Unknown
39	Coastal AK waters northwest of Yakutat Bay, AK	P-12744	Tidal -- Current	Unknown
		P-12705	Tidal -- Current	1,000,000
		P-12694	Tidal -- Current	Unknown
		P-12679	Tidal -- Current	32,000
		P-12678	Tidal -- Current	Unknown
Pending Preliminary Permits				
28	CA-Mexico Border to Monterey Bay, CA	P-13052	Wave	100,000
30	San Francisco Bay to Humboldt Bay, CA	P-13076	Wave	Unknown
		P-13075	Wave	20,000
		P-13053	Wave	100,000
		P-12781	Wave	40,000

UNIT	UNIT NAME	PROJECT #	CLASSIFICATION	CAPACITY (KW)
31	Humboldt Bay, CA to Coos Bay, OR	P-12780	Wave	Unknown
		P-12779	Wave	40,000
33	Winchester Bay, OR to Columbia River and Estuary, OR	P-13047	Wave	180,000
		P-12793	Wave	Unknown
		P-12750	Wave	Unknown
		P-12727	Wave	Unknown
36	Grays Harbor, WA to Cape Flattery, WA	P-13058	Wave	6,000
			Total Known Capacity	1,925,900

Source: FERC, Issued Preliminary Permits, June 30, 2009. Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.xls FERC, Pending Preliminary Permits, June 30, 2009. Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-pending.xls

LNG PROJECTS

Similar to tidal and wave energy projects, the number of future LNG projects that will be built within critical habitat is unknown. As described in Section 3.4, many LNG projects are likely to be abandoned during the development stages for reasons unrelated to green sturgeon critical habitat. In addition, the potential impact of LNG facilities on green sturgeon habitat remains uncertain, as is the nature of any project modifications that might be requested to mitigate adverse impacts. Because these LNG projects are still in the development stages, the potential impact of possible sturgeon conservation efforts on the project's energy production and the associated cost of that energy are unclear.

Proposed LNG terminals within the study area have a combined natural gas production capacity of 7,800 million cubic feet per day, with combined natural gas production in excess of the 25 million Mcf per year threshold (see Exhibit D-2). As discussed in Section 3, the most dramatic impact on LNG projects potentially foreseen could include facility re-siting projects to areas outside of the designation.

EXHIBIT D-2. SUMMARY OF ECONOMIC IMPACTS TO LNG PROJECTS

UNIT	DESCRIPTION	PROJECT NAME	CAPACITY (MMcf/d)
18	Coos Bay, OR	Jordan Cove Energy Project	1,000
24A	Lower Columbia River Estuary, OR	Port Westward LNG Facility	700
		Oregon LNG Facility	1,000
		Northern Star LNG Facility	1,000
28	CA-Mexico Border to Monterey Bay, CA	Clearwater Port LNG Project	1,200
		Long Beach LNG Facility	700
		Woodside Energy LNG Facility	800
		Esperanza Energy	1,200
39	Coastal AK waters northwest of Yakutat Bay, AK	Kenai Peninsula LNG Facility	213
		Lefthand Bay, AK Facility	Unknown
		Valdez, AK Facility	Unknown
		North Aleutian Basin Facility	Unknown
		Total Known Capacity	7,800

Source: California Energy Commission, *Location and Capacity of Proposed LNG Terminals,* March 2008. Accessed at: http://www.energy.ca.gov/lng/projects.html.

If LNG projects are re-sited to less desirable alternative sites outside of the study area because of green sturgeon critical habitat, this may result in higher natural gas costs as developers attempt to recoup increased construction costs. However, the construction of LNG facilities and associated increased energy supplies to consumers aim to generally result in lower energy prices than would have otherwise been expected. Therefore, this analysis is unable to forecast potential energy impacts resulting from changes to LNG projects without specific information about recommended sturgeon conservation measures or future forecasts of energy prices that reflect future markets with increased energy supplies from LNG projects.

HYDROPOWER PROJECTS

Approximately six percent (11 dams) of the 189 dams that fall within critical habitat areas have hydropower capacity. As discussed in Section 2.5, the primary project modifications for dam projects (provision of fish passage) are not expected to affect energy markets. It is unclear whether or not flow regime changes could be considered necessary for green sturgeon at any particular hydropower project, and if so, what flow level and by what method of change that might be required. While the critical habitat rule characterizes water flow as a primary constituent element for the sturgeon, NMFS has not specified minimum flow requirements for green sturgeon. Therefore, no impacts associated with flow regime changes are forecast. However, given the uncertainty about potential future project modifications, the remainder of this section provides a qualitative discussion of the data necessary to estimate energy impacts resulting from changes in flow regime.

Impacts associated with changes to flow regimes may vary by orders of magnitude depending upon the particular hydropower project and specific flow regime recommendation. If direct spill of water through a hydropower project is requested, spilled water no longer passes through the turbines and therefore cannot be used to generate electricity. This may result in losses in profits to producers and/or welfare impacts to power consumers resulting from replacing lost electricity production with more expensive energy sources. Alternatively, seasonal changes to flow through turbines may be requested. While this water may still pass through the turbines, demand for power varies seasonally, thus the value of power changes throughout the year. To the extent that flow change recommendations require to be passed at times of the year when it is less valuable, there may be an associated economic cost.

Power generation is a function of multiple parameters related to the specific infrastructure characteristics of the dam and the hydrology of the river system. In the case that these data were available for all projects within the region, an impacts modeling exercise would be possible, though massive and complex. Critical to a system-wide analysis of impacts to power production is the existence of a dynamic regional hydrological model. In the event that NMFS recommended minimum flow standards for sturgeon, flow changes implemented at upstream dams will affect the level of flow change necessary for sturgeon conservation at downstream projects. Importantly, this means that even impoundments located outside of critical habitat may affect flow within the designation and therefore may require modification to operations. Because the same water flows through each of these projects, attributing the impacts of changes in operation to any one critical habitat unit is difficult.

For example, hydropower systems like the Federal Columbia River Power System (FCRPS) are operated as an optimized system subject to constraints, where the optimization involves multiple objectives. Changing the amount or timing of flow at one dam will produce changes at other dams in the system. Therefore, the impacts of implementing system-wide operational changes are not tied to the site locations of the specific dams implementing the flow regimes changes.

Given a paucity of available data, the complexity of a comprehensive modeling exercise, and the high level of uncertainty about whether flow regime changes will be required, the analysis does not forecast potential changes in electricity production resulting from green sturgeon conservation efforts at hydropower projects.

APPENDIX E | SENSITIVITY ANALYSIS

Sections 2 through 4 of this economic analysis present estimated annualized impacts by unit and economic activity. These estimated impacts assume that a certain baseline level of protection is afforded green sturgeon by existing state and Federal regulations, as well as the presence of other listed anadromous fish species. However, a large degree of uncertainty exists regarding this level of baseline protection and future actions likely to be undertaken specifically for the benefit of green sturgeon and its habitat.

Because of this high level of uncertainty, this appendix presents impacts without applying the "probability score," in order to inform decisionmakers about the range of potential impacts. Exhibit E-1 presents total unscaled impacts by unit, as well as the difference between these impacts and those estimated in previous chapters. Exhibits E-2 and E-3 present the total impacts ranked by unit under the low- and high-end scenarios. The remaining exhibits present activity-specific estimated impacts.

EXHIBIT E-1. SUMMARY OF ANNUALIZED IMPACTS BY UNIT (DISCOUNTED AT 7 PERCENT)

		LOW		HIGH	
UNIT	DESCRIPTION	TOTAL	CHANGE	TOTAL	CHANGE
1	Elkhorn Slough, CA	$230,000	$13,000	$230,000	$13,030
2	Upper Sacramento River	$20,000,000	$15,600,000	$20,000,000	$15,700,000
3	Lower Sacramento River	$13,000,000	$8,060,000	$13,000,000	$8,350,000
4	Yolo Bypass	$970,000	$413,000	$970,000	$413,440
5	Sutter Bypass	$63,000	$50,400	$63,000	$50,400
6	Lower Feather River	$4,300,000	$2,310,000	$4,400,000	$2,350,000
7	Lower Yuba River	$2,100,000	$1,510,000	$2,100,000	$1,510,000
8	Sacramento-San Joaquin Delta	$14,000,000	$11,000,000	$14,000,000	$11,500,000
9	Suisun Bay	$760,000	$607,000	$1,200,000	$1,040,000
10	San Pablo Bay	$1,700,000	$1,380,000	$7,200,000	$3,060,000
11	San Francisco Bay	$4,900,000	$3,920,000	$6,300,000	$5,170,000
12	Tomales Bay	$620,000	$494,000	$2,100,000	$1,790,000
13	Noyo Harbor	$120,000	$101,000	$120,000	$101,108
14	Eel River	$100,000	$85,000	$100,000	$84,973
15	Humboldt Bay	$76,000	$62,300	$76,000	$62,300

UNIT	DESCRIPTION	LOW		HIGH	
		TOTAL	CHANGE	TOTAL	CHANGE
16	Klamath River	$45,000	$35,700	$45,000	$35,700
17	Rogue River	$10,000	$8,340	$10,000	$8,340
18	Coos Bay	$210,000	$137,000	$33,000,000	$16,400,000
19	Winchester Bay	$33,000	$20,600	$33,000	$20,600
20	Siuslaw River	$27,000	$18,200	$27,000	$18,200
21	Alsea River	$16,000	$6,400	$16,000	$6,400
22	Yaquina River	$33,000	$29,400	$33,000	$29,400
23	Tillamook Bay	$70,000	$53,900	$70,000	$53,900
24a	Lower Columbia River Estuary	$3,600,000	$2,870,000	$100,000,000	$80,900,000
24b	Lower Columbia River	$12,000,000	$9,610,000	$12,000,000	$9,610,000
25	Willapa Bay	$150,000	$39,400	$150,000	$39,400
26	Grays Harbor	$140,000	$109,000	$140,000	$109,000
27	Puget Sound	$15,000,000	$12,200,000	$15,000,000	$12,200,000
28	US/Mexico Border to Monterey Bay	$1,700,000	$408,000	$190,000,000	$408,000
29	Monterey Bay to San Francisco Bay	$300,000	$104,000	$8,500,000	$104,000
30	San Francisco Bay to Humboldt Bay	$520,000	$1,190	$1,200,000	$1,190
31	Humboldt Bay to Coos Bay	$750,000	$41,500	$1,400,000	$41,500
32	Coos Bay to Winchester Bay	$220,000	--	$550,000	--
33	Winchester Bay to Columbia R. Estuary	$500,000	$41,500	$930,000	$41,500
34	Columbia River Estuary to Willapa Bay	$540,000	--	$2,700,000	--
35	Willapa Bay to Grays Harbor	$0	--	$0	--
36	Grays Harbor to US/Canada Border	$470,000	$1,190	$2,100,000	$1,190
37	Strait of Juan de Fuca	$250,000	$30,800	$250,000	$30,800
38	Alaska/Canada Border to Yakutat Bay	$270,000	--	$270,000	--
39	Coastal Alaska Waters northwest of Yakutat Bay	$36,000,000	$1,190	$310,000,000	$1,190
40	Nehalem Bay	$3,000	$2,690	$3,000	$2,690

EXHIBIT E-2. RANKED IMPACTS (LOW SCENARIO)

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS	RANK WITH PROBABILITY SCORE
39	Coastal AK waters northwest of Yakutat Bay, AK	$36,000,000	1
2	Upper Sacramento River, CA	$20,00,000	3
27	Puget Sound, WA	$15,000,000	4
8	Sacramento-San Joaquin Delta, CA	$13,000,000	5
3	Lower Sacramento River, CA	$13,000,000	2
24b	Lower Columbia River, OR/WA	$12,000,000	6
11	San Francisco Bay, CA	$4,900,000	9
6	Lower Feather River, CA	$4,300,000	7
24a	Lower Columbia River estuary, OR/WA	$3,600,000	10
7	Lower Yuba River, CA	$2,100,000	12
10	San Pablo Bay, CA	$1,700,000	18
28	CA-Mexico Border to Monterey Bay, CA	$1,700,000	8
4	Yolo Bypass, CA	$970,000	13
9	Suisun Bay, CA	$760,000	24
31	Humboldt Bay, CA to Coos Bay, OR	$740,000	11
12	Tomales Bay, CA	$620,000	25
34	Columbia River and Estuary to Willapa Bay, WA	$540,000	14
30	San Francisco Bay, CA to Humboldt Bay, CA	$510,000	15
33	Winchester Bay, OR to Columbia River and Estuary, OR	$490,000	17
36	Grays Harbor, WA to Cape Flattery, WA	$470,000	16
29	Monterey Bay, CA to San Francisco Bay, CA	$300,000	23
38	AK/Canada border to Yakutat Bay, AK	$260,000	19
37	Strait of Juan de Fuca to Rosario Strait, WA	$250,000	21
1	Elkhorn Slough, CA	$230,000	20
18	Coos Bay, OR	$210,000	27
32	Coos Bay, OR to Winchester Bay, OR	$210,000	22
25	Willapa Bay, WA	$150,000	26
26	Grays Harbor, WA	$140,000	28
13	Noyo Harbor, CA	$120,000	29
14	Eel River, CA	$100,000	30
15	Humboldt Bay, CA	$76,000	32
23	Tillamook Bay, OR	$68,000	31
5	Sutter Bypass, CA	$63,000	33
16	Klamath River, CA	$45,000	36
19	Winchester Bay, OR	$32,000	34
22	Yaquina River, OR	$32,000	38

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS	RANK WITH PROBABILITY SCORE
20	Siuslaw River, OR	$26,000	37
21	Alsea River, OR	$16,000	35
17	Rogue River, OR	$10,000	39
40	Nehalem Bay, OR	$2,900	40
35	Willapa Bay, WA to Grays Harbor, WA	$0	41

EXHIBIT E-3. RANKED IMPACTS (HIGH SCENARIO)

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS	RANK WITH PROBABILITY SCORE
39	Coastal AK waters northwest of Yakutat Bay, AK	$310,000,000	1
28	CA-Mexico Border to Monterey Bay, CA	$190,000,000	2
24a	Lower Columbia River estuary, OR/WA	$100,000,000	3
18	Coos Bay, OR	$33,000,000	4
2	Upper Sacramento River, CA	$20,000,000	8
27	Puget Sound, WA	$15,000,000	9
8	Sacramento-San Joaquin Delta, CA	$14,000,000	10
3	Lower Sacramento River, CA	$13,000,000	6
24b	Lower Columbia River, OR/WA	$12,000,000	12
29	Monterey Bay, CA to San Francisco Bay, CA	$8,500,000	5
10	San Pablo Bay, CA	$7,200,000	7
11	San Francisco Bay, CA	$6,300,000	17
6	Lower Feather River, CA	$4,400,000	14
34	Columbia River and Estuary to Willapa Bay, WA	$2,700,000	11
7	Lower Yuba River, CA	$2,100,000	19
36	Grays Harbor, WA to Cape Flattery, WA	$2,100,000	13
12	Tomales Bay, CA	$2,100,000	23
31	Humboldt Bay, CA to Coos Bay, OR	$1,400,000	15
9	Suisun Bay, CA	$1,200,000	26
30	San Francisco Bay, CA to Humboldt Bay, CA	$1,200,000	16
4	Yolo Bypass, CA	$970,000	20
33	Winchester Bay, OR to Columbia River and Estuary, OR	$920,000	18
32	Coos Bay, OR to Winchester Bay, OR	$550,000	21
38	AK/Canada border to Yakutat Bay, AK	$260,000	22
37	Strait of Juan de Fuca to Rosario Strait, WA	$250,000	24
1	Elkhorn Slough, CA	$230,000	25

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS	RANK WITH PROBABILITY SCORE
25	Willapa Bay, WA	$150,000	27
26	Grays Harbor, WA	$140,000	28
13	Noyo Harbor, CA	$120,000	29
14	Eel River, CA	$100,000	30
15	Humboldt Bay, CA	$76,000	32
23	Tillamook Bay, OR	$70,000	31
5	Sutter Bypass, CA	$63,000	33
16	Klamath River, CA	$45,000	36
19	Winchester Bay, OR	$33,000	34
22	Yaquina River, OR	$33,000	38
20	Siuslaw River, OR	$27,000	37
21	Alsea River, OR	$16,000	35
17	Rogue River, OR	$10,000	39
40	Nehalem Bay, OR	$3,000	40
35	Willapa Bay, WA to Grays Harbor, WA	$0	41

EXHIBIT E-4. SUMMARY OF IMPACTS TO DREDGING ACTIVITIES BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)		
		LOW	MID	HIGH
1	Elkhorn Slough, CA	$88,000	$216,000	$344,000
3	Lower Sacramento River, CA	$176,000	$432,000	$689,000
8	Sacramento-San Joaquin Delta, CA	$220,000	$540,000	$861,000
9	Suisun Bay, CA	$273,000	$670,000	$1,070,000
10	San Pablo Bay, CA	$537,000	$1,320,000	$2,100,000
11	San Francisco Bay, CA	$1,520,000	$3,740,000	$5,960,000
13	Noyo Harbor, CA	$44,000	$108,000	$172,000
15	Humboldt Bay, CA	$0	$0	$0
18	Coos Bay, OR	$44,000	$108,000	$172,000
22	Yaquina River, OR	$0	$0	$0
23	Tillamook Bay, OR	$0	$0	$0
24a	Lower Columbia River Estuary, OR	$44,000	$108,000	$172,000
24b	Lower Columbia River, OR	$528,000	$1,300,000	$2,070,000
25	Willapa Bay, WA	$0	$0	$0
26	Grays Harbor, WA	$0	$0	$0
27	Puget Sound, WA	$1,190,000	$2,920,000	$4,650,000
28	CA-Mexico Border to Monterey Bay, CA	$308,000	$756,000	$1,200,000
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$0	$0
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	$132,000	$324,000	$516,000
32	Coos Bay, OR to Winchester Bay, OR	$0	$0	$0
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0	$0	$0
34	Columbia River and Estuary to Willapa Bay, WA	$0	$0	$0
35	Willapa Bay, WA to Grays Harbor, WA	$0	$0	$0
36	Grays Harbor, WA to Cape Flattery, WA	$0	$0	$0
37	Strait of Juan de Fuca to Rosario Strait, WA	$88,000	$216,000	$344,250
38	AK/Canada border to Yakutat Bay, AK	$0	$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	$0	$0	$0
40	Nehalem Bay, OR	$0	$0	$0

EXHIBIT E-5. SUMMARY OF IMPACTS TO IN-WATER CONSTRUCTION ACTIVITIES BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)		
		LOW	MID	HIGH
1	Elkhorn Slough, CA	$0	$0	$0
2	Upper Sacramento River, CA	$13,000	$59,500	$106,000
3	Lower Sacramento River, CA	$39,000	$179,000	$318,000
5	Sutter Bypass, CA	$0	$0	$0
6	Lower Feather River, CA	$3,250	$14,900	$26,500
7	Lower Yuba River, CA	$325	$1,490	$2,650
8	Sacramento-San Joaquin Delta, CA	$87,800	$401,600	$716,000
9	Suisun Bay, CA	$19,500	$89,300	$159,000
10	San Pablo Bay, CA	$10,800	$49,600	$88,300
11	San Francisco Bay, CA	$61,800	$283,000	$504,000
12	Tomales Bay, CA	$0	$0	$0
13	Noyo Harbor, CA	$0	$0	$0
14	Eel River, CA	$13,000	$59,500	$106,000
15	Humboldt Bay, CA	$3,250	$14,900	$26,500
16	Klamath River, CA	$9,750	$44,600	$79,500
17	Rogue River, OR	$1,630	$7,440	$13,300
18	Coos Bay, OR	$4,880	$22,300	$39,800
19	Winchester Bay, OR	$4,880	$22,300	$39,800
20	Siuslaw River, OR	$3,250	$14,900	$26,500
21	Alsea River, OR	$1,630	$7,440	$13,300
22	Yaquina River, OR	$0	$0	$0
23	Tillamook Bay, OR	$4,880	$22,300	$39,800
24a	Lower Columbia River Estuary, OR	$250,000	$1,150,000	$2,040,000
24b	Lower Columbia River, OR	$757,000	$3,470,000	$6,170,000
25	Willapa Bay, WA	$6,500	$29,800	$53,000
26	Grays Harbor, WA	$813	$3,720	$6,630
27	Puget Sound, WA	$2,170,000	$9,920,000	$17,700,000
28	CA-Mexico Border to Monterey Bay, CA	$78,000	$357,000	$636,000
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$0	$0
40	Nehalem Bay, OR	$0	$0	$0

EXHIBIT E-6. SUMMARY OF IMPACTS TO NPDES-PERMITTED FACILITIES

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)					
		MINOR			MAJOR		
		LOW	MID	HIGH	LOW	MID	HIGH
1	Elkhorn Slough, CA	$0	$0	$0	$0	$0	$0
2	Upper Sacramento River, CA	$0	$14,400	$28,800	$59,500	$78,600	$97,700
3	Lower Sacramento River, CA	$0	$28,800	$57,600	$119,000	$157,000	$195,000
4	Yolo Bypass, CA	$0	$0	$0	$0	$0	$0
5	Sutter Bypass, CA	$0	$0	$0	$0	$0	$0
6	Lower Feather River, CA	$0	$7,200	$14,400	$59,500	$78,600	$97,700
7	Lower Yuba River, CA	$0	$1,440	$2,880	$0	$0	$0
8	Sacramento-San Joaquin Delta, CA	$0	$14,400	$28,800	$107,000	$141,000	$176,000
9	Suisun Bay, CA	$0	$0	$0	$0	$0	$0
10	San Pablo Bay, CA	$0	$21,600	$43,200	$143,000	$189,000	$234,000
11	San Francisco Bay, CA	$0	$49,000	$97,900	$202,000	$267,000	$332,000
12	Tomales Bay, CA	$0	$2,880	$5,760	$0	$0	$0
13	Noyo Harbor, CA	$0	$0	$0	$11,900	$15,700	$19,500
14	Eel River, CA	$0	$8,640	$17,300	$23,800	$31,400	$39,100
15	Humboldt Bay, CA	$0	$8,640	$17,300	$23,800	$31,400	$39,100
16	Klamath River, CA	$0	$0	$0	$0	$0	$0
17	Rogue River, OR	$0	$2,880	$5,760	$0	$0	$0
18	Coos Bay, OR	$0	$30,200	$60,500	$35,700	$47,200	$58,600
19	Winchester Bay, OR	$0	$10,100	$20,200	$0	$0	$0
20	Siuslaw River, OR	$0	$11,500	$23,000	$0	$0	$0
21	Alsea River, OR	$0	$2,880	$5,760	$0	$0	$0
22	Yaquina River, OR	$0	$15,800	$31,700	$11,900	$15,700	$19,500

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)					
		MINOR			MAJOR		
		LOW	MID	HIGH	LOW	MID	HIGH
23	Tillamook Bay, OR	$0	$14,400	$28,800	$23,800	$31,400	$39,100
24a	Lower Columbia River estuary	$0	$43,200	$86,400	$23,800	$31,400	$39,100
24b	Lower Columbia River	$0	$338,000	$677,000	$274,000	$362,000	$449,000
25	Willapa Bay, WA	$0	$47,500	$95,100	$0	$0	$0
26	Grays Harbor, WA	$0	$69,100	$138,000	$47,600	$62,900	$78,100
27	Puget Sound, WA	$0	$1,400,000	$2,800,000	$286,000	$377,000	$469,000
28	CA-Mexico Border to Monterey Bay, CA	$0	$4,320	$8,640	$369,000	$487,000	$606,000
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$0	$0	$95,300	$126,000	$156,000
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$1,440	$2,880	$0	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	$0	$2,880	$5,760	$35,700	$47,200	$58,600
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0	$2,880	$5,760	$35,700	$47,200	$58,600
36	Grays Harbor, WA to Cape Flattery, WA	$0	$1,440	$2,880	$0	$0	$0
37	Strait of Juan de Fuca to Rosario Strait, WA	$0	$5,760	$11,500	$23,800	$31,400	$39,100
38	AK/Canada border to Yakutat Bay, AK	$0	$0	$0	$0	$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	$0	$1,440	$2,880	$0	$0	$0
40	Nehalem Bay, OR	$0	$2,880	$5,760	$0	$0	$0

EXHIBIT E-7. SUMMARY OF IMPACTS TO AGRICULTURAL PESTICIDE APPLICATION

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)		
		LOW	MID	HIGH
3	Lower Sacramento River, CA	$11,900	$2,670,000	$5,330,000
4	Yolo Bypass, CA	$9,840	$449,000	$888,000
5	Sutter Bypass, CA	$0	$0	$0
6	Lower Feather River, CA	$15,400	$1,470,000	$2,920,000
7	Lower Yuba River, CA	$46,000	$228,000	$410,000
12	Tomales Bay, CA	$0	$0	$0
15	Humboldt Bay, CA	$129	$3,710	$7,280

EXHIBIT E-8. SUMMARY OF ECONOMIC IMPACTS TO DAM PROJECTS BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)		
		LOW	MID	HIGH
2	Upper Sacramento River, CA	$15,700,000	$19,100,000	$22,500,000
3	Lower Sacramento River, CA	$267,000	$6,220,000	$12,200,000
4	Yolo Bypass, CA	$4,600	$107,000	$210,000
5	Sutter Bypass, CA	$0	$0	$0
6	Lower Feather River, CA	$73,600	$1,720,000	$3,360,000
7	Lower Yuba River, CA	$1,660,000	$1,760,000	$1,860,000
8	Sacramento-San Joaquin Delta, CA	$32,200	$751,000	$1,470,000
16	Klamath / Trinity River, CA	$0	$0	$0
24a	Lower Columbia River Estuary, OR	$96,600	$2,250,000	$4,410,000
24b	Lower Columbia River, OR	$276,000	$6,440,000	$12,600,000

EXHIBIT E-9. SUMMARY OF ECONOMIC IMPACTS TO WATER DIVERSIONS BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)		
		LOW	MID	HIGH
2	Upper Sacramento River, CA	$180,000	$236,000	$293,000
3	Lower Sacramento River, CA	$2,310,000	$3,030,000	$3,750,000
4	Yolo Bypass, CA	$312,000	$410,000	$507,000
5	Sutter Bypass, CA	$48,000	$63,000	$78,000
6	Lower Feather River, CA	$804,000	$1,060,000	$1,310,000
7	Lower Yuba River, CA	$92,000	$121,000	$150,000
8	Sacramento – San Joaquin Delta, CA	$8,840,000	$11,600,000	$14,400,000
12	Tomales Bay, CA	$468,000	$614,000	$761,000
21	Alsea River, OR	$4,000	$5,250	$6,500

EXHIBIT E-10. SUMMARY OF ECONOMIC IMPACTS TO POWER PLANTS BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)		
		LOW	MID	HIGH
1	Elkhorn Slough, CA	$11,900	$15,700	$19,500
8	Sacramento-San Joaquin Delta, CA	$226,000	$299,000	$371,000
9	Suisun Bay, CA	$0	$0	$0
10	San Pablo Bay, CA	$83,400	$110,000	$137,000
11	San Francisco Bay, CA	$345,000	$456,000	$567,000
15	Humboldt Bay, CA	$12,300	$16,300	$20,200
28	CA-Mexico Border to Monterey Bay, CA	$11,900	$15,700	$19,500
29	Monterey Bay, CA to San Francisco Bay, CA	$11,900	$15,700	$19,500
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	$0	$0	$0

EXHIBIT E-11. SUMMARY OF IMPACTS TO BOTTOM TRAWL FISHERIES BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7 PERCENT)[B]	
		LOW	HIGH
28	CA-Mexico Border to Monterey Bay, CA	$18,200	$91,162
29	Monterey Bay, CA to San Francisco Bay, CA	$157,000	$785,000
30	San Francisco Bay, CA to Humboldt Bay, CA	$179,000	$894,000
31	Humboldt Bay, CA to Coos Bay, OR	$166,000	$831,000
32	Coos Bay, OR to Winchester Bay, OR	$82,900	$414,000
33	Winchester Bay, OR to Columbia River and Estuary	$108,000	$539,000
34	Columbia River and Estuary to Willapa Bay, WA	$542,000	$2,710,000
35	Willapa Bay, WA to Grays Harbor, WA	$0	$0
36	Grays Harbor, WA to Cape Flattery, WA	$398,000	$1,990,000
37	Strait of Juan de Fuca to Rosario Strait, WA	$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	$36,100,000	$180,000,000

EXHIBIT E-12. SUMMARY OF ECONOMIC IMPACTS TO TIDAL/WAVE ENERGY PROJECTS BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)
11	San Francisco Bay, CA	$65,900
25	Willapa Bay, WA	$68,300
27	Puget Sound, WA	$546,000
28	CA-Mexico Border to Monterey Bay, CA	$65,900
29	Monterey Bay, CA to San Francisco Bay, CA	$0
30	San Francisco Bay, CA to Humboldt Bay, CA	$330,000
31	Humboldt Bay, CA to Coos Bay, OR	$198,000
32	Coos Bay, OR to Winchester Bay, OR	$132,000
33	Winchester Bay, OR to Columbia River and Estuary, OR	$330,000
34	Columbia River and Estuary to Willapa Bay, WA	$0
35	Willapa Bay, WA to Grays Harbor, WA	$0
36	Grays Harbor, WA to Cape Flattery, WA	$65,900
37	Strait of Juan de Fuca to Rosario Strait, WA	$0
38	AK/Canada border to Yakutat Bay, AK	$264,000
39	Coastal AK waters northwest of Yakutat Bay, AK	$330,000

EXHIBIT E-13. SUMMARY OF ECONOMIC IMPACTS TO LNG PROJECTS

UNIT	DESCRIPTION	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)	
		LOW	HIGH
18	Coos Bay, OR	$0	$32,500,000
24a	Lower Columbia River Estuary, OR	$0	$97,500,000
24b	Lower Columbia River, OR	$0	$0
28	CA-Mexico Border to Monterey Bay, CA	$0	$130,000,000
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$0
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	$0	$0
32	Coos Bay, OR to Winchester Bay, OR	$0	$0
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0	$0
34	Columbia River and Estuary to Willapa Bay, WA	$0	$0
35	Willapa Bay, WA to Grays Harbor, WA	$0	$0
36	Grays Harbor, WA to Cape Flattery, WA	$0	$0
37	Strait of Juan de Fuca to Rosario Strait, WA	$0	$0
38	AK/Canada border to Yakutat Bay, AK	$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	$0	$130,000,000

EXHIBIT E-14. SUMMARY OF ECONOMIC IMPACTS TO DESALINATION PROJECTS BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED COSTS (DISCOUNTED AT 7%)	
		LOW	HIGH
10	San Pablo Bay, CA	$0	$3,610,000
28	CA-Mexico Border to Monterey Bay, CA	$0	$55,500,000
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$7,530,000

EXHIBIT E-15. SUMMARY OF ECONOMIC IMPACTS TO RESTORATION ACTIVITIES BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 7%)	
		LOW	HIGH
2	Upper Sacramento River, CA	$0	$108,000
3	Lower Sacramento River, CA	$0	$317,000
4	Yolo Bypass, CA	$0	$0
5	Sutter Bypass, CA	$0	$0
6	Lower Feather River, CA	$0	$47,300
7	Lower Yuba River, CA	$0	$6,750
8	Sacramento-San Joaquin Delta, CA	$0	$527,000
9	Suisun Bay, CA	$0	$486,000
10	San Pablo Bay, CA	$0	$1,860,000
11	San Francisco Bay, CA	$0	$1,380,000
12	Tomales Bay, CA	$0	$1,440,000

APPENDIX F | 3 PERCENT DISCOUNT RATE EXHIBITS

Appendix F provides detailed tables for impacts discussed in Sections 2 through 4 of this economic analysis. Present values and annualized costs are estimated based on a discount rate of three percent.

For most activities, estimated impacts are based on an assumed annual cost applied evenly across all relevant years. Because impacts are based on an evenly distributed annual cost, annualized impacts for these activities are not affected by the discount rate selected. Impacts to NPDES-permitted activities and power plants incorporate certain assumptions about the timing of capital costs and operation and maintenance activities; therefore, impacts to these activities do change based on the discount rate.

EXHIBIT F-1. SUMMARY OF ANNUALIZED IMPACTS BY UNIT (DISCOUNTED AT 3 PERCENT)

UNIT	DESCRIPTION	LOW	HIGH
1	Elkhorn Slough, CA	$220,000	$220,000
2	Upper Sacramento River	$3,900,000	$3,900,000
3	Lower Sacramento River	$4,700,000	$4,700,000
4	Yolo Bypass	$550,000	$550,000
5	Sutter Bypass	$13,000	$13,000
6	Lower Feather River	$2,000,000	$2,000,000
7	Lower Yuba River	$600,000	$610,000
8	Sacramento-San Joaquin Delta	$2,700,000	$2,800,000
9	Suisun Bay	$150,000	$200,000
10	San Pablo Bay	$310,000	$4,100,000
11	San Francisco Bay	$940,000	$1,100,000
12	Tomales Bay	$120,000	$270,000
13	Noyo Harbor	$23,000	$23,000
14	Eel River	$15,000	$15,000
15	Humboldt Bay	$13,000	$13,000
16	Klamath River	$8,900	$8,900
17	Rogue River	$2,100	$2,100
18	Coos Bay	$72,000	$16,000,000
19	Winchester Bay	$12,000	$12,000
20	Siuslaw River	$8,600	$8,600
21	Alsea River	$9,300	$9,300

UNIT	DESCRIPTION	LOW	HIGH
22	Yaquina River	$3,000	$3,000
23	Tillamook Bay	$15,000	$15,000
24a	Lower Columbia River Estuary	$710,000	$20,000,000
24b	Lower Columbia River	$2,300,000	$2,300,000
25	Willapa Bay	$110,000	$110,000
26	Grays Harbor	$29,000	$29,000
27	Puget Sound	$3,000,000	$3,000,000
28	US/Mexico Border to Monterey Bay	$1,300,000	$190,000,000
29	Monterey Bay to San Francisco Bay	$190,000	$8,300,000
30	San Francisco Bay to Humboldt Bay	$520,000	$1,200,000
31	Humboldt Bay to Coos Bay	$700,000	$1,400,000
32	Coos Bay to Winchester Bay	$220,000	$550,000
33	Winchester Bay to Columbia R. Estuary	$460,000	$890,000
34	Columbia River Estuary to Willapa Bay	$540,000	$2,700,000
35	Willapa Bay to Grays Harbor	$0	$0
36	Grays Harbor to US/Canada Border	$470,000	$2,100,000
37	Strait of Juan de Fuca	$220,000	$220,000
38	Alaska/Canada Border to Yakutat Bay	$270,000	$270,000
39	Coastal Alaska Waters northwest of Yakutat Bay	$36,000,000	$310,000,000
40	Nehalem Bay	$300	$300

EXHIBIT F-2. SUMMARY OF IMPACTS TO NPDES-PERMITTED FACILITIES (DISCOUNTED AT 3 PERCENT)

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 3%)					
		MINOR			MAJOR		
		LOW	MID	HIGH	LOW	MID	HIGH
1	Elkhorn Slough, CA	$0	$0	$0	$0	$0	$0
2	Upper Sacramento River, CA	$0	$1,490	$2,980	$4,600	$6,570	$8,550
3	Lower Sacramento River, CA	$0	$2,980	$5,970	$9,200	$13,100	$17,100
4	Yolo Bypass, CA	$0	$0	$0	$0	$0	$0
5	Sutter Bypass, CA	$0	$0	$0	$0	$0	$0
6	Lower Feather River, CA	$0	$746	$1,490	$4,600	$6,570	$8,550
7	Lower Yuba River, CA	$0	$149	$298	$0	$0	$0
8	Sacramento-San Joaquin Delta, CA	$0	$1,490	$2,980	$8,280	$11,800	$15,400
9	Suisun Bay, CA	$0	$0	$0	$0	$0	$0
10	San Pablo Bay, CA	$0	$2,240	$4,480	$11,000	$15,800	$20,500
11	San Francisco Bay, CA	$0	$5,070	$10,100	$15,600	$22,300	$29,100
12	Tomales Bay, CA	$0	$298	$597	$0	$0	$0
13	Noyo Harbor, CA	$0	$0	$0	$920	$1,320	$1,710
14	Eel River, CA	$0	$895	$1,790	$1,840	$2,630	$3,420
15	Humboldt Bay, CA	$0	$895	$1,790	$1,840	$2,630	$3,420
16	Klamath River, CA	$0	$0	$0	$0	$0	$0
17	Rogue River, OR	$0	$597	$1,190	$0	$0	$0
18	Coos Bay, OR	$0	$3,130	$6,270	$2,760	$3,940	$5,130
19	Winchester Bay, OR	$0	$1,040	$2,090	$0	$0	$0
20	Siuslaw River, OR	$0	$1,190	$2,390	$0	$0	$0
21	Alsea River, OR	$0	$298	$597	$0	$0	$0
22	Yaquina River, OR	$0	$1,640	$3,280	$920	$1,320	$1,710

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 3%)					
		MINOR			MAJOR		
		LOW	MID	HIGH	LOW	MID	HIGH
23	Tillamook Bay, OR	$0	$1,490	$2,980	$1,840	$2,630	$3,420
24a	Lower Columbia River estuary	$0	$4,480	$8,950	$1,840	$2,630	$3,420
24b	Lower Columbia River	$0	$35,100	$70,120	$21,200	$30,200	$39,300
25	Willapa Bay, WA	$0	$9,850	$19,700	$0	$0	$0
26	Grays Harbor, WA	$0	$14,300	$28,600	$7,360	$10,500	$13,700
27	Puget Sound, WA	$0	$145,000	$290,000	$22,100	$31,500	$41,000
28	CA-Mexico Border to Monterey Bay, CA	$0	$895	$1,790	$57,000	$81,500	$106,000
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$0	$0	$14,700	$21,000	$27,400
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$298	$597	$0	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	$0	$597	$1,190	$5,520	$7,890	$10,300
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0	$597	$1,190	$5,520	$7,890	$10,300
36	Grays Harbor, WA to Cape Flattery, WA	$0	$298	$597	$0	$0	$0
37	Strait of Juan de Fuca to Rosario Strait, WA	$0	$1,190	$2,390	$3,680	$5,260	$6,800
38	AK/Canada border to Yakutat Bay, AK	$0	$0	$0	$0	$0	$0
39	Coastal AK waters northwest of Yakutat Bay, AK	$0	$298	$597	$0	$0	$0
40	Nehalem Bay, OR	$0	$298	$597	$0	$0	$0

EXHIBIT F-3. SUMMARY OF ECONOMIC IMPACTS TO POWER PLANTS BY UNIT

UNIT	DESCRIPTION	TOTAL ANNUALIZED IMPACTS (DISCOUNTED AT 3%)		
		LOW	MID	HIGH
1	Elkhorn Slough, CA	$1,840	$2,630	$3,420
8	Sacramento-San Joaquin Delta, CA	$34,900	$50,000	$65,000
9	Suisun Bay, CA	$0	$0	$0
10	San Pablo Bay, CA	$12,900	$18,400	$23,900
11	San Francisco Bay, CA	$53,300	$76,200	$99,100
15	Humboldt Bay, CA	$1,840	$2,630	$3,420
28	CA-Mexico Border to Monterey Bay, CA	$9,200	$13,100	$17,100
29	Monterey Bay, CA to San Francisco Bay, CA	$9,200	$13,100	$17,100
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$0	$0
31	Humboldt Bay, CA to Coos Bay, OR	$0	$0	$0

EXHIBIT F-4. TOTAL ESTIMATED ANNUALIZED IMPACTS BORNE BY SMALL ENTITIES BY UNIT AND ACTIVITY TYPE

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL (LOW)	TOTAL (HIGH)
1	Elkhorn Slough, CA	$216,000	$0				$2,630	**$219,000**	**$219,000**
2	Upper Sacramento River, CA	$11,500	$6,020			$3,870,000		**$3,890,000**	**$3,890,000**
3	Lower Sacramento River, CA	$117,000	$13,100	$2,350,000		$1,750,000		**$4,230,000**	**$4,230,000**
4	Yolo Bypass, CA		$0	$385,000				**$385,000**	**$385,000**
5	Sutter Bypass, CA	$0	$0	$0				**$0**	**$0**
6	Lower Feather River, CA	$2,860	$5,680	$1,290,000		$520,000		**$1,820,000**	**$1,820,000**
7	Lower Yuba River, CA	$298	$124	$198,000		$376,000		**$574,000**	**$574,000**
8	Sacramento-San Joaquin Delta, CA	$177,000	$10,200			$2,380,000	$47,700	**$2,610,000**	**$2,610,000**
9	Suisun Bay, CA	$152,000	$0				$0	**$152,000**	**$152,000**
10	San Pablo Bay, CA	$265,000	$15,900				$16,900	**$298,000**	**$298,000**
11	San Francisco Bay, CA	$765,000	$23,000				$73,800	**$862,000**	**$862,000**
12	Tomales Bay, CA	$0	$298	$0		$123,000		**$123,000**	**$123,000**
13	Noyo Harbor, CA	$18,500	$1,200					**$19,700**	**$19,700**
14	Eel River, CA	$11,900	$3,080					**$15,000**	**$15,000**
15	Humboldt Bay, CA	$2,980	$3,150	$3,180			$2,630	**$11,900**	**$11,900**
16	Klamath River, CA	$8,930	$0			$0		**$8,930**	**$8,930**
17	Rogue River, OR	$1,490	$398					**$1,890**	**$1,890**
18	Coos Bay, OR	$65,200	$5,660					**$70,800**	**$70,800**
19	Winchester Bay, OR	$11,200	$870					**$12,000**	**$12,000**
20	Siuslaw River, OR	$7,440	$955					**$8,390**	**$8,390**
21	Alsea River, OR	$3,720	$224			$5,250		**$9,190**	**$9,190**

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL (LOW)	TOTAL (HIGH)
22	Yaquina River, OR	$0	$2,360					**$2,360**	**$2,360**
23	Tillamook Bay, OR	$11,200	$3,710					**$14,900**	**$14,900**
24a	Lower Columbia River Estuary, OR/WA	$230,000	$5,840			$451,000		**$686,000**	**$686,000**
24b	Lower Columbia River, OR/WA	$895,000	$53,200			$1,250,000		**$2,200,000**	**$2,200,000**
25	Willapa Bay, WA	$29,800	$8,620					**$38,400**	**$38,400**
26	Grays Harbor, WA	$3,570	$20,800					**$24,400**	**$24,400**
27	Puget Sound, WA	$2,420,000	$155,000					**$2,580,000**	**$2,580,000**
28	CA-Mexico Border to Monterey Bay, CA	$1,050,000	$72,300		$17,600 to $88,000		$11,700	**$1,150,000**	**$1,220,000**
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$17,800		$157,000 to $785,000		$12,800	**$188,000**	**$816,000**
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$274		$179,000 to $894,000			**$179,000**	**$894,000**
31	Humboldt Bay, CA to Coos Bay, OR	$313,000	$7,400		$166,000 to $831,000			**$487,000**	**$1,150,000**
32	Coos Bay, OR to Winchester Bay, OR	$0			$82,900 to $414,000	$0		**$82,900**	**$414,000**
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0	$6,690		$108,000 to $539,000	$0		**$114,000**	**$545,000**
34	Columbia River and Estuary to Willapa Bay, WA	$0			$542,000 to $2,710,000			**$542,000**	**$2,710,000**
35	Willapa Bay, WA to Grays Harbor, WA	$0			$0			**$0**	**$0**

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS	TOTAL (LOW)	TOTAL (HIGH)
36	Grays Harbor, WA to Cape Flattery, WA	$0	$239		$398,000 to $1,990,000			**$398,000**	**$1,990,000**
37	Strait of Juan de Fuca to Rosario Strait, WA	$214,000	$5,890		$0			**$220,000**	**$220,000**
38	AK/Canada border to Yakutat Bay, AK	$0	$0					**$0**	**$0**
39	Coastal AK waters northwest of Yakutat Bay, AK	$0	$237		$35,800,000 to $179,000,000			**$35,800,000**	**$179,000,000**
40	Nehalem Bay, OR	$0	$224					**$224**	**$224**
	Total	**$7,010,000**	**$450,000**	**$4,230,000**	**$37,400,000 to $187,000,000**	**$10,700,000**	**$168,000**	**$60,000,000**	**$210,000,000**

[a] Average net cash farm income of operations for affected crop types for affected counties in critical habitat areas is approximately $147,000 (2007$). National Agricultural Statistics Service, 2002 Census of Agriculture.

[b] Per entity estimates rely on the Dun and Bradstreet data for fishing entities in affected counties. While nearly all industries potentially affected by the proposed rule are land-based, the commercial fishing industry is not. Because its operations occur, in most cases, offshore, tracking the locations of small entities using Dun and Bradstreet databases is problematic. Exhibit C-8 presents some supplemental data on fishing entities. Public comments from ODFW include estimates of variable expenses for productive large trawlers in the study area. The Fisheries Economic Assessment Model (FEAM) estimates that average annual gross income for productive larger trawlers is $268,683. Public comments of Bruce McIntosh, the Oregon Department of Fish and Wildlife on December 29, 2008.

EXHIBIT F-5. ESTIMATED ANNUALIZED IMPACTS PER SMALL ENTITY BY UNIT AND ACTIVITY TYPE

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS
1	Elkhorn Slough, CA	$54,000	$0				$1,310
2	Upper Sacramento River, CA	$140	$114			$125,000	
3	Lower Sacramento River, CA	$426	$39	$3,840		$21,000	
4	Yolo Bypass, CA		$0	$64,100			
5	Sutter Bypass, CA	$0	$0	$0			
6	Lower Feather River, CA	$55	$86	$4,210		$17,300	
7	Lower Yuba River, CA	$74	$25	$15,200		$188,000	
8	Sacramento-San Joaquin Delta, CA	$1,870	$75			$95,000	$2,270
9	Suisun Bay, CA	$38,000	$0				$0
10	San Pablo Bay, CA	$1,630	$63				$736
11	San Francisco Bay, CA	$1,460	$16				$249
12	Tomales Bay, CA	$0	$50	$0		$61,400	
13	Noyo Harbor, CA	$3,090	$110				
14	Eel River, CA	$1,700	$220				
15	Humboldt Bay, CA	$119	$63	$529			$438
16	Klamath River, CA	$2,980	$0			$0	
17	Rogue River, OR	$1,490	$199				
18	Coos Bay, OR	$2,960	$202				
19	Winchester Bay, OR	$2,790	$174				
20	Siuslaw River, OR	$1,490	$119				
21	Alsea River, OR	$930	$75			$2,630	
22	Yaquina River, OR	$0	$591				
23	Tillamook Bay, OR	$656	$206				
24a	Lower Columbia River Estuary, OR/WA	$20,900	$254			$75,100	
24b	Lower Columbia River, OR/WA	$4,140	$141			$36,800	
25	Willapa Bay, WA	$3,720	$308				
26	Grays Harbor, WA	$149	$444				
27	Puget Sound, WA	$2,780	$103				
28	CA-Mexico Border to Monterey Bay, CA	$940	$23		$629 to $3,140		$52

UNIT	SPECIFIC UNIT	IN-WATER CONSTRUCTION & DREDGING	POINT AND NON-POINT SOURCE POLLUTION	AGRICULTURAL PESTICIDE APPLICATION[a]	BOTTOM TRAWL FISHERIES[b]	DAMS & WATER DIVERSIONS	POWER PLANTS
29	Monterey Bay, CA to San Francisco Bay, CA	$0	$45		$15,700 to $78,500		
30	San Francisco Bay, CA to Humboldt Bay, CA	$0	$4		$35,700 to $179,000		
31	Humboldt Bay, CA to Coos Bay, OR	$5,400	$68		$9,780 to $48,900		
32	Coos Bay, OR to Winchester Bay, OR	$0			$16,600 to $82,900	$346	
33	Winchester Bay, OR to Columbia River and Estuary, OR	$0	$119		$3,170 to $15,800	$0	
34	Columbia River and Estuary to Willapa Bay, WA	$0			$45,100 to $226,000	$0	
35	Willapa Bay, WA to Grays Harbor, WA	$0			$0		
36	Grays Harbor, WA to Cape Flattery, WA	$0	$20		$66,300 to $332,000		
37	Strait of Juan de Fuca to Rosario Strait, WA	$2,020	$40		$0		
38	AK/Canada border to Yakutat Bay, AK	$0	$0				
39	Coastal AK waters northwest of Yakutat Bay, AK	$0	$1		$298,000 to $1,490,000		
40	Nehalem Bay, OR	$0	$75				

[a] Average net cash farm income of operations for affected crop types for affected counties in critical habitat areas is approximately $147,000 (2007$). National Agricultural Statistics Service, 2002 Census of Agriculture.

[b] Per entity estimates rely on the Dun and Bradstreet data for fishing entities in affected counties. While nearly all industries potentially affected by the proposed rule are land-based, the commercial fishing industry is not. Because its operations occur, in most cases, offshore, tracking the locations of small entities using Dun and Bradstreet databases is problematic. Exhibit C-8 presents some supplemental data on fishing entities. Public comments from ODFW include estimates of variable expenses for productive large trawlers in the study area. The Fisheries Economic Assessment Model (FEAM) estimates that average annual gross income for productive larger trawlers is $268,683. Public comments of Bruce McIntosh, the Oregon Department of Fish and Wildlife on December 29, 2008.