Economic Impacts Associated with Potential Critical Habitat Designation for the Black Abalone

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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 black abalone. The analysis examines the potential impacts of restricting or modifying specific water or land 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 black abalone. A separate Draft Biological Report (NMFS 2010a) 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 Draft ESA 4(b)(2) report (NMFS 2010b) to support NMFS' proposed critical habitat designation.

Approach

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

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

- Define the geographic area for the analysis and identify the specific areas to be analyzed for purposes of this designation. The Draft Biological Report (NMFS 2010a) that supports the

proposed black abalone critical habitat designation describes how each of these areas meets the definition of critical habitat set forth in Section 3 of the Endangered Species Act (ESA).

- Identify activities that may affect black abalone primary constituent elements (PCEs; see NMFS 2010a) and therefore may incur an economic impact because of the black abalone critical habitat designation.
- Estimate the baseline level of protection afforded black abalone by area and activity type.
- For each economic activity, establish the existing and expected level of economic activity that may be affected by black abalone conservation efforts in each critical habitat area.
- Estimate potential economic impacts of black abalone conservation efforts by economic activity type and sum these impacts by area.

These steps are described in greater detail in Section 1.

Results

Seventeen categories of economic activities were identified as being potentially affected by a critical habitat designation for black abalone. Since a large degree of uncertainty exists with regard to future actions likely to be undertaken specifically for the conservation of black abalone and their habitat as a result of a black abalone critical habitat designation, this analysis presents a range of possible impacts. This range is based on low-end and high-end impact scenarios developed for 10 activities: in-water construction, sand replenishment, NPDES-permitted facilities, coastal urban development, side-casting agricultural activities (irrigation), oil and chemical spill prevention and clean-up, power plants, desalination plants, and tidal and wave energy projects. These scenarios are discussed further in Section 2. The remaining activities (also discussed in Section 2 of the analysis) for which data limitations precluded a quantitative assessment of economic effects, include: dredging, agricultural activities (pesticide application and livestock farming), vessel groundings, liquefied natural gas terminals, mineral and petroleum exploration and extraction, non-native species prevention and management, kelp harvesting, and activities that lead to global climate change.

The annualized impacts by area of concern are presented below in tables ES-1 (discounted at seven percent) and ES-2 (discounted at three percent) for both low and high scenarios as well as the mean. In the low-end scenario, annualized impacts by area vary from $0 to $253,600 (discounted at seven percent); Area 7 incurs the highest impacts. In the high end scenario, annualized impacts by area vary from $0 to $151.3 million (discounted at seven percent); Area 10 incurs the highest impacts. Areas 10 and 8 have the highest amount of activity types present (11 and 10 activities, respectively). Areas 6, 13, 14, and 18 have the lowest impacts, $0, since the only activities identified in these areas being considered for

designation can only be discussed qualitatively. However, this does not mean that in the future, there will be $0 costs.

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 black abalone 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 C tests the sensitivity of the assumptions in this analysis about the degree to which black abalone critical habitat, as opposed to existing Federal, state, and local regulations and regulations for other ESA-listed species and their critical habitat, drive the costs in particular areas.

Table ES-1: Summary of Annualized Impacts by Area* (discounted at 7 percent)

Area	Annualized Impacts (7% Discount Rate)			Activities with only a qualitative analysis (NOT included in the estimated costs)**
	Low	Mean	High	
1	$3,300	$279,625	$555,950	Agricultural pesticide application
2	$15,100	$317,925	$620,750	Agricultural pesticide application and Non-native species introduction and management
3	$0	$222,100	$444,200	Agricultural pesticide application
4	$37,900	$306,350	$574,800	Agricultural pesticide application and Non-native species introduction and management
5	$10,300	$22,150	$34,000	
6	$0	$0	$0	
7	$253,600	$907,350	$1,561,100	Agricultural pesticide application and Kelp harvesting
8	$8,600	$809,000	$1,609,400	Agricultural pesticide application, Vessel grounding, Non-native species introduction and management, and Kelp harvesting
9	$5,000	$129,250	$253,500	Agricultural pesticide application and Kelp harvesting
10	$55,400	$75,655,525	$151,255,650	Agricultural pesticide application, Mineral and petroleum exploration and extraction, Non-native species introduction and management and Kelp harvesting
11	$42,400	$179,475	$316,550	Non-native species introduction and management and Kelp harvesting
12	$11,500	$1,564,400	$3,117,300	Agricultural pesticide application and Kelp harvesting
13	$0	$0	$0	Kelp harvesting
14	$0	$0	$0	Kelp harvesting
15	$0	$13,450	$26,900	Kelp harvesting
16	$0	$29,400	$58,800	Agricultural pesticide application and Kelp harvesting
17	$1,350	$5,950	$10,550	Kelp harvesting
18	$0	$0	$0	Kelp harvesting
19	$24,300	$174,775	$325,250	Kelp harvesting
20	$1,350	$3,300	$5,250	Kelp harvesting
Total***	$470,000	$79,916,925	$159,363,850	Agricultural pesticide application, Vessel grounding, Mineral and petroleum exploration and extraction, Non-native species introduction and management, and Kelp harvesting

*Note: Section 2 of the report presents results of the analysis in more detail.

**Note: Activities that lead to global climate change (e.g. fossil fuel combustion) are also discussed qualitatively in this analysis and are recognized as potential threats to black abalone in all areas (see Section 2.16).

***Note: Totals are adjusted for double-counting of NPDES outfalls and acres of agricultural land that overlap multiple areas. See sections 2.3 and 2.6 for more details.

Table ES-2: Summary of Annualized Impacts by Area* (discounted at 3 percent)

Area	Annualized Impacts (3% Discount Rate)			Activities with only a qualitative analysis (NOT included in the estimated costs)**
	Low	Mean	High	
1	$3,300	$279,825	$556,350	Agricultural pesticide application
2	$15,100	$304,225	$593,350	Agricultural pesticide application and Non-native species introduction and management
3	$0	$261,225	$522,450	Agricultural pesticide application
4	$33,200	$287,900	$542,600	Agricultural pesticide application and Non-native species introduction and management
5	$10,300	$21,400	$32,500	
6	$0	$0	$0	
7	$252,000	$903,750	$1,555,500	Agricultural pesticide application and Kelp harvesting
8	$7,000	$805,300	$1,603,600	Agricultural pesticide application, Vessel grounding, Non-native species introduction and management, and Kelp harvesting
9	$5,000	$128,550	$252,100	Agricultural pesticide application and Kelp harvesting
10	$45,800	$68,410,925	$136,776,050	Agricultural pesticide application, Mineral and petroleum exploration and extraction, Non-native species introduction and management and Kelp harvesting
11	$29,800	$100,350	$170,900	Non-native species introduction and management and Kelp harvesting
12	$8,300	$1,559,000	$3,109,700	Agricultural pesticide application and Kelp harvesting
13	$0	$0	$0	Kelp harvesting
14	$0	$0	$0	Kelp harvesting
15	$0	$13,450	$26,900	Kelp harvesting
16	$0	$26,400	$52,800	Agricultural pesticide application and Kelp harvesting
17	$1,350	$6,050	$10,750	Kelp harvesting
18	$0	$0	$0	Kelp harvesting
19	$18,000	$168,525	$319,050	Kelp harvesting
20	$1,350	$3,300	$5,250	Kelp harvesting
Total***	$430,400	$72,615,925	$144,801,450	Agricultural pesticide application, Vessel grounding, Mineral and petroleum exploration and extraction, Non-native species introduction and management, and Kelp harvesting

* Note: Section 2 of the report presents results of the analysis in more detail.

** Note: Activities that lead to global climate change (e.g. fossil fuel combustion) are also discussed qualitatively in this analysis and are recognized as potential threats to black abalone in all areas (see Section 2.16).

*** Note: Totals are adjusted for double-counting of NPDES outfalls and acres of agricultural land that overlap multiple areas. See sections 2.3 and 2.6 for more details.

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 black abalone. The analysis examines the potential impacts of restricting or modifying specific water and land uses 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 designations for West Coast salmon and steelhead, the Southern Distinct Population Segment (DPS) of North American green sturgeon, and the leatherback sea turtle (critical habitat proposed in January of 2010), the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) is applying a cost-effectiveness framework to analyze the economic impacts of the designation of critical habitat for black abalone. This framework supports the Endangered Species Act (ESA) 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 designation" for any particular area.[1] For this analysis, the cost-effectiveness framework has been modified, given the general uncertainty about specific management actions likely to be undertaken.[2] This economic analysis addresses the "benefits of exclusion" portion of the weighing process, while the Draft Biological Report and the Draft ESA section 4(b)(2) Report address and compare our results to the "benefits of designation" for each particular area considered. These other reports also present more detailed information regarding presence of black abalone and identified PCEs in areas under consideration for critical habitat designation.

Note: Information, where appropriate, was taken from the "Economic Impacts Associated with Potential Critical Habitat Designation for the Leatherback Sea Turtle" (2009), prepared by NMFS; the "Economic Analysis of the Impacts of Designating Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon" (2009), prepared by Industrial Economics, Inc. for NMFS;

[1] National Marine Fisheries Service (NMFS). *Final Economic Analysis of Critical Habitat Designation for 12 West Coast Salmon and Steelhead ESUs*. August 2005.

[2] Section 1.2.1 of this report is a reduced form of the framework discussion provided in the West Coast salmon critical habitat analysis by the Northwest Fisheries Science Center.

and the “Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs” (2005), prepared by NMFS.

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 Management and Budget (OMB) through its guidelines on regulatory analysis.[3] 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.[4] BCA is a well-established procedure for assessing the "best" course or scale of action, where "best" is that course which maximizes net benefits.[5] 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 black abalone. (Conceptually, the “benefits of exclusion,” which is the language used in section 4(b)(2) of the ESA, are identical to the “costs of designation,” and so estimates of these costs could be used in a benefit-cost framework).

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 black abalone and their 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 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

[3] 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.
[4] Ibid.

designation, quantified in terms of the metric. However, the available data are insufficient to quantify the benefits of designating critical habitat for black abalone, 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 the acres of wetlands protected) or multiple outcomes that can be integrated into a single numerical index (e.g., units of health improvement).[6]

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 black abalone 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.

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

In addition, 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 black abalone 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 importance to the conservation of black abalone (e.g., the quality of the habitat and level of support for black abalone recruitment and survival). 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 Draft Biological Report and the Draft ESA section 4(b)(2) report for this rule.

By proceeding in order of these priorities (either in terms of designation 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 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 area 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 black abalone. The "without critical habitat" scenario represents the baseline for the analysis, considering habitat protections already afforded black abalone under its Federal listing and under other Federal, State, and local regulations, including protections afforded black abalone resulting from protections afforded other listed species, such as West Coast salmon and steelhead, delta smelt, green sturgeon, and marine mammals. The "with critical habitat" scenario attempts to describe the incremental impacts associated specifically with the proposed designation of critical habitat for the black abalone.[7] This analysis does provide an overview of costs that may be considered coextensive with the listing of black abalone 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 of the ESA represent opportunity costs related to black abalone 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.

At the guidance of 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.[8]

[7] We note that although the focus of this analysis is on the incremental effects of designating critical habitat, due to uncertainties with regard to future management actions associated with black abalone critical habitat, it was difficult in some cases to exclude potential impacts that may already occur under the baseline. Thus, the analysis may include some costs which would have occurred under the baseline regardless of designating critical habitat.

[8] 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.

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 black abalone and their 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 black abalone.

The baseline for this analysis is the existing state of regulation prior to the designation of critical habitat that provides protection to the species' habitat under the ESA and other Federal, State and local laws and regulations. The baseline includes the protections of sections 7 and 9 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.

> Section 7 of the ESA, 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 of the ESA defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered species, 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 of the ESA.

The protection of listed species and habitat is not limited to the ESA. 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 (CWA) 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.

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

1.3.2 Types of Economic Impacts of Critical Habitat Designation

This analysis focuses on the incremental impacts of the critical habitat designation for black abalone. The purpose of the analysis is to determine the impacts on water and land uses 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.

When critical habitat is designated, section 7 of the ESA 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 economic impacts of the rulemaking.

Incremental impacts may include the direct costs associated with additional effort for future consultations, reinitiated consultations, and new consultations occurring specifically because of the designation, and additional project modifications that would not have been otherwise 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, 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.

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 consultations; and 2) implementation of any project modifications requested by NMFS through section 7 consultation to avoid destruction or adverse modification of critical habitat.

Administrative Section 7 Consultation Costs

Parties involved in section 7 consultations for black abalone include NMFS, a Federal action agency (the Federal action, such as funding or a permit or other authorization, provides the "Federal nexus" requiring consultation), and in some cases, a private entity involved in the project or activity. NMFS could also

serve as the Federal action agency, in which case the consultation would be conducted internally between regions, divisions, or offices. While consultations are required for activities that involve a Federal nexus and may affect 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 destroy or adversely modify critical habitat. Administrative efforts for consultation may therefore result in both baseline and incremental impacts.

The geographic scope of the black abalone critical habitat being considered 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 of the ESA. 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 geographic scope and thus may overlap with multiple areas of concern. This makes it difficult to attribute those consultation costs to a particular area. Due to the 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, Table 1.3-1 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 listed species 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 reinitiating 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 (*i.e.*, a determination has been made that the activity has no effect on the species), or consultations resulting from the new information about the potential presence of the species provided by the designation). 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. Table 1.3-1 provides estimated consultation costs representing effort required for all types of consultation, including those that consider both adverse modification and jeopardy, in 2010 dollars. 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 mean of a potential range of impacts to account for variability regarding levels of effort of specific consultations.

Table 1.3-1: Example Range of Incremental Administrative Consultation Costs, Per Consultation (2010$)

Consultation Type	Service	Federal Agency	Third Party	Biological Assessment	Total Costs
Incremental consultation resulting entirely from critical habitat designation					
Technical Assistance	$550	n/a	$1,100	n/a	$1,550
Informal	$2,400	$3,000	$2,150	$2,100	$9,900
Formal	$5,400	$6,050	$3,650	$5,000	$20,400
Programmatic	$16,200	$13,600	n/a	$5,850	$35,650
Re-initiation of consultation to address adverse modification					
Technical Assistance	$275	n/a	$550	n/a	$800
Informal	$1,200	$1,500	$1,100	$1,050	$5,000
Formal	$2,700	$3,000	$1,800	$2,500	$10,200
Programmatic	$8,100	$6,800	n/a	$2,900	$17,800
Additional effort to address adverse modification in a new consultation					
Technical Assistance	$140	n/a	$275	n/a	$400
Informal	$600	$760	$540	$525	$2,500
Formal	$1,350	$1,500	$900	$1,250	$5,100
Programmatic	$4,050	$3,400	n/a	$1,450	$8,900

Adapted from the IEc (2009).
Note: 1. 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.
2. Totals may not sum due to rounding.
3. Estimates reflect average hourly time required by staff.

ESA Section 7 Project Modification Impacts

ESA 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. As stated above, in some cases the project modifications undertaken to address jeopardy to the species would be similar to those undertaken to address impacts on critical habitat and are difficult to separate. In this analysis, we included these project modifications and their associated economic impacts, regardless of whether the same modifications (and economic impacts) would already be undertaken to avoid jeopardy to the species.

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 ESA. Indirect impacts are those unintended changes in economic behavior that may occur outside of the ESA, through other Federal, State, local, or private actions, but that are caused by the designation of critical habitat. Below, common types of indirect impacts that may be associated with the designation of critical habitat are identified (see "Additional Indirect Impacts"). 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.

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 ESA section 7 consultation processes 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 ESA 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 of the ESA 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 adjacent to critical habitat may have a lower market value than an identical property that is not adjacent to the boundaries of critical habitat due to perceived limitations or restrictions. The converse may also be true. 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

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 area for the analysis, and identify the specific areas to be analyzed for purposes of this designation. The proposed rule to designate critical habitat and the Draft Biological Report (NMFS 2010a) analyze how each of these areas meets the definition of critical habitat set forth in Section 3 of the ESA.
2. Identify activities (e.g., NPDES-permitted facilities or tidal-wave projects) that may affect black abalone primary constituent elements (PCEs) and therefore may incur an economic impact because of the black abalone critical habitat designation.
3. Estimate the baseline level of protection afforded black abalone habitat by area and activity type.
4. For each economic activity, establish the existing and expected level of economic activity that may be affected by black abalone critical habitat conservation efforts in each critical habitat area.
5. Estimate potential incremental economic impacts of black abalone critical habitat conservation efforts by economic activity type and sum by area.

These steps are described in greater detail below.

1.4.1 Define Geographic Study Area

The geographic area spans from the Del Mar Landing Ecological Reserve to Dana Point in California, including several offshore islands (NMFS 2010a). NMFS has divided this area into 20 specific areas to be considered for critical habitat designation (hereafter, "areas"), as shown in Figure 1.4-1. The proposed rule to designate critical habitat for black abalone and the Draft Biological Report (NMFS 2010a) describe how each of these areas meets the definition of critical habitat. Within each of the 20 areas below, the area considered for designation as critical habitat includes the rocky intertidal habitat from the mean higher high water (MHHW) line onshore to 6 meters depth offshore:

- **Area 1:** From Del Mar Landing Ecological Reserve to Bodega Head
- **Area 2:** From Bodega Head to Point Bonita
- **Area 3:** Farallon Islands
- **Area 4:** From the southern point at the mouth of San Francisco Bay to Moss Beach
- **Area 5:** From Moss Beach to just north of Pescadero State Beach
- **Area 6:** Año Nuevo Island
- **Area 7:** From just north of Pescadero State Beach to Natural Bridges State Beach
- **Area 8:** From Pacific Grove to Prewitt Creek
- **Area 9:** From Prewitt Creek to Cayucos
- **Area 10:** From Montaña de Oro State Park to just south of Government Point
- **Area 11:** Palos Verdes Peninsula from the Palos Verdes/Torrance border to Los Angeles Harbor
- **Area 12:** From Corona Del Mar State Beach to Dana Point
- **Area 13:** San Miguel Island
- **Area 14:** Santa Rosa Island
- **Area 15:** Santa Cruz Island
- **Area 16:** Anacapa Island
- **Area 17:** San Nicolas Island
- **Area 18:** Santa Barbara Island
- **Area 19:** Catalina Island
- **Area 20:** San Clemente Island

Figure 1.4-1: Specific Areas Considered for Designation as Black Abalone Critical Habitat, Specific Areas 1-8

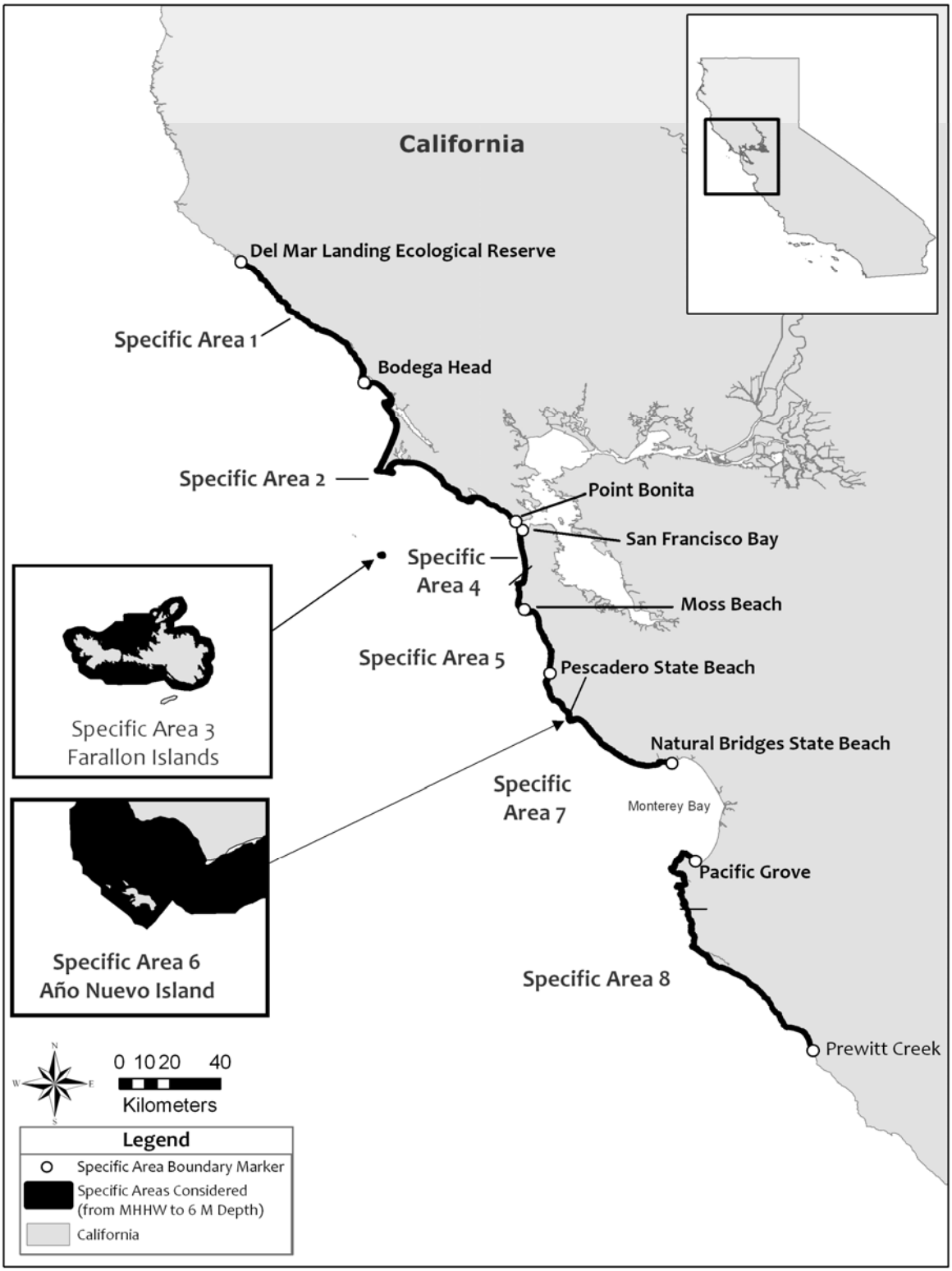


Figure 1.4-2: Specific Areas Considered for Designation as Black Abalone Critical Habitat, Specific Areas 9, 10, 13, 14, 15, and 16

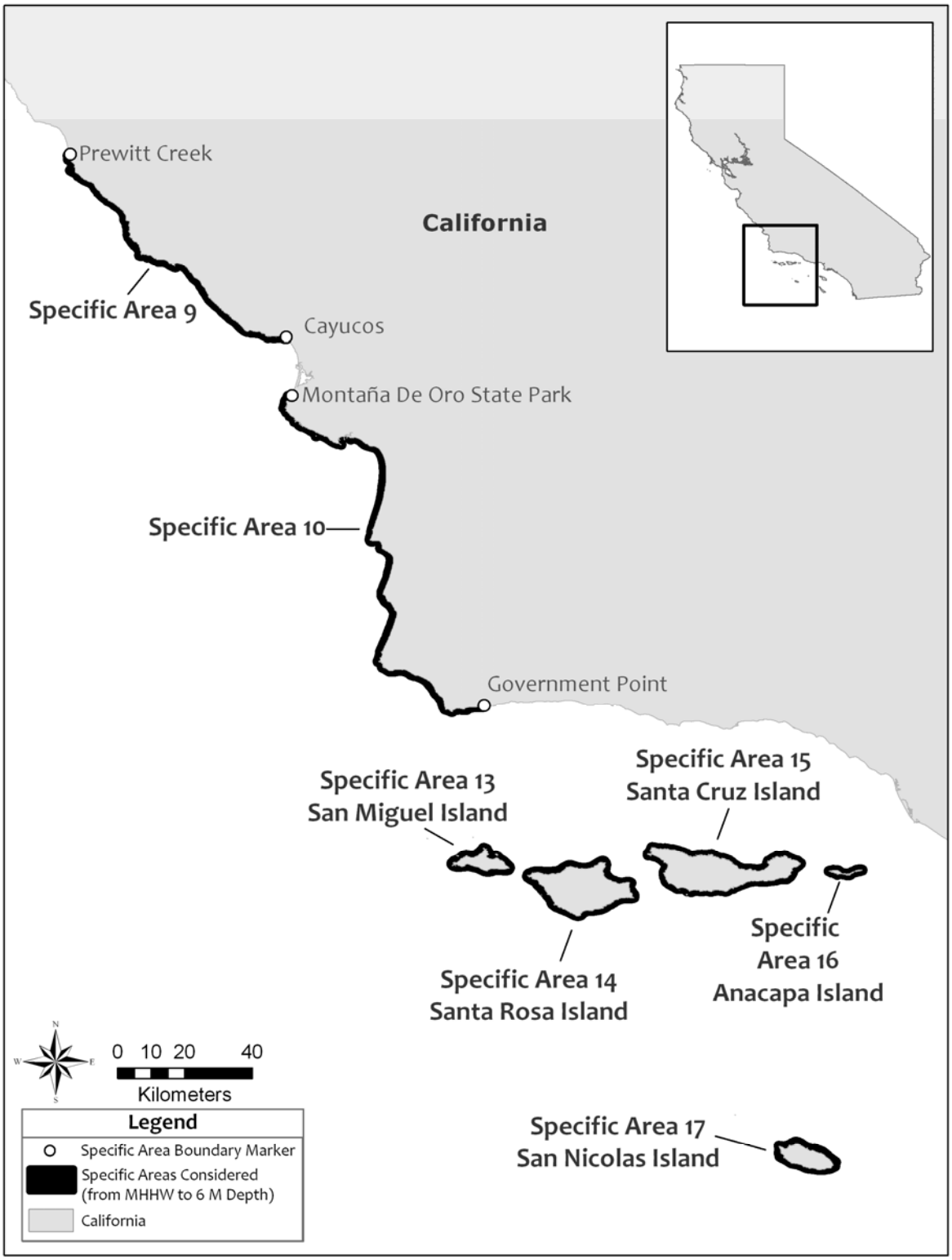
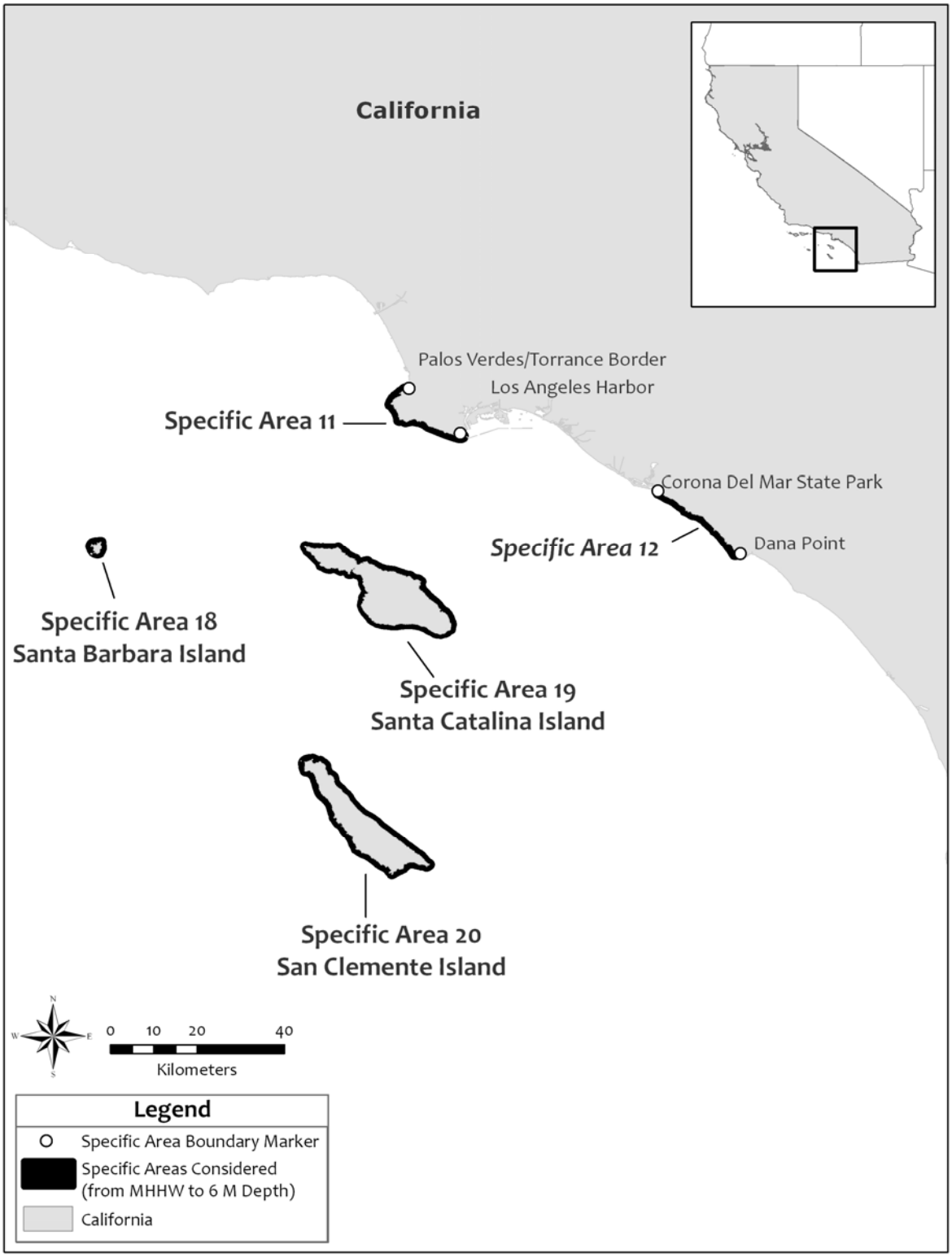


Figure 1.4-3: Specific Areas Considered for Designation as Black Abalone Critical Habitat, Specific Areas 11, 12, 18, 19, and 20



For most categories of activities analyzed in this economic report, the boundaries of these 20 areas make up the geographic study area for the economic analysis. Certain categories of activities, however, may not occur within the boundaries of these 20 areas, but may still have an effect on these areas and, thus, be affected by the designation of black abalone critical habitat. These categories of activities include NPDES-permitted facilities (point source pollution may runoff into nearshore coastal marine waters) and agricultural activities (such as pesticide application, irrigation, and livestock farming). A different geographic study area was defined for the analysis of economic impacts to these categories of activities, to include activities that occur outside of the boundaries of the 20 areas, but that may still be affected by the designation.

Previous critical habitat designations have defined the geographic study area for such activities based on a fixed distance from the boundaries of the occupied specific areas. For example, the proposed leatherback sea turtle critical habitat designation considered activities occurring within 1 mile (low economic impact estimate) and 5 miles (high economic impact estimate) of the mean lower low water (MLLW) line along the outer coast. For black abalone, however, information is lacking to determine the appropriate fixed distance from the specific area boundaries within which activities may be affected by the critical habitat designation. Instead, this analysis defined the geographic study area for NPDES-permitted facilities and agricultural activities by using standard watershed units as mapped by the U.S. Geological Survey and described by ten-digit, fifth-field hydrologic unit codes (referred to in this report as HUC5s, or "watersheds") and by twelve-digit, sixth-field hydrologic unit codes (referred to in this report as HUC6s, or "subwatersheds"). In one area, standard watershed units described by eight-digit, fourth-field hydrologic unit codes (referred to in this report as HUC4s, or "cataloguing units") were used. It is important to note that each HUC4 consists of two or more HUC5s, which each consists of two or more HUC6s. Thus, the HUC6s are the base unit in this analysis. Below is a description of the step-wise approach used to define the geographic study area for these three categories of activities.

Within each of the 20 areas, we first identified the watersheds and subwatersheds that border and drain directly into rocky intertidal areas. We defined two different geographic study areas to obtain a "low" economic impact estimate (hereafter, "low buffer") and a "high" economic impact estimate (hereafter, "high buffer"). For the low buffer, the geographic study area included the HUC6s that border and drain directly into rocky intertidal habitat within each of the 20 areas. For the high buffer, the geographic study area included the HUC6s within the HUC5s that border and drain directly into rocky intertidal habitat within each of the 20 areas.

We then identified watersheds and subwatersheds that do not border and drain directly into the rocky intertidal habitats within the 20 areas, but that are located close enough that discharge from the watershed or subwatershed could potentially affect rocky intertidal habitats. To identify these watersheds and subwatersheds, we used data on the plume extent of coastal California rivers. In a study of flood output from 110 coastal California watersheds in 1998 (an El Niño year), the average plume extent into nearshore waters was found to be 30 km out from the coast.[10] This average plume extent of 30 km is reasonable for a river about the size of the Santa Clara River (with a drainage basin of 4,178 km^2)[11] during storm events.[12] Using this information, we identified all coastal rivers along the coast of California with a drainage area of at least 3,000 km^2 that occur within 30 km of rocky intertidal habitat within the 20 areas. The coastal rivers included were (the drainage area and the areas that may be affected are listed in parentheses):

- The Pajaro River (3,393 km^2; specific area 7 – from just north of Pescadero State Beach to Natural Bridges State Beach, and specific area 8 – from Pacific Grove to Prewitt Creek);
- The Salinas River (10,952 km^2; specific area 7 – from just north of Pebble Beach to Natural Bridges, and specific area 8 – from Pacific Grove to Prewitt Creek);
- The Santa Maria River (4,815 km^2; specific area 10 – from Montaña de Oro to just south of Government Point);
- The Santa Clara River (4,178 km^2; specific area 16 – Anacapa Island); and
- The Santa Ana River (4,381 km^2; specific area 12 – from Corona del Mar State Beach to Dana Point).

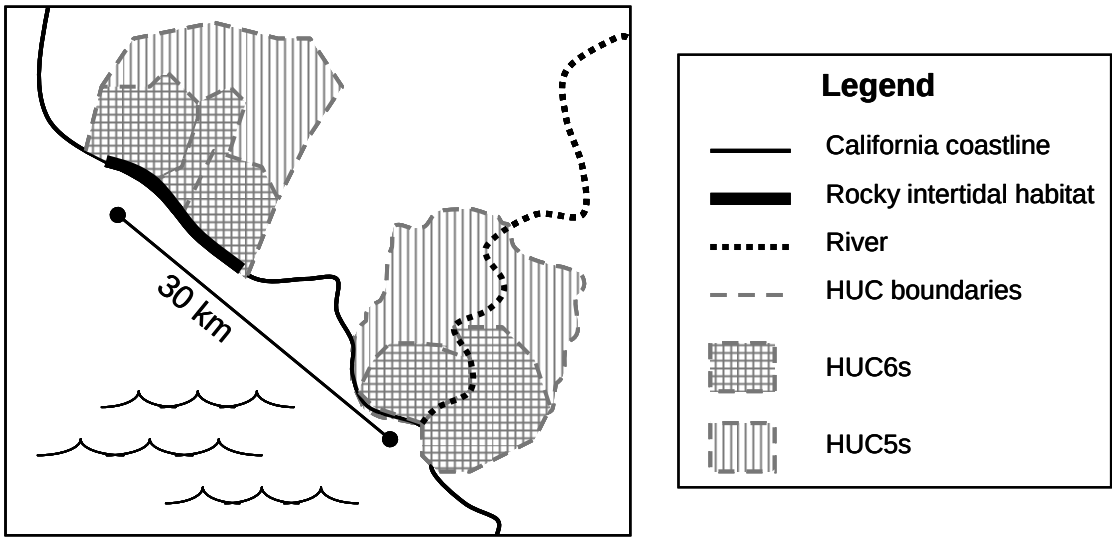
For the low buffer, the geographic study area included the HUC6s around the mouth of the river. For the high buffer, the geographic study area included the HUC6s within the HUC5s around the mouth of the river. Thus, the geographic study area for each of the 20 areas included (see Figure 1.4-2): (a) for the low buffer, the HUC6s that border and drain directly into rocky intertidal habitat; and (b) for the high buffer, the HUC6s within the HUC5s that border and drain directly into rocky intertidal habitat, as well as those that border the mouths of coastal rivers with a drainage area of at least 3,000 km^2 and that are within 30 km of rocky intertidal habitat within the specific areas.

[10] Mertes and Warrick 2001.
[11] Willis and Griggs 2003
[12] Personal communication with J. Warrick, USGS, on May 12, 2010

Finally, the San Francisco Bay (including the south bay and extending up to where the Napa River flows into the bay) and surrounding areas (specific areas 2, 3, and 4) were treated as unique cases. The San Francisco Bay plume extends out from the mouth of the bay to as far as the Gulf of the Farallones (Hurst and Bruland 2008), and may affect rocky intertidal habitats within specific area 2 (from Bodega Head to Point Bonita), specific area 3 (the Farallon Islands), and specific area 4 (from the southern point at the mouth of San Francisco Bay to Moss Beach). Several watersheds drain into the San Francisco Bay and out into nearshore coastal waters. In order to account for all of the watersheds draining into the San Francisco Bay, we considered all of the HUC6s making up the HUC5s that border and drain directly into the San Francisco Bay, for the high buffer only. For the high buffer, the geographic study area included all of the HUC6s within the HUC5s bordering San Francisco Bay. Thus, the geographic study area for specific areas 2, 3, and 4 included: (a) for the low buffer, the HUC6s that border and drain directly into rocky intertidal habitat within the specific areas; and (b) for the high buffer, the HUC6s within the HUC5s that border and drain directly into rocky intertidal habitat within the specific areas, as well as those that border San Francisco Bay.

Figure 1.4-4 illustrates how the geographic study area was defined for the analysis of economic impacts on NPDES-permitted facilities and agricultural activities. The coastline for an occupied specific area is depicted below. For the low buffer, the geographic study area for this specific area consists of the HUC6s that border and drain directly into rocky intertidal habitat. For the high buffer, the geographic study area for this specific area consists of the HUC5 (encompassing the HUC6s) that border and drain directly into rocky intertidal habitat, as well as the HUC5 that borders the mouth of the river (note that for clarity, not all of the HUC6s within the HUC5s are depicted in the illustration).

Figure 1.4-4: Illustration of Geographic Study Area Defined for NPDES-permitted Facilities and Agricultural Activities.



1.4.2 Identify Economic Activities That May Affect PCEs

Joint NMFS-U.S. Fish and Wildlife Service regulations, 50 CFR 424.12(b), state that in determining what areas are critical habitat, the agencies "shall consider those physical and biological features that are essential to the conservation of a given species and that may require special management considerations or protection." Features to consider may include, but are not limited to:

(1) Space for individual and population growth, and for normal behavior;

(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;

(3) Cover or shelter;

(4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally;

(5) Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

ESA regulations also require agencies to "focus on the principle biological or physical constituent elements" (hereafter referred to as "Primary Constituent Elements" or PCEs) within the specific areas considered for designation. NMFS identified five PCEs essential for the conservation of black abalone in marine waters of the U.S. West Coast (see the Draft Biological Report (NMFS 2010a) for more information on PCEs):

1. *Rocky substrate*. Suitable rocky substrate includes rocky benches formed from consolidated rock of various geological origins (e.g., igneous, metamorphic, and sedimentary) that contain channels with macro- and micro- crevices or large boulders (greater than or equal to 1 m in diameter) and

occur from mean higher high water (MHHW) to a depth of 6 m. All types of relief (high, medium and low; 0.5 to greater than 2 m vertical relief; Wentworth, 1922) support black abalone and complex configurations of rock surfaces likely afford protection from predators, direct impacts of breaking waves, wave-born projectiles, and excessive solar heating during daytime low tides. Most black abalone occupy the middle and lower intertidal zones. In highly exposed locations downwind of large offshore kelp beds, the majority of abalone may be found in the high intertidal where drift kelp fragments tend to be concentrated by breaking surf. Leighton (1959) found evidence for ontogenetic shifts in depth distribution among juvenile abalone on the Palos Verdes Peninsula. Juvenile black abalone (10-30 mm) were found at mid-intertidal depths on undersides of rock providing clear beneath-rock open space while juveniles in the 5-10 mm size range were found at higher intertidal zones in narrow crevices and in depressions abraded into rock surfaces by the intertidal chiton, *Nutallina californica* (Reeve, 1847). Black abalone observed at greater depths (3-6 m) typically were mature adults. California contains approximately 848.5 miles (1365.5 km) of consolidated rocky coastline and 599.3 miles (964.5 km) or 70 percent of it falls within the areas considered in this proposed critical habitat designation.

2. *Food resources*. Abundant food resources including bacterial and diatom films, crustose coralline algae, and a source of detrital macroalgae, are required for growth and survival of all stages of black abalone. From post-larval metamorphosis to a size of about 20 mm, black abalone consume microbial and possibly diatom films (Leighton, 1959; Leighton and Boolootian, 1963; Bergen, 1971) and crustose coralline algae. At roughly 20 mm black abalone begin feeding on both attached macrophytes and pieces of drift plants cast into the intertidal zone by waves and currents. The primary macroalgae consumed by juvenile and adult black abalone are giant kelp (*Macrocystis pyrifera*) and feather boa kelp (*Egregia menziesii*) in southern California (i.e., south of Point Conception) habitats, and bull kelp (*Nereocystis leutkeana*) in central and northern California habitats (i.e., north of Santa Cruz). Southern sea palm (*Eisenia arborea*), elk kelp (*Pelagophycus porra*), stalked kelp (*Pterygophora californica*), and other brown kelps (*Laminaria sp.*) may also be consumed by black abalone.
3. *Juvenile settlement habitat*. Rocky intertidal habitat containing crustose coralline algae and crevices or cryptic biogenic structures (e.g., urchins, mussels, chiton holes, conspecifics, anemones) is important for successful larval recruitment and juvenile growth and survival of black abalone less than approximately 25 mm shell length. The presence of adult abalone may facilitate larval settlement and metamorphosis, because adults may: (1) promote the maintenance

of substantial substratum cover by crustose coralline algae by grazing other algal species that could compete with crustose coralline algae; and/or (2) outcompete encrusting sessile invertebrates (e.g. tube worms and tube snails) for space on rocky substrates thereby promoting the growth of crustose coralline algae and settlement of larvae; and/or (3) emit chemical cues necessary to induce larval settlement (Miner *et al.*, 2006; Toonen and Pawlick, 1994). Increasing partial pressure of CO_2 may decrease calcification rates of coralline algae, thereby reducing their abundance and ultimately affecting the survival of newly settled black abalone (Feely *et al.*, 2004; Hall-Spencer *et al.*, 2008). Laboratory experiments have shown that the presence of pesticides (e.g., dichlorodiphenyltrichloroethane (DDT), 2,4-dichlorophenoxyacetic acid (2,4-D), methoxychlor, dieldrin) interfered with larval settlement of abalone because the chemical cues emitted by coralline algae and its associated diatom films which trigger abalone settlement are blocked (Morse *et al.*, 1979), and the pesticide oxadiazon was found to severely reduce algal growth (Silver and Riley, 2001). We are not aware of additional information regarding processes that mediate crustose coralline algae abundance and solicit the public for more information on this topic.

4. *Suitable water quality*. Suitable water quality includes temperature, salinity, pH, and other chemical characteristics necessary for normal settlement, growth, behavior, and viability of black abalone. The biogeographical water temperature range of black abalone is from 12 to 25ºC, but they are most abundant in areas where the water temperature ranges from 18 to 22ºC (Hines *et al.*, 1980). There is increased mortality due to WS during periods following elevated sea surface temperature (Raimondi *et al.*, 2002). The CHRT did not consider the presence of the bacteria that causes WS when evaluating the condition of this PCE because it is thought to be present throughout a large portion of the species' current range (greater than 60 percent), including all coastal specific areas south of Monterey County, CA and the Farallon Islands (J. Moore, pers. comm.). Instead the CHRT relied on sea surface temperature information to evaluate water quality in terms of disease virulence, recognizing that elevated sea surface temperatures are correlated with increased rates of WS transmission and manifestation in abalone. Elevated levels of contaminants (e.g., copper, oil, polycyclic aromatic hydrocarbon (PAH) endocrine disrupters, persistent organic compounds (POC)) can cause mortality of black abalone. In 1975, toxic levels of copper in the cooling water effluent of a nuclear power plant near Diablo Canyon, California, were associated with abalone mortalities in a nearshore cove that received significant effluent flows (Shepherd and Breen, 1992; Martin *et al.*, 1977). As mentioned above for the *Juvenile settlement habitat* PCE, laboratory experiments have shown that the presence of some pesticides

interfere with larval settlement of abalone (Morse *et al.*, 1979) and severely reduce algal growth (Silver and Riley, 2001). We are not aware of other studies that have established direct and indirect links between currently used pesticides and effects on black abalone habitat quality and solicit the public for more information on this topic. The suitable salinity range for black abalone is from 30 to 35 parts per thousand (ppt), and the suitable pH range is 7.5 - 8.5. Ocean pH values that are outside of the normal range for seawater (i.e., pH less than 7.5 or greater than 8.5; http://www.marinebio.net/marinescience/02ocean/swcomposition.htm) may cause reduced growth and survivorship in abalone as has been observed in other marine gastropods (Shirayama and Thornton, 2005). Specifically, with increasing uptake of atmospheric CO_2 by the ocean, the pH of seawater becomes more acidic, which may decrease calcification rates in marine organisms and result in negative impacts to black abalone in at least two ways: (1) disrupting an abalone's ability to maintain and grow its protective shell; and/or (2) reducing abundance of coralline algae (and associated diatom films and bacteria), a calcifying organism that may mediate settlement through chemical cues and support and provide food sources for newly settled abalone (Feely *et al.*, 2004; Hall-Spencer *et al.*, 2008).

5. *Suitable nearshore circulation patterns*. Suitable circulation patterns are those that retain eggs, sperm, fertilized eggs and ready-to-settle larvae enough so that successful fertilization and settlement to suitable habitat can take place. Nearshore circulation patterns are controlled by a variety of factors including wind speed and direction, current speed and direction, tidal fluctuation, geomorphology of the coastline, and bathymetry of subtidal habitats adjacent to the coastline. Anthropogenic activities may also have the capacity to influence nearshore circulation patterns (e.g., intake pipes, sand replenishment, dredging, in water construction, etc.). These factors, in combination with the early life history dynamics of black abalone, may influence retention or dispersal rates of eggs, sperm, fertilized eggs and ready-to-settle larvae (Siegel *et al.*, 2008). Given that black abalone gamete and larval durations are relatively short, larvae have little control over their position in the water column, and ready-to-settle larvae require shallow, intertidal habitat for settlement, forces that disperse larvae offshore (i.e., by distances on the order of greater than tens of kilometers) may decrease the likelihood that they will successfully settle to suitable habitats. However, retention of larvae inshore due to bottom friction and minimal advective flows near kelp beds (the "sticky water" phenomenon; Wolanski and Spagnol, 2000; Zeidberg and Hamner, 2002) may increase the likelihood that larvae will successfully settle to suitable habitats.

NMFS then identified 17 categories of economic activity that may have an effect on one or more of the five PCEs described above. These "activities" may require modification to avoid destruction or adverse modification of black abalone critical habitat. These activities include the operation of some facilities, such as water temperature control, 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
- Sand replenishment
- NPDES-permitted facilities
- Coastal urban development
- Side-casting
- Agriculture (including pesticide application, irrigation, and livestock farming)
- Oil & chemical spills: prevention & clean-up
- Vessel groundings
- Power plants
- Desalination plants
- Tidal and wave energy projects
- Liquefied natural gas (LNG) projects
- Mineral and petroleum exploration and extraction
- Non-native species: prevention and management
- Kelp harvesting
- Activities that lead to global climate change (e.g. fossil fuel combustion)

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

1.4.3 Estimate the Baseline Level of Protection Afforded Black Abalone

If the critical habitat rule goes into effect, activities affecting black abalone 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 black abalone critical habitat over and above other baseline protections that may already be in place. Because of the close relationship in terms of management requirements under the ESA between black abalone and other listed threatened and

endangered species, protections for these species may provide the strongest baseline protections to black abalone critical habitat areas. The following sections provide additional detail regarding baseline protections (i.e. National Marine Sanctuaries and other critical habitats) that are provided by these species to black abalone critical habitat. In addition, a number of regulations, laws, and initiatives have been created specifically to address human-induced impacts on marine species and their habitats. These are summarized in Appendix B.

National Marine Sanctuaries

There are three Nation Marine Sanctuaries (NMS) along the California coast: (1) the Gulf of the Farallones National Marine Sanctuary (GFNMS), which spans from Bodega Rock, CA to Rocky Point, CA (Areas 2 and 3); (2) the Monterey Bay National Marine Sanctuary (MBNMS), which runs from Rocky Point, CA to Cambria, CA (Areas 4-9); and (3) the Channel Islands National Marine Sanctuary (CINMS) which is made up of San Miguel Island (Area 13), Santa Rosa Island (Area 14), Santa Cruz Island (Area 15), Anacapa Island (Area 16), and Santa Barbara Island (Area 18). Both the GFNMS and CINMS prohibit: exploring for, developing, or producing minerals within the Sanctuary, discharging or depositing of any materials into the Sanctuary; and drilling into, dredging, constructing or placing any structure or material into the Sanctuary.[13] The GFNMS also prohibits: oil and gas exploration; oil tankers, barges, and other merchant and cargo vessels; introducing or otherwise releasing from within or into the Sanctuary an introduced species; and anchoring and deserting a vessel within the Sanctuary.[14] The MBNMS prohibits exploring for, developing, or producing oil and gas. The MBNMS restricts the alteration of or construction on seafloor and discharging or depositing of any materials into the Sanctuary.[15]

Salmon and Steelhead Critical Habitat

Salmon and steelhead critical habitats are almost exclusively riverine and do not overlap with the areas being considered for designation as black abalone critical habitat. However, some modifications to upland and riverine activities (e.g., restrictions to pesticide use) may affect water quality and prey in the areas being considered for designation as critical habitat for black abalone. The degree and extent of effects are unknown. Because of the high visibility and regional importance of salmon and steelhead

[13] Complete list found at: Channel Islands National Marine Sanctuary. *Regulations and Restrictions*. Accessed at: http://channelislands.noaa.gov/drop_down/reg.html, on May 2010.
[14] Gulf of the Farallones National Marine Sanctuary Accessed at: http://farallones.noaa.gov/, on May 2010.
[15] Marine Conservation Biology Institute. *Monterey Bay National Marine Sanctuary*. Accessed at: http://www.mcbi.org/what/what_pdfs/Monterey_Bay.pdf, on May 2010.

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.[16] 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.[17] 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.

Green Sturgeon Critical Habitat

Green sturgeon critical habitat includes marine waters within 60 fathoms depth along the west coast. Thus, consultations on this species may overlap with the areas being considered for designation as black abalone critical habitat. NMFS identified several activities that would affect green sturgeon critical habitat in marine coastal waters, including dredging, in-water construction, NPDES, agricultural pesticide application, power plants, desalination plants, and tidal and wave energy projects (73 FR 52084 September 8, 2008). These categories of activities have also been identified as special management concerns for the areas being considered for designation as black abalone critical habitat. It also is worth noting that all of the approximately 20 completed formal consultations that address impacts to green sturgeon to date also address impacts to one or more listed salmon and/or steelhead species. Salmonid species included in green sturgeon consultations to date have largely been located in Northern California.

Proposed Leatherback Sea Turtle Critical Habitat

Critical habitat for the leatherback sea turtle is currently proposed within marine waters out to the 2,000 meter depth contour along the west coast. Thus, consultations on this species may overlap with the areas being considered for designation as black abalone critical habitat. NMFS identified several activities that would affect the proposed leatherback critical habitat in marine coastal waters, including NPDES, agricultural pesticide application, oil spills, power plants, desalination plants, and tidal and wave energy projects (75 FR 319 January 5, 2010). These categories of activities have also been identified as special

[16] National Marine Fisheries Service. *Final Economic Analysis of Critical Habitat Designation for Seven West Coast Salmon and Steelhead ESUs*. Long Beach, CA, August 2005.

[17] 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.

management concerns for the areas being considered for designation as black abalone critical habitat. Protections for the proposed leatherback critical habitat may provide some baseline protection once it is finalized. However, since it has not yet been finalized, it does not provide any baseline protections at this time.

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 current and expected actions likely to be affected by critical habitat designation for black abalone for each potentially affected economic activity in each area being considered for designation. This level of future activity is developed using GIS data and other published data on existing, pending, or future actions [e.g., Federal Energy Regulatory Commission (FERC) permit license data for liquefied natural gas projects]. Due to 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 affect black abalone, the number of projects requiring modifications to avoid impacts to black abalone 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 three desalination plants exist in the areas, seven 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 black abalone. However, due to the uncertainty of the approval rate for proposed desalination plants, it is unknown at this time as to whether all of these projects will be constructed.

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 that may require consultation regarding black abalone critical habitat. We also recognize that because black abalone and other listed species, particularly Southern DPS green sturgeon, occur in the areas being considered for designation, a portion of affected future projects would be expected to undertake conservation efforts that are protective of black abalone critical habitat regardless of this rule. Thus, after estimating the number of projects potentially required to undertake conservation efforts, we then apply a scaling factor (the “incremental score”) to more accurately represent the portion of the project modifications that would be affected by the black abalone critical habitat over and above the existing baseline. For example, a power plant in black abalone critical habitat may be required to implement conservation measures to minimize effects of water temperature changes, but, due

to the listing of black abalone, some portion of those measures may already be implemented absent critical habitat for black abalone.

In order to determine the incremental scores associated with any possible change to activities, the existing protections in each area were considered. Information on various regulations that are believed to contribute to existing protections is available within this economic report. Also considered in some areas for some activities were consultations that NMFS has already engaged in via section 7 of the ESA and the conservation measures that have been included in those reports. Laws in place to conserve and protect marine resources include the Coastal Zone Management Act and various state regulations along with regulations promulgated by the three National Marine Sanctuaries within the area. Critical habitat for green sturgeon has recently been designated in nearshore waters along much of the west coast and changes to activities necessary to protect green sturgeon critical habitat may yield benefits to black abalone critical habitat in these areas of overlap. Further, whether or not ESA listed species, critical habitat or marine mammals protected under the MMPA, were present in the area was taken into consideration. While protection afforded to ESA listed species may not directly affect black abalone critical habitat, they may provide indirect benefits. Table 1.4-1 outlines the basis for the incremental scoring based on existing Federal, state, and local standards and regulations as well as overlap with other critical habitats. (Refer to Table 3-4 for a summary of scores for all areas being considered for designation).

Table 1.4-1: Basis for Incremental Scoring

Score	Existing Federal, state, and local standards and regulations	Other critical habitats
0.1	High	Some overlap with other critical habitats, however needs of the species differ slightly.
0.2	High	No overlap
0.5	Moderate	Similar costs used in other critical habitats, which attributed 100% to the exact same activities analyzed; however, needs of the species differ.
1.0	Little to none	No overlap

1.4.5 Estimate Potential Economic Impacts by Area

For each potentially affected economic activity, we identify project modifications that may be necessary to avoid destruction or adverse modification of the areas being considered for designation as black abalone critical habitat. Because a large degree of uncertainty exists with regard to future actions likely to be undertaken specifically for the benefit of black abalone critical habitat, this analysis begins by estimating economic impacts of likely management actions that may take into account black abalone as well as other listed species.

1.4.6 Calculate Total Impacts by Area

To create a total impact estimate for each area being considered for designation, we multiplied the number of affected projects by the annualized costs per project and the incremental score for each area and economic activity type, then summed these activity scores in each area. This process is summarized in the following equation:

$$C_U = \sum_i N_{i,U} x C_{i,U} x I_{i,U}$$

Where

C_U = Total annualized economic impacts (costs) for area 'U' (*2010 dollars*)

$N_{i,U}$ = Annual number of affected projects for activity 'i' in area 'U'

$C_{i,U}$ = Annualized economic impacts (costs) on activity 'i' in area 'U' (*2010 dollars*)

$I_{i,U}$ = Incremental impact of black abalone critical habitat on activity 'i' in area 'U' (*0.1 – 1.0*)

The final estimates of the total impacts by area are presented in Section 3 of this analysis.

1.4.7 Discount Rate

The OMB Circular A-94 states that a 7 percent discount rate should be used as a base-case for regulatory analysis to approximate the marginal pretax rate of return on an average investment in the private sector in recent years.[18] Major assumptions should be varied and net present value and other outcomes recomputed to determine how sensitive outcomes are to changes in the assumptions.[19] For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent.[20] Thus Section 2 of this analysis assumes a discount rate of 7 percent. Appendix D tests the sensitivity of this assumption by applying a discount rate of 3 percent.

1.4.8 Analytical 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 and water uses in the study area is 20 years. In most cases, therefore, the analysis estimates economic impacts from 2010 to 2029 (20 years from the expected year of a critical habitat designation).

1.5 Report Organization

The remainder of this report proceeds through three sections, including:

- Section 2 describes the 17 categories of economic activity that may require modification to avoid destruction or adverse modification of black abalone critical habitat, if designated.
- Section 3 discusses the results of the analysis by area and activity. These results are derived from the activity counts and related cost estimates presented in earlier sections.
- Appendix A summarizes threats to black abalone critical habitat identified by NMFS.
- Appendix B summarizes laws and regulations that may provide baseline protection to black abalone critical habitat.
- Appendix C provides a sensitivity analysis testing the degree to which black abalone critical habitat drive the costs in particular areas.
- Appendix D tests the sensitivity of the discount rate by applying a 3 percent discount rate.
- Appendix E presents an Initial Regulatory Flexibility Analysis.
- Appendix F analyzes energy impacts.

[18] U.S. Office of Management and Budget. 1992. "Circular A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs." October 29, 1992. Accessed at: http://www.whitehouse.gov/omb/assets/a94/a094.pdf.
[19] Ibid.

SECTION 2: ECONOMIC IMPACTS BY ACTIVITY

NMFS identified 17 categories of economic activity that may require modification to avoid destruction or adverse modification of black abalone critical habitat, if designated. This section describes each activity in terms of their threat to black abalone, extent of occurrence within critical habitat, specific baseline elements that may provide protection to black abalone, and the potential economic impacts of black abalone conservation efforts.

Ten of the 17 categories have a quantitative assessment with specific cost estimates presented for each activity type. These activities are: in-water construction, sand replenishment, national pollutant discharge elimination system (NPDES) permitted facilities, coastal urban development, side-casting, agricultural activities (irrigation), oil & chemical spills, power plants, desalination plants, and tidal and wave energy projects. The remaining activities are discussed qualitatively due to uncertainty regarding project modifications and lack of cost data. They are: dredging, agricultural activities (pesticide application and livestock farming), vessel groundings, liquefied natural gas (LNG) projects, mineral and petroleum exploration and extraction, non-native species introduction and management, kelp harvesting, and activities that lead to global climate change.

As stated above, in Section 1.4.7, a seven percent discount rate is applied to all the activities below that have cost estimates. Appendix D provides a sensitivity analysis for this assumption, by imposing a three percent discount rate.

2.1 Economic Impacts of Critical Habitat Designation on Dredging and Disposal of Dredged Material, and In-water Construction Projects

2.1.1 Description of Threat

NMFS identified dredging and disposal of dredged material as a potential threat to the essential features of the black abalone critical habitat. While there are currently no identified dredging and disposal activities within the boundaries of the areas considered for designation as critical habitat for black abalone, the activity is still considered a potential concern.[21] This activity may affect the *rocky substrate*

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

[21] Note that this is looking at dredging/disposal as the main activity, and does not include dredging/disposal activities that occur as part of other activities. For example, dredging/disposal may occur as part of in-water construction and the costs would be included in the estimated costs for those activities.

and *water quality* PCEs. For harbors, dredging and disposal typically occurs off sandy habitats and may not affect black abalone habitat. Dredging that occurs near rocky intertidal areas, however, may cause increased sedimentation onto rocky substrate. In addition, a variety of harmful substances, including heavy metals, oil, TBT, PCBs and pesticides, can be effectively absorbed into the seabed sediments. The dredging and disposal processes can release these contaminants into the water column, affecting water quality, and making them available to be taken up by animals and plants, which could cause morphological or reproductive disorders.[22]

NMFS has identified in-water construction or alteration activities (excluding dredging) as a potential threat to the essential features identified for black abalone critical habitat in four areas: Areas 10, 17, 19, and 20. In-water construction activities include: coastal armoring, pier construction, pile driving, jetties, harbors, and other large in-water structures, etc. that may cause increased sedimentation or affect wave action along the coast. These activities may affect the *rocky substrate*, *food resources*, *settlement habitat*, and *nearshore circulation pattern* PCEs. During construction or maintenance of in-water structures, increased sedimentation can smother or scour adults and juveniles as well as interfere with feeding and larval settlement.[23] Artificial structures may affect intertidal communities by providing stepping-stones between populations, resulting in range extensions for species with limited dispersal distances.[24] The presence of in-water structures may affect black abalone habitat by affecting the distribution and abundance of other intertidal invertebrate species or the distribution and abundance of algal species that provide food for abalone. Changes in algal communities could also affect settlement of larval abalone (believed to be influenced by coralline algae). Artificial structures, like breakwaters, may also alter the physical environment by reducing wave action and modifying nearshore circulation and sediment transport.[25] Construction of coastal defense structures (such as breakwaters) to protect against flooding or to prevent coastal erosion is likely to increase over the next decades in response to sea level rise or the increased frequency of storms.[26]

2.1.2 Regulatory Environment & Extent of Activity

The Federal nexus for these types of projects may be through the permitting or funding provided by the U.S. Army Corps of Engineers (USACE), Navy, US Air Force, and National Marine Sanctuaries (NMS) permits (required in sanctuaries). The USACE issues permits pursuant to Section 10 of the Rivers and

[22] ABP Research R512 1995
[23] Airoldi 2003
[24] Thompson et al. 2002
[25] Martins et al. 2009
[26] Thompson et al. 2002

Harbors Act of 1899 (RHA), and Section 404 of the Clean Water Act (CWA), among several others.[27] Although in-water construction projects are commonly undertaken by private or non-Federal parties, in most cases they must obtain a USACE permit. The USACE must then consult with NOAA fisheries under section 7 of the ESA.

Section 10 of the RHA requires approval prior to the accomplishment of any work in or over navigable waters of the United States, or which affects the course, location, condition or capacity of such waters. Typical activities requiring Section 10 permits are:

- Construction of piers, wharves, bulkheads, dolphins, marinas, ramps, floats, intake structures, and cable or pipeline crossings.

Section 404 of the CWA requires approval prior to discharging dredged or fill material into the waters of the United States. Typical activities requiring Section 404 permits are:

- Depositing of fill or dredged material in waters of the U.S. or adjacent wetlands.
- Site development fill for residential, commercial, or recreational developments.
- Construction of revetments, groins, breakwaters, levees, dams, dikes, and weirs.
- Placement of riprap and road fills.

The purpose of the Section 404 program is to insure that the physical, biological, and chemical quality of our nation's water is protected from irresponsible and unregulated discharges of dredged or fill material that could permanently alter or destroy these valuable resources.

For this analysis, the location and frequency of dredging projects within the specific areas is based on the USACE awarded dredging contracts advertised by the USACE from Fiscal Year 2000 to 2009.[28] However, most of the dredging projects in California take place in rivers or in bays, to allow for vessels with deep drafts to safely navigate or maneuver. These types of areas are not being considered for designation. Thus, these data indicate that there are currently no dredging and disposal activities occurring in the specific areas.

[27] USACE. Permits for Navigational Dredging: Ports, Marinas, Refineries, Private Residences and Disposal of Dredged Material. Accessed at: http://www.spn.usace.army.mil/Permits/dredging_work_permits.html, on April 2010.
[28] U.S. Army Corps of Engineers. *Navigation Data Center, U.S. Waterway Data: Dredging Information System*. Accessed as: http://www.ndc.iwr.usace.army.mil/data/datadrg.htm on March 2010.

In-water construction activities are prevalent throughout the California coast in the specific 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 can be found in past actions. That is, this analysis identifies the location of in-water construction projects within the specific areas using the latitude and longitude of historic USACE section 10 jurisdictional determinations (JDs), which are believed to contain the bulk of relevant projects to black abalone habitat impacts. Approved and preliminary JDs are tools used by the USACE to help implement Section 404 of the CWA and Sections 9 and 10 of the RHA. Data containing approved and preliminary JDs were collected from the San Francisco and Los Angeles USACE Districts. The San Francisco district only had latitude and longitude data available for the year 2009, while the Los Angeles district had latitude and longitude data for the years 2004 to 2009. To adjust for temporal differences in the data, 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 Table 2.1-1.

Table 2.1-1: Approximate Location and Estimated Annual Level of In-water Construction Projects by Area

Area	Average Annual Number of JDs
10	0.6
17	0.2
19	0.4
20	0.2
Total	1.4

2.1.3 Impacts of Critical Habitat Designation on Dredging and Disposal of Dredged Material and In-water Construction Projects

Black abalone critical habitat could impose modifications related to dredging such as:

- Restrictions on the spatial and temporal extent of dredging activities and the deposition of dredge spoil; and
- Requirements to treat (detoxify) dredge spoil.

Modifications related to other in-water construction activities include:

- Bank stabilization measures; and
- More natural erosion control.

Table 2.1-2 summarizes potential per project costs (in 2010 dollars) for modifications to dredging and

disposal activities and to in-water construction activities resulting from the critical habitat designation for black abalone. These costs are based on the estimated costs reported in the economic report for the salmon and steelhead critical habitat designation.[29] The modifications considered in the economic analysis for the salmon and steelhead critical habitat designation may be similar, or identical, to those that could be required to protect black abalone critical habitat.

Table 2.1-2: Potential per Project Costs of Implementing Conservation Efforts for Dredging and In-water Construction Projects (2010$)

Specific Actions	Sub-Activity	Per Project Annualized Costs (Discounted at 7%)		
		Low	Mean	High
Dredging	Dredging	$46,250	$114,375	$182,500
In-water Construction	Bank stabilization	$4,750	$8,250	$11,750
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 2010 dollars using the U.S. Bureau of Economic Analysis, National Economic Accounts, National Income and Product Accounts table, 2010.				

Existing Federal, state, and local standards and regulations appear to offer the black abalone critical habitat some level of baseline protection. In addition, this analysis assumes that conservation measures undertaken for green sturgeon critical habitat may provide an additional baseline level of protection for black abalone critical habitat where habitats coexist. However, black abalone and green sturgeon have different habitat needs, and thus, different types of modifications would be considered to meet those needs. Therefore, this analysis assumes that approximately 50 percent of impacts in areas where green sturgeon critical habitat is present may be attributable to black abalone habitat (see Section 1.4.4 regarding the basis for scoring). In cases where green sturgeon critical habitat is not present, approximately 100 percent of impacts are attributed to black abalone habitat. Appendix C provides a sensitivity analysis for these assumptions, providing estimates assuming that black abalone critical habitat is responsible for the generation of all project modification costs for all projects. Although some level of protection would already be expected to exist under the listing of the black abalone, this analysis is unable to separate those costs from critical habitat costs. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to dredging and disposal of dredged material and in-water construction activities that may occur as a result of a black abalone critical habitat designation. NMFS will consider any additional information received in developing the final economic analysis supporting its final determinations to designate critical habitat for black abalone.

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

2.1.4 Summary of Economic Impacts to Dredging and Disposal of Dredged Material and In-water Construction Projects by Area

There are no known dredging and disposal activities within the boundaries of the specific areas. Therefore, NMFS was unable to present a quantitative assessment for possible dredging and disposal activity modifications for this analysis.

Table 2.1-3 presents a summary of potential impacts to in-water construction activities.

Table 2.1-3: Summary of Economic Impacts to In-water Construction Projects by Area

Area	Activity Count (Estimated Annual Number of Projects)	Incremental Score	Total Annualized Costs (Discounted at 7%)		
			Low	Mean	High
10	0.6	0.5	$1,400	$2,500	$3,500
17	0.2	1.0	$950	$1,650	$2,350
19	0.4	1.0	$1,900	$3,300	$4,700
20	0.2	1.0	$950	$1,650	$2,350
Total			$5,200	$9,050	$12,900

2.2 Economic Impacts of Critical Habitat Designation on Sand Replenishment

2.2.1 Description of Threat

NMFS has identified sand replenishment (or beach nourishment) as a potential threat to the essential features identified for black abalone critical habitat in four areas: Areas 2, 4, 7, and 11. This activity may affect the *rocky substrate* PCE.

Sand replenishment activities involve the placement of large amounts of sand in the supralittoral and intertidal zones. The amount of sand flowing from the supralittoral zone into the intertidal zone can be substantial, ranging anywhere from centimeters to more than a meter.[30] Sand movements could directly impact intertidal organisms by smothering or scouring.[31]

2.2.2 Regulatory Environment & Extent of Activity

Sand replenishment activities involve dredging sand from a source location and placing it at another location. Thus, sand replenishment activities have the same federal nexus as identified above for

[30] USACE. "Chapter 4: Environmental Effects of Beach Nourishment Projects." Accessed at: http://www.saw.usace.army.mil/coastal/ShoreProtectionBenefits_Part2.pdf.
[31] Littler 1983

dredging. The USACE is responsible for administering Section 404 permits under the CWA, which are related to sand replenishment activities (see Section 2.1.2 regarding Section 404 permit requirements).

For this analysis, the location and frequency of sand replenishment or beach nourishment projects within the specific areas is based on the USACE awarded dredging contracts advertised by the USACE from Fiscal Year 2000 to 2009, where the class of work is identified as "beach nourishment."[32] These data are shown in Table 2.2-1.

Table 2.2-1: Approximate Location and Estimated Annual Level of Sand Replenishment Projects by Area

Area	Estimated Annual Number of Projects
2	0.2
4	0.1
7	0.3
11	0.1
Total	0.7

2.2.3 Impacts of Critical Habitat Designation on Sand Replenishment

Black abalone critical habitat could impose modifications related to sand replenishment such as:[33]

- Monitor the water quality (turbidity) during and after the project.
- Place a buffer around pertinent areas within critical habitat that sand replenishment projects have to work around.
- Ensure any dredge discharge pipelines are sited to avoid rocky intertidal habitat.
- Construct training dikes to help retain the sand at the receiving location, which should minimize movement of sand into rocky intertidal areas.

It is unknown how many of the modifications listed above would be applied to future sand replenishment projects and to what extent. For example, depending on the location and magnitude of a sand replenishment project, there may be minor, major, or no modifications required for the location of dredge discharge pipelines. Because there is much uncertainty regarding the modifications, the cost estimates

[32] U.S. Army Corps of Engineers. *Navigation Data Center, U.S. Waterway Data: Dredging Information System*. Accessed as: http://www.ndc.iwr.usace.army.mil/data/datadrg.htm on March 2010.

will be based on requiring biological and shoreline monitoring during and after the project. This modification is most likely to be required for all future projects.

The following table provides cost estimates for biological and shoreline monitoring related to sand replenishment projects, in 2008 dollars (adjusted to 2010 dollars). Biological monitoring includes beach profiles and limited marine biology before construction, turbidity monitoring during construction, and beach profiles and limited biology for approximately 6 years after construction. Shoreline monitoring includes: beach monitoring along transects, aerial photos, and lagoon closure and maintenance records.

Table 2.2-1: Cost Estimates for Monitoring of Sand Replenishment Projects

Project Type	**Per Project, 6 Year Cost**[34]
Biological: Pre and Post Project Monitoring (2008$)	$250,000
Shoreline: Pre and Post Project Monitoring (2008$)	$600,000
Total	$850,000
Total (2010$)	$860,000
Annual Cost	$143,000
Source: Cost estimates taken from SANDAG and Moffatt & Nichol, "Feasibility Study: San Diego Regional Beach Sand Replenishment Project," August 2007 and personal communication with Shelby Tucker, SANDAG on April 14, 2010.	

In the absence of specific information about the extent of the regulatory baseline for black abalone, project modification costs for sand replenishment activities are assumed to be attributable to the black abalone critical habitat designation. Conservation measures undertaken for green sturgeon critical habitat may provide an additional baseline level of protection (under dredging) for black abalone critical habitat where habitats coexist. However, black abalone and green sturgeon have different habitat needs, and thus, different types of modifications (i.e. monitoring) would be considered to meet those needs. For example, pre- and post-project monitoring within rocky intertidal areas may be required to address impacts on black abalone critical habitat, whereas other modifications would be required for green sturgeon. Thus, this analysis assumes that approximately 100 percent of impacts would be attributable to black abalone critical habitat.

[33] Applicable modifications were taken from San Diego Association of Governments (SANDAG) and U.S. Department of the Navy, "San Diego Regional Beach Sand Project Final Environmental Impact Report/Environmental Assessment," (June 2000).

[34] These costs are per project and project monitoring (pre, during and post construction) lasts about 6-6.5 years: 6 months-1 year for pre-construction, 6 months for construction, and 5 years for post-construction monitoring.

2.2.4 Summary of Economic Impacts to Sand Replenishment by Area

Table 2.2-2 presents a summary of potential impacts to sand replenishment activities.

Table 2.2-2: Summary of Economic Impacts to Sand Replenishment Activities by Area

Area	Estimated Annual Number of Projects	Incremental Score	Total Annualized Impacts (Discounted at 7%)
2	0.2	1.0	$28,600
4	0.1	1.0	$14,300
7	0.3	1.0	$42,900
11	0.1	1.0	$14,300
Total			$100,100

2.3 Economic Impacts of Critical Habitat Designation on National Pollutant Discharge & Elimination System (NPDES) Permitted Facilities

2.3.1 Description of Threat

NMFS has identified point source pollution, particularly National Pollutant Discharge & Elimination System (NPDES) permitted facilities as a threat to black abalone critical habitat in 14 areas: Areas 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 16, 17, and 19. This activity may affect the *food resources* and *water quality* PCEs.

Exposure to heavy metals can affect growth of marine organisms, either promoting or inhibiting growth depending on the combination and concentrations of metals. Bays, inlets, or estuaries are more likely to be affected due to higher residence times, and thus high concentration, of metals. There is little information on these effects, however.[35] Sewage outfalls may affect food resources by causing light levels to be reduced to levels too low to support *Macrocystis* germination and growth. Eutrophication occurs around southern California sewage outfalls where phytoplankton crops and primary production exceed typical levels and approach values characteristic of upwelling periods.

2.3.2 Regulatory Environment & Extent of Activity

Under the NPDES program, the Environmental Protection Agency (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. According to a 2001 Memorandum of Agreement between the EPA, National

[35] Crowe et al. 2000.

Marine Fisheries Service (NMFS), and the U. S. Fish and Wildlife Service (USFWS), the EPA has provided States and Tribes authority over their CWA permitting when appropriate.[36]

Although development and implementation of State water quality standards are subject to a section 7 consultation between NMFS and the EPA, as an added precaution, NMFS may review each individual NPDES permit application to confirm that listed species are not adversely affected by water quality impacts. If the proposed permit does not appear to meet State water quality standards, NMFS may object to issuance of the permit, and the State may ask the applicant to alter the permit to meet the standards. Although the State Agencies themselves issue the vast majority of NPDES permits, the EPA issues federal NPDES permits for tribal lands and for any discharges into federal ocean waters beyond state boundaries.

The NPDES contains general and individual permits. General permits cover multiple facilities within a specific category, whereas individual permits are tailored for a specific discharge and analyzed on a case-by-case basis. The EPA developed a major/minor classification system for individual industrial and municipal NPDES permits to provide an initial framework for setting permit issuance priorities during the first and second rounds of NPDES permit issuance. Major permits almost always have the capability to impact receiving waters if not controlled. Minor permits may or may not adversely impact receiving waters if not controlled. There are approximately 65,000 dischargers in the United States which have been issued NPDES permits. Currently, 7,500 of these are termed "major" permits, due to size or composition of wastewater or both. The remainder are termed "minor" permits.[37]

Table 2.3-1 presents the number of current NPDES permits for outfalls within the high and low buffers (outlined in Section 1.4.1). NPDES-permitted outfalls are facilities holding permits to discharge municipal and industrial wastes to surface water. While these amounts represent active past and present permit locations, we assume the general pattern of permitting locations is likely to continue into the future.

[36] 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.
[37] U.S. Environmental Protection Agency, Office of Water. "National NPDES Minor Permit Issuance Strategy," Office of Water Enforcement and Permits, Permits Division, Technical Support Branch. January, 1986.

Table 2.3-1: Estimated Number of Minor and Major NPDES-permitted Facilities, by buffer and area

	Minor		Major	
Area	**Low buffer**	**High buffer**	**Low buffer**	**High buffer**
1	0	4	0	0
2	1	23	0	19
3	0	22	0	19
4	0	22	3	22
5	0	1	0	1
7	3	6	1	4
8	1	4	1	4
9	2	2	0	1
10	0	2	2	7
11	16	50	8	11
12	1	2	2	5
16	0	1	0	2
17	1	1	0	0
19	0	0	2	2
Total	25	93	19	56

*Note: Totals are adjusted for double-counting of outfalls that overlap multiple areas.
Source: US EPA Water Discharge Permit Compliance System (PCS)

Section 403 of the CWA requires that NPDES permits for dischargers into the territorial seas, the contiguous zone and the oceans be issued in compliance with EPA's guidelines for determining the degradation of marine waters. Changes to the NPDES regulations on September 1, 1983 also provide that the Regional Administrator shall issue general permits covering discharges from offshore oil and gas facilities within the Region's jurisdiction. Ocean discharge guidelines set forth criteria for determinations of unreasonable degradation and irreparable harm which must be addressed prior to the issuance of a NPDES permit. Some factors considered in a determination of unreasonable degradation are: The composition and vulnerability of biological communities which may be exposed to such pollutants including threatened or endangered species, the importance of receiving water area to the surrounding biological community including forage areas and migratory pathways, the existence of special aquatic sites including marine sanctuaries and refuges, etc., and marine water quality criteria developed pursuant to Section 304(a)(1) of the CWA.[38]

[38] U.S. Environmental Protection Agency. "The NPDES Permitting Process for Oil and Gas Activities on the Outer Continental Shelf." June 18, 1985.

2.3.3 Impacts of Critical Habitat Designation on NPDES-permitted Facilities

Black abalone critical habitat could impose modifications on NPDES-permitted facilities, such as:

- Where federal permits are necessary, ensure discharge meets standards other than existing federal standards and regulations (EPA, CWA).
- Require measures to prevent or respond to a catastrophic event (i.e., using best technology to avoid unnecessary discharges).

Changes to discharge permits that may be required to accommodate black abalone critical habitat are unknown at this time. However, if changes were imposed, the goals would likely be to reduce the concentrations/levels/types of toxins into the environment, especially surrounding kelp.

Although there have been no formal consultations regarding water quality issues associated with black abalone to date, a number of such consultations have occurred with regard to other species that can be used to estimate the potential modifications and associated costs that may result from the black abalone critical habitat designation. 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, and clean up of Superfund sites.

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 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.[39]

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

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

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.

Using EPA data, 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 $15,100 annually (in 2010 dollars) to comply with temperature control criteria, while major facilities will incur $5,800 to $37,700 annually in O&M costs.[40] In addition, major facilities are assumed to incur capital costs of $47,140 annually.[41] Based on EPA's sample of facilities all costs are assumed to incur uniformly over a 20-year period.

Existing Federal, state, and local standards and regulations appear to offer the black abalone critical habitat a high level of baseline protection. In addition, this analysis assumes that conservation measures undertaken for green sturgeon critical habitat may also offer some additional baseline protections. Therefore this analysis assumes that approximately 10 percent of impacts in areas where green sturgeon critical habitat is present may be attributable to black abalone habitat. In cases where green sturgeon critical habitat is not present, approximately 20 percent of impacts are attributed to black abalone habitat. Appendix C provides a sensitivity analysis for these assumptions, providing estimates assuming that black abalone critical habitat is responsible for the generation of all project modification costs for all projects.

2.3.4 Summary of Economic Impacts to NPDES-permitted Facilities by Area

Tables 2.3-2 and 2.3-3 present a summary of our findings regarding the potential economic impacts to minor and major NPDES-permitted facilities as a result of this designation. While NMFS consults on all federal and tribal permits, it does not necessarily consult on every state permit; however, for purposes of this analysis we assumed consultation on all permits. Therefore, these estimated costs are likely to be an overestimate of the true costs.

[40] This analysis applied EPA's economic impact assessment to estimate modification costs for NPDES-permitted facilities. See NMFS August, 2005 for more information.

[41] 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,

For both minor and major NPDES-permitted facilities, Areas 2, 3, 4, and 11 all rank in the top four as having moderate to high economic impacts. Area 11 is estimated to be associated with the highest economic impacts related to management of pollutant discharge into water bodies for minor facilities; followed by Areas 3, 2, and 4, respectively. When looking at major facilities, Area 3 is estimated to have the highest economic impacts, followed by Areas 4, 2, and 11, respectively. This is mainly due to the large number of facilities identified in these specific areas, compared to the rest of the specific areas.

Table 2.3-2: Summary of Economic Impacts to Minor NPDES-permitted Facilities by Area

Area	Low buffer	High buffer	Incremental Score	Total Annualized Costs (Discounted at 7%)		
				Low	Mean	High
1	0	4	0.1	$0	$3,000	$6,000
2	1	23	0.1	$0	$17,350	$34,700
3	0	22	0.2	$0	$33,200	$66,400
4	0	22	0.1	$0	$16,600	$33,200
5	0	1	0.1	$0	$750	$1,500
7	3	6	0.1	$0	$4,550	$9,100
8	1	4	0.1	$0	$3,000	$6,000
9	2	2	0.1	$0	$1,500	$3,000
10	0	2	0.1	$0	$1,500	$3,000
11	16	50	0.1	$0	$37,750	$75,500
12	1	2	0.1	$0	$1,500	$3,000
16	0	1	0.2	$0	$1,500	$3,000
17	1	1	0.2	$0	$1,500	$3,000
Total*				$0	$77,150	$154,300

*Note: Totals are adjusted for double-counting of outfalls that overlap multiple areas.

August 2005. Adjusted to 2009 dollars using the U.S. Bureau of Economic Analysis, National Economic Accounts, National Income and Product Accounts table, 2009.

Table 2.3-3: Summary of Economic Impacts to Major NPDES-permitted Facilities by Area

Area	Low buffer	High buffer	Incremental Score	Total Annualized Costs (Discounted at 7%)		
				Low	Mean	High
2	0	19	0.1	$0	$80,600	$161,200
3	0	19	0.2	$0	$161,200	$322,400
4	3	22	0.1	$15,900	$101,250	$186,600
5	0	1	0.1	$0	$4,250	$8,500
7	1	4	0.1	$5,300	$19,600	$33,900
8	1	4	0.1	$5,300	$19,600	$33,900
9	0	1	0.1	$0	$4,250	$8,500
10	2	7	0.1	$10,600	$35,000	$59,400
11	8	11	0.1	$42,400	$67,850	$93,300
12	2	5	0.1	$10,600	$26,500	$42,400
16	0	2	0.2	$0	$16,950	$33,900
19	2	2	0.2	$21,200	$27,550	$33,900
Total*				$111,300	$337,000	$562,700

*Note: Totals are adjusted for double-counting of outfalls that overlap multiple areas.

2.4 Economic Impacts of Critical Habitat Designation on Coastal Urban Development

2.4.1 Description of Threat

NMFS has identified coastal urban development as a potential threat to the essential features identified for black abalone critical habitat in eight areas: Areas 2, 4, 7, 8, 10, 17, 19, and 20. Coastal urban development activities that may affect black abalone habitat include residential and commercial development. These activities may affect the *rocky substrate*, *food resources*, and *settlement habitat* PCEs.

The main concern is the increased sediment load that may result from urbanization of the coast and of watersheds (i.e., increased transport of fine sediments into the coastal zone by runoff). In addition, construction of coastal armoring is often associated with coastal urban development to protect structures from wave action or to prevent erosion (see "in-water construction" in Section 2.1). There has been little study of the effects of increased sedimentation on rocky shoreline communities.[42] Increased sedimentation may affect settlement of larvae and propagules by covering up settlement habitat as well as affecting the growth of encrusting coralline algae,[43] thought to be important for settlement. Increased sedimentation may also affect feeding by covering up food resources, altering algal communities

[42] Airoldi 2003

(including algal communities on the rocky reef and the growth of kelp forests that supply drift algae), and altering invertebrate communities (affecting biological interactions). Ephemeral and turf-forming algae were found to be favored in rocky intertidal areas that experience intermittent inundation.[44] Sedimentation may also reduce the amount of habitat available for black abalone. For example, in a study on San Nicolas Island, black abalone "dominated areas where rock contours provided a refuge from sand deposition."[45] Take-related effects include smothering or scouring of adults and juveniles.

2.4.2 Regulatory Environment & Extent of Activity

The most common Federal nexus for residential and related development activities is the requirement for a USACE permit for construction or expansion of stormwater outfalls, discharge or fill of wetlands, flood control projects, bank stabilization, and in-stream work.

Coastal urban development is prevalent throughout the California coast within the specific areas. While the specific locations of future coastal development activities are not known, this analysis assumes that a reasonable proxy for understanding the location of future actions is past actions.

Identifying the location and extent of wetlands on a parcel of land is essential to the planning process of development projects, whether that project is for the construction of a single family home, a residential subdivision, or a commercial development.[46] This process is known as USACE jurisdictional determinations (JDs). This analysis identifies the location of coastal development projects within the specific areas using the latitude and longitude of historic USACE section 10 (of the RHA) and 404 (of the CWA) JDs, which are believed to contain the bulk of relevant projects that may impact black abalone habitat (see Section 2.1.2 for a detailed description of the data used). These data are presented in Table 2.4-1.

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[43] See Steneck et al. 1997, cited in Airoldi 2003
[44] Airoldi 1998, cited in Thompson et al. 2002
[45] Littler et al. 1983, cited in Airoldi 2003
[46] USACE. 2000. Public Notice: Jurisdictional Determinations. Accessed at: http://www.nap.usace.army.mil/cenap-op/regulatory/jd.htm, on May 2010.

Table 2.4-1: Approximate Location and estimated average level of Coastal Urban Development Projects by Area

Area	Average Number of JDs from 2004-2009
2	5
4	1
7	3
8	1
10	0.8
17	0.2
19	0.6
20	0.2
Total	11.8

2.4.3 Impacts of Critical Habitat Designation on Coastal Urban Development

Black abalone critical habitat could impose modifications on coastal urban development activities such as requiring:

- Stormwater pollution prevention plans;
- Permanent stormwater site plans; and
- Stormwater best management practice (BMP) operations and maintenance.

Per project modification costs are based off of estimated costs for the maintenance of erosion and sediment control BMPs (to be borne in a single year) for 1-acre commercial development, 10-acre commercial development, and 10-acre residential development. The low scenario represents costs associated with 1-acre commercial development. The high scenario represents costs associated with 10-acre commercial and residential development. These cost estimates are based on information from the Washington Department of Ecology.[47] All potential project modification costs were aggregated and applied as the average project cost to each project.

Existing Federal, state, and local standards and regulations in the Nation Marine Sanctuaries (NMS) appear to offer the black abalone critical habitat some level of baseline protection. However, it is thought that the designation of critical habitat will offer more support to the conservation of black abalone by specifically requiring consideration of potential effects on black abalone habitat. Therefore this analysis assumes that approximately 50 percent of impacts in areas that overlap a NMS may be attributable to

[47] Washington Department of Ecology, prepared by Herrera Environmental Consultants, Inc. *Year 2001 Minimum Requirements for Stormwater Management in Western Washington Cost Analysis,* August 2001.

black abalone habitat. In cases where a NMS is not present, approximately 100 percent of impacts are attributed to black abalone habitat. Appendix C provides a sensitivity analysis for these assumptions, providing estimates assuming that black abalone critical habitat is responsible for the generation of all project modification costs for all projects.

2.4.4 Summary of Economic Impacts to Coastal Urban Development by Area

Table 2.4-2 below presents a summary of potential impacts to coastal urban development activities.

Table 2.4-2: Summary of Economic Impacts to Coastal Urban Development Projects by Area

Area	Activity Count (Estimated Annual Number of Projects)	Incremental Score	Total Annualized Costs (Discounted at 7%)		
			Low	Mean	High
2	5	0.5	$5,000	$20,400	$35,800
4	1	0.5	$1,000	$4,100	$7,200
7	3	0.5	$3,000	$12,200	$21,400
8	1	0.5	$1,000	$4,100	$7,200
10	0.8	1.0	$1,600	$6,500	$11,400
17	0.2	1.0	$400	$1,650	$2,900
19	0.6	1.0	$1,200	$4,900	$8,600
20	0.2	1.0	$400	$1,650	$2,900
Total			$18,600	$75,850	$133,100

2.5 Economic Impacts of Critical Habitat Designation on Side-Casting Activities

2.5.1 Description of Threat

NMFS has identified side-casting as a potential threat to the essential features identified for black abalone critical habitat in two areas: Areas 7 and 8. These activities may affect the *rocky substrate*, *food resources*, and *settlement habitat* PCEs.

Side-casting is the practice of pushing or dumping excess earthen material (e.g., material excavated during mining activities or from the road bed during road construction or maintenance activities) over the side of roads and landings or alongside an excavation.[48] Side-casting increases the likelihood of landslides and can result in road failures and other earth movements. The main concern with side-casting is the increased likelihood of sediment input into rocky intertidal habitats. Potential effects on black

[48] CRWQCB 2001; Klamath Resource Information System (KRIS). *Watershed conditions: Roads and erosion*. Accessed at: http://www.krisweb.com/watershd/roads.htm on March 2010.

abalone habitat would be similar to those described above for coastal urban development (i.e., effects on larval settlement habitat, reductions or changes to food resources, inundation of rocky habitat).[49]

2.5.2 Regulatory Environment & Extent of Activity

Currently, the only known federal nexus is for projects occurring within the MBNMS and thus requiring a MBNMS permit. Sanctuary regulations prohibit discharge of materials within its boundaries, as well as outside its boundaries if the material may enter the sanctuary and harm sanctuary resources.[50] However, under certain circumstances, a permit may be obtained from the MBNMS to allow for a prohibited activity. Caltrans has been approved for two permits relevant to side-casting.[51]

Area 7

Caltrans has requested to place up to 30,000 cubic yards of sediment, transported from the base of Waddell Bluffs across California Highway 1, onto the beach below for dispersal by oceanic processes. Sediment is deposited on the beach using tracked and wheeled earth-moving equipment. The placement of rock debris over the embankment is expected to further protect the Waddell beach parking lot/vista point from wave erosion. The permit is effective from May 2009 to April 2010.

Area 8

Caltrans is interested in placing the debris (generated from the combined influence of fire and wet weather) seaward of California Highway 1 in several locations along the Big Sur coast, in Monterey County. This project is part of the Basin Complex Fire Emergency Response Projects. In response to the Basin Complex Fire (which occurred during July and August 2008) in Big Sur, emergency projects are proposed at numerous locations along Highway 1 to protect the highway facility and traveling public from threats associated with debris flow and rock fall from areas denuded by the fire. Projects consist of installing temporary (until the watershed is recovered, approximately 5 years) debris flow barriers upstream from identified culvert inlets and construction of permanent rock fall drapery and temporary barriers at the toe of identified rocky cut slopes. The permit is effective from October 2009 to October 2010.

[49] Ibid.

[50] MBNMS. *Resource Protection Issues: Landslide Disposal*. MBNMS Resource Management Issues. Accessed at: http://montereybay.noaa.gov/resourcepro/resmanissues/landslide.html

[51] Data obtained through personal communication with Erica Burton, National Ocean Service, on March 2010.

2.5.3 Impacts of Critical Habitat Designation on Side-Casting Activities

Black abalone critical habitat could impose modifications related to side-casting activities such as the requirement to[52]:

- Haul away (or store locally) excess material from road maintenance activities, rather than side cast;
- Place excess material at a stable site at a safe distance from rocky intertidal habitats; or
- Use of mulch or vegetation to stabilize the material.

In 2006, the USACE provided average costs estimates for transporting dredged material from the marina/channel to a nearby confined disposal facility (CDF) or temporary storage location. The cost of removing materials from a CDF surrounded by salt marsh or open water, and loading the material into a transport vehicle, is estimated to range from $12 to $14 per cubic yard dried (CYD). The costs of transporting dredged material can range anywhere from $4 to $9 per CYD, depending on the distance the material is being transported.[53] This analysis assumes a low scenario that utilizes the low cost ranges to remove, load, and transport the dredged material. Similarly, the high scenario applies the high cost ranges to remove, load, and transport the dredged material.

Existing standards and regulations in the MBNMS appear to offer the black abalone critical habitat a moderate to high level of baseline protection. Therefore this analysis assumes that approximately 50 percent of impacts in areas that overlap the MBNMS may be attributable to black abalone habitat. Appendix C provides a sensitivity analysis for these assumptions, providing estimates assuming that black abalone critical habitat is responsible for the generation of all project modification costs for all projects. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to side-casting activities that may occur as a result of a critical habitat designation for black abalone. As stated above, NMFS will consider any additional information received in developing the final economic analysis supporting its final determinations to designate or exclude areas from critical habitat for black abalone.

2.5.4 Summary of Economic Impacts to Side-Casting Activities by Area

Table 2.5-1 below presents a summary of potential impacts to side-casting activities. Area 7 is the only area that we can attribute impacts, since the cubic yards for Area 8 is unknown.

[52] See "Spoil disposal" info under "Road maintenance", Coast Property Owners Association. *Road maintenance*. Accessed at: http://www.cpoabigsur.org/Community/Road_Maintenance/Road_Maintenance_Main.html. Adapted from Weaver and Hagans 1994.

Table 2.5-1: Summary of Economic Impacts to Side-Casting Activities by Area

Area	Number of Cubic Yards	Incremental Score	Total Annualized Costs (Discounted at 7%)		
			Low	Mean	High
7	30,000	0.5	$240,000	$292,500	$345,000
8*	N/A	0.5	N/A	N/A	N/A
Total			$240,000	$292,500	$345,000

* Note that there are no costs, because the historical data used did not provide the number of cubic yards in this area. This does not mean that in the future, there will be no costs.

2.6 Economic Impacts of Critical Habitat Designation on Agricultural Activities

2.6.1 Description of Threat

NMFS has identified agricultural activities as a potential threat to black abalone critical habitat in 10 areas: Areas 1, 2, 3, 4, 7, 8, 9, 10, 12, and 16. These activities include irrigation, pesticide application, and livestock farming. Agricultural activities may affect the *water quality, rocky substrate, food resources,* and *larval settlement habitat* PCEs.

Soil erosion from intensive irrigated agriculture or livestock farming in areas adjacent to the coast can cause increased sedimentation into rocky intertidal habitats (see "Coastal urban development" for effects of sedimentation in section 2.4).[54] Thus, it is reasonable to assume that there may potentially be adverse impacts to black abalone and their habitat in nearshore waters receiving sediment input from lands where intensive agricultural irrigation or livestock farming activities occur.

Regarding agricultural pesticides, laboratory experiments showed that the presence of pesticides (those examined in the study were DDT, methoxychlor, dieldrin, and "2,4-D") interfered with larval settlement, but had a much lesser effect on survival of larvae.[55] In addition, pesticide use can have effects on blue and green algae, including herbicide contamination of water that could severely reduce algal growth[56];

[53] Bayshore Dredged Material Management Plan, Raritan & Sandy Hook Bays, June 2009.
[54] Morse, D.E., N. Hooker, H. Duncan, and L. Jensen. 1979. "Y-aminobutyric acid, a neurotransmitter, induces planktonic abalone larvae to settle and begin metamorphosis." Science 204:407-410.
[55] Morse, D.E., N. Hooker, L. Jensen, and H. Duncan. 1979. "Induction of larval abalone settling and metamorphosis by y-aminobutyric acid and its congeners from crustose red algae: II: Applications to cultivation, seed-production, and bioassays; principal causes of mortality and interference." Proceedings of the World Mariculture Society 10:81-91.
[56] Note that effects on brown algae are still unknown.

however, these studies focused on the impacts of agricultural pesticides in streams.[57] The concentration of agricultural pesticides that flows into coastal marine waters and rocky intertidal habitats is unknown, as is the concentration at which negative effects on larval settlement habitat and marine algal growth occur. Thus, the potential effects of agricultural pesticides on black abalone habitat are uncertain and discussed qualitatively rather than quantitatively.

2.6.2 Regulatory Environment & Extent of Activity

Irrigation

Operation of the Federal water projects is subject to consultation under section 7 of the ESA. Federal water projects include flood control activities, pumping plants, water diversions (i.e., for irrigation), water intake structures, and fish screen projects. Any water supplier providing water via contract with U.S. Bureau of Reclamation (USBR) or using infrastructure owned or maintained by the USBR is subject to consultation under section 7 of the ESA. Projects associated with privately owned diversions may require a Federal permit from the USACE under sections 401 or 404 of the Clean Water Act.[58]

Pesticide Application

Under the ESA, the EPA must consult with the U.S. 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 July 2002, a federal court ordered EPA to consult with the USFWS and NMFS to ensure that the registration of 37 pesticide active ingredients under the FIFRA complies with section 7 of the ESA. In January 2004, the EPA was enjoined from authorizing the application of a set of pesticides within certain distances from "salmon-supporting waters."[59] The 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.[60] Although unknown at the present time, given the primarily marine environment inhabited by black abalone and the uncertainty regarding the concentration of pesticides that may be introduced to these

[57] Silver, J. and Riley, B. 2001. Environmental Impact of Pesticides Commonly Used on Urban Landscapes. Restoring Healthy School Landscapes. pp. 8-16.
[58] NMFS 2007.
[59] Washington Toxics Coalition, et al. v. EPA, C01-0132 (W.D. WA), 22 January 2004.
[60] Ibid.

habitats from agricultural applications, the protections for salmon-supporting waters would likely be adequately protective of black abalone critical habitat.

Livestock Farming

A Federal nexus exists for all management activities relevant to livestock farming occurring on Federal lands. Activities conducted by the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) are wide-ranging, but include fuel reduction activities, road construction, road obliteration, and road maintenance, maintenance of recreation facilities, fisheries programs, timber sales, permitting of livestock farming,[61] and permitting of various use permits.

Spatial Scope

This analysis uses spatial soil data to determine the amount of farmland used for agricultural activities. The data consisted of three types of farmland: prime farmland, farmland of statewide importance, and farmland of local importance. Prime farmland is defined as land that has been used for irrigated agricultural production at some time during the four years prior to collection and has certain soil attributes determined by the USDA. Farmland of statewide importance is defined as land that has been used for irrigated agricultural production at some time during the four years. Farmland of Local Importance is defined as land of importance to the local agricultural economy as determined by each county's board of supervisors and a local advisory committee.[62] Therefore, the high range cost estimates include all farmland acres identified and the low range cost estimates were multiplied by 25 percent to account for the definition of the farmland identified. In addition, each of the farmland types were identified within 20 and 100 yards from a waterbody (i.e. stream, river) within the low and high buffers, respectively, (outlined is Section 1.4.1) for each of the areas considered for designation. Table 2.6-1 presents the acres of agricultural land used in the production of crops.

[61] The consultation history indicates that NOAA Fisheries consults on livestock farming on Federal lands, but does not consult on similar activities on private or other non-Federal lands. The reason for this is that livestock farming on non-Federal lands rarely needs a Federal permit, and thus does not have a Federal nexus.

[62] California Department of Conservation. FMMP - Important Farmland Map Categories Accessed at: http://www.conservation.ca.gov/dlrp/fmmp/mccu/Pages/map_categories.aspx, on May 2010.

Table 2.6-1: Estimated Acres of Prime Farmlands and Farmlands of Statewide Importance by Area

Area	within 20 yard buffer of streams/shoreline in the low buffer	within 100 yard buffer of streams/shoreline in the high buffer
1	441	4,988
2	1,352	7,568
3	0	1,848
4	54	6,596
7	710	20,751
8	306	19,386
9	662	5,608
10	2,237	22,576
12	113	5,054
16	0	728
Total*	5,875	75,404

*Note: Totals are adjusted for double-counting of acres that overlap multiple areas.
Source: USDA NRCS Soil Survey Geographic Database (SSURGO)

Livestock farming activities also occur within the specific areas. However, in order to be considered for this analysis, the activity must be located within federal lands. There is only one federal livestock farming land located along the California coast. The Stornetta Public Lands were donated to the Bureau of Land Management (BLM) in 2004. Approximately 1,000 acres are used for livestock farming north and west of Highway 1 in Mendocino County CA. However, Mendocino County is not considered in this analysis. Therefore, there are no identified livestock farming lands that can potentially impact black abalone critical habitat.

2.6.3 Impacts of Critical Habitat Designation on Agricultural Activities

Black abalone critical habitat could impose modifications related to agricultural activities such as:

- Irrigated agriculture
    - Planning appropriate ground cover.
- Livestock farming
    - Fencing riparian areas;
    - Placing salt or mineral supplements to draw cattle away from rivers;
    - Total rest of allotments when possible; and
    - Frequent monitoring.

Because the effects of agricultural pesticides on black abalone habitat are uncertain, it is unknown whether the critical habitat designation would impose additional modifications on agricultural pesticide

application. As described above, this analysis assumes that the court-ordered injunction restricting pesticide use in areas surrounding salmon- and steelhead-supporting waters will provide protection for black abalone critical habitat. In addition, NMFS has now completed consultation on registration of 6 of 37 pesticide active ingredients that were part of the litigation – chlorpyrifos, malathion and diazinon in a biological opinion dated November 18, 2008 (NMFS 2008) and carbaryl, carbamate and methomyl in a biological opinion dated April 20, 2009 (NMFS 2009b). NMFS concluded that the registration of these pesticides was likely to jeopardize most listed salmon populations and was likely to adversely modify critical habitat. NMFS identified reasonable and prudent alternatives that included, among other things, no-application buffers of up to 1000 feet for aerial application and up to 500 feet for ground applications. Thus, restrictions have already been placed on the application of pesticides by the courts and in biological opinions issued by NMFS to protect ESA-listed salmonids and their critical habitat, including no-application buffers ranging from 60 ft to 1000 ft[63] around salmonid habitats where NMFS concluded jeopardy or destruction or adverse modification to designated critical habitat for ESA-listed Pacific salmonids. The purpose of these buffers is to reduce pesticide exposure to ESA-listed salmonids and their habitat, which would also reduce pesticide exposure to black abalone and their habitat along the coast. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to agricultural pesticide application that may occur as a result of a black abalone critical habitat designation. NMFS will consider any additional information received in developing the final economic analysis supporting its final determinations to designate critical habitat for black abalone.

Table 2.6-2 summarizes potential per project costs (in 2010 dollars) for modifications to agricultural activities resulting from critical habitat designation for black abalone. However, since the number of farmland acres that will require such modifications is highly speculative, this analysis assumes that all acres will be subject to the following costs.

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

Table 2.6-2: Potential per Project Costs of Implementing Conservation Efforts for Agricultural Activities (2010$)

Activity	Typical Project Modifications	Estimated Costs
Irrigated Agriculture	Conservation crop rotation, underground outlets, land smoothing, structures for water control, subsurface drains, field ditches, mains or laterals, and toxic salt reduction.	$30 per acre[1]
Livestock farming	Fencing riparian areas, placing salt or mineral supplements to draw cattle away from rivers, total rest of allotments when possible, and frequent monitoring.	$32 per acre[2]

Notes:
[1] Based off of a 1992 USDA cost estimate for water management systems for erosion control, practice SP35. Source: U.S. Environmental Protection Agency. "Polluted Runoff (Nonpoint Source Pollution): Irrigation Water Management." Accessed at: http://www.epa.gov/owow/nps/MMGI/Chapter2/ch2-2f.html, last updated on January 2010. Adjusted to 2010 dollars.
[2] Costs for livestock farming are based on costs of modifications resulting from critical habitat designations from the salmon and steelhead species economic report. These modifications may be similar, or identical, to those that could be requested for black abalone.

Existing protections regarding pesticide application for ESA-listed salmonids and their designated critical habitat may provide a high level of baseline protection for black abalone critical habitat. However, in the case of irrigated agriculture, approximately 100 percent of impacts are attributed to black abalone critical habitat, assuming that black abalone critical habitat is responsible for the general of all project modification costs for all projects.

2.6.4 Summary of Economic Impacts to Agricultural Activities by Area

Table 2.6-3 presents a summary of potential impacts to agricultural irrigation within the low and high buffers. In all scenarios, Area 10 is estimated to have the highest impacts. This is due to the high number of acres identified for this area.

Table 2.6-3: Summary of Economic Impacts to Agricultural Irrigation by Area

Area	Estimated Acres of Prime Farmlands		Incremental Score	Total Annualized Impacts (Discounted at 7%)		
	within 20 yard buffer of streams/shoreline in the low buffer	within 100 yard buffer of streams/shoreline in the high buffer		Low	Mean	High
1	441	4,988	1.0	$3,300	$76,450	$149,600
2	1,352	7,568	1.0	$10,100	$118,550	$227,000
3	0	1,848	1.0	$0	$27,700	$55,400
4	54	6,596	1.0	$400	$99,150	$197,900
7	710	20,751	1.0	$5,300	$313,900	$622,500
8	306	19,386	1.0	$2,300	$291,950	$581,600
9	662	5,608	1.0	$5,000	$86,600	$168,200
10	2,237	22,576	1.0	$16,800	$347,050	$677,300
12	113	5,054	1.0	$900	$76,250	$151,600
16	0	728	1.0	$0	$10,950	$21,900
Total*				$44,000	$1,153,050	$2,262,100

*Note: Totals are adjusted for double-counting of acres that overlap multiple areas.

2.7 Economic Impacts of Critical Habitat Designation on Oil and Chemical Spills: Prevention and clean-up

2.7.1 Description of Threat

NMFS has identified oil and chemical spills as a potential threat to the essential features of the specific areas being considered for designation in all areas. However, past history of spill clean-up data indicates that there are eight areas of primary concern: Areas 4, 5, 7, 8, 9, 12, 15, and 19. Clean-up activities may affect the *rocky substrate, food resources, settlement habitat,* and *water quality* PCEs.

The effects of oil spills vary from no discernable differences to widespread mortality of marine invertebrates over a large area and reduced densities persisting a year after the spill.[64] Oil spill clean-up activities may be as destructive, or more destructive, than the oil spill itself. Oil spill clean-up may involve application of toxic dispersants (although less toxic dispersants have been developed in recent years) and the use of physical cleaning methods such as the use of high pressure and/or high temperature water to flush out oil.[65] The use of dispersants and physical cleaning methods may affect black abalone directly or affect food resources (algal community). In experimental studies, effects on limpets and decreases in barnacle cover were greater in oil and oil/dispersant plots compared to control and dispersant

[64] Crowe et al. 2000.
[65] Ibid.

only plots.[66] Chemical spills could also affect food resources, if the chemicals kill algae or affect algal growth.

2.7.2 Regulatory Environment & Extent of Activity

The United States Coast Guard (USCG) has the authority to respond to all oil and hazardous substance spills in the offshore/coastal zone, while the EPA has the authority to respond in the inland zone. The EPA and the USCG oversee the Oil Pollution Prevention regulations promulgated under the authority of the Federal Water Pollution Control Act. Among other issues, these regulations address requirements for Spill Prevention, Control and Countermeasure Plans and Facility Response Plans for offshore and onshore oil producers and carriers. The Facility Response Plans are submitted to the USCG for the transportation-related portion of the facility and to EPA for the non-transportation portions. The National Oil and Hazardous Substances Pollution Contingency Plan (or National Contingency Plan), is the Federal government's guideline for responding to both oil spills and hazardous substance releases. Regional Response Team IX (RRT-IX) is a formal organization of tribal, state and federal agencies as defined by the National Contingency Plan. Co-chaired by the EPA and the USCG, RRT-IX is responsible for ensuring that state and federal resources are available when needed for emergency response within the states of Arizona, California and Nevada and the 146 tribal nations, and that the multi-agency relationships and coordination systems exist to support these emergency response efforts (The Regional Contingency Plan for federal region IX).[67]

NOAA's Emergency Response Division (ERD), part of NOAA's Office of Response and Restoration facilitates spill prevention, preparedness, response, and restoration at national and local levels. Information on present and past spills and summary documents are provided on their website and serve as a communications tool to various responders and federal and local planners (http://www.incidentnews.gov). The ERD has responded to nearly every major marine spill in the United States over the last 25 years.

In 2001, an "Inter-agency Memorandum of Agreement (MOA) Regarding Oil Spill Planning and Response Activities under the FWPCA's National Oil and Hazardous Substances Pollution Contingency Plan and the Endangered Species Act" was signed by NOAA, USFWS, EPA, and USCG. The purpose of the MOA is to increase cooperation and understanding among agencies involved in ESA compliance at

[66] Crowe et al. 2000.
[67] California Department of Fish and Game. *The Regional Contingency Plan for federal region IX*. Accessed at: http://www.dfg.ca.gov/ospr/response/acp/marine/2005RCP/RCP102405.pdf.

every stage in oil spill planning and response. The MOA outlines procedures to streamline the ESA compliance process before, during, and after an incident.

In November 2003, NOAA issued a programmatic biological opinion to EPA and USCG that addressed most response actions undertaken by these agencies to limit or prevent oil discharges and their effects on listed species and their habitats in the Pacific Northwest. This consultation included such species as salmon species, whale species, and the Steller sea lion. The consultation found that many oil spill response activities could be treated programmatically, but that some actions which were "less predictable" were identified as potentially requiring individual consultation.[68]

The extent of oil spills can be determined by the occurrence of oil spills and the quantity of oil spilled. The USCG records indicate that nationally, 95 percent of oil spills are spills of less than 1,000 gallons.[69] "Major" spills are 10,000 gallons or more. "Serious" spills are 25-10,000 gallons.[70] National data from 1992-2001 on oil spills is presented in Table 2.7-1. The data shows that the number of spills and amount of oil spilled has generally decreased since 1997.

Table 2.7-1: U.S. National Oil Spill Data, 1992-2001

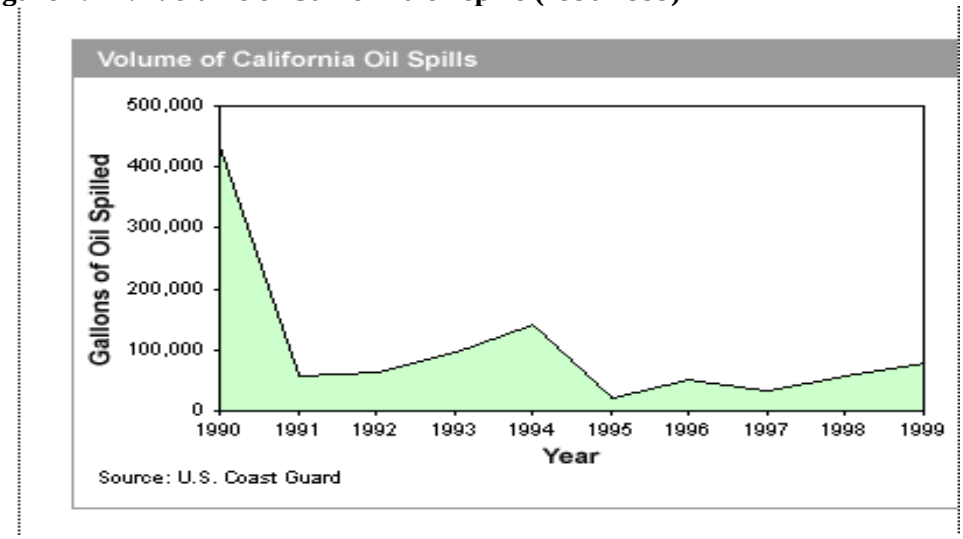
Year	Number of Spills	Gallons Spilled
1992	708	1,585,955
1993	618	2,060,422
1994	662	3,945,487
1995	505	1,899,525
1996	521	3,146,931
1997	395	1,019,809
1998	436	798,832
1999	367	1,315,204
2000	353	838,044
2001	253	501,045

Source: U.S. Coast Guard (USCG). "Oil Spill Response Research & Development Program, A Decade of Achievement." U.S. Coast Guard Research & Development Center, Groton, CT 06340-6048, Report No. CG-D-07-03. Accessed at: http://www.environmental-research.com/erc_reports/ERC_report_11.pdf.

[68] NOAA Fisheries, Endangered Species Act Section 7 Programmatic Formal Consultation and Magnuson- Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Oil Spill Response Activities Conducted Under the Northwest Area Contingency Plan (NWACP), November 6, 2003.
[69] National Marine Fisheries Service (NMFS). *Economic Impacts Associated with Potential Critical Habitat Designation for the Southern Resident Population of Killer Whales*. November 7, 2006.
[70] Puget Sound Water Quality Action Team. *State of the Sound 2004*. Accessed at: http://www.psparchives.com/publications/puget_sound/sos/04sos/PSATSOS2004.pdf on June 9, 2009.

In California, total gallons of oil spills have been less than 100,000 gallons per year from 1995-1999 (see Figure 2.7-1).

Figure 2.7-1: Volume of California oil spills (1990-1999)[71]



The Office of Spill Prevention and Response (OSPR) was created after the Exxon Valdez spill in 1989 and then another large vessel spilled 300,000 gallons of crude oil off Southern California in 1990. OSPR has the Department of Fish and Game's public trustee and custodial responsibilities for protecting, managing and restoring the State's fish, wildlife, and plants. It is one of the few State agencies in the nation that has both major pollution response authority and public trustee authority for wildlife and habitat. This mandate ensures that prevention, preparedness, restoration and response will provide the best protection for California's natural resources.

Incident data were obtained from NOAA's Office of Response and Restoration for years 2000-2009. Note that these data only include incidents that NOAA worked on. Through personal communication with the Office of Response and Restoration, NMFS was informed that this dataset would not include most small incidents, because NOAA does not usually take part in these incidents. However, NOAA is generally involved in all medium and large incidents and therefore, these incidents would be included in the dataset.

Spill incident data were plotted by integrating latitude and longitude information with GIS to determine how many past incidents occurred in each area. Each data entry was then examined to decipher if it was

[71] Natural Resource Defense Council (NRDC). *Oil Spills*. Accessed at: http://www.nrdc.org/greengate/wildlife/oilf.asp, on September 15, 2008.

an actual spill or potential spill and how many gallons of oil, or harmful chemicals, were associated with it. An example of a potential spill is if a vessel carrying diesel sank, but no diesel or chemicals leaked from the sunken vessel. An average of gallons spilled per incident was calculated for both actual and potential incidents in each area. Some entries did not have number of gallons available. For these entries, an average was taken for entries that did specify gallons and applied to the missing entries. These averages were then multiplied by the number of incidents (actual and potential), by area, to get the total amount of oil and chemicals that did spill, and potentially could have spilled, over the 10-year period. These totals were then divided by 10 years to get an annual estimated gallons spilled per area. These data are shown in Table 2.7-2.

Table 2.7-2: Estimated Number of Gallons Spilled per Year by Area

Area	Actual	Actual + Potential
4	140	350
5	70	70
7	0	200
8	0	140
9	0	70
12	0	1
15	0	40
19	0	180
Total	210	1,051

2.7.3 Impacts of Critical Habitat Designation on Oil and Chemical Spills

Designation of black abalone critical habitat could impose modifications related to oil and chemical spills, including response and cleanup, such as:

- Restrict or minimize the use or type of response to oil spills (e.g., boom, dispersants, *in situ* burning) in areas where black abalone PCEs are found to be present.
- Mitigation measures include adoption of oil/chemical spill clean-up protocols and oil/chemical spill prevention plans.
- More Clean Seas boats as first responders to prevent oil/chemical spills from coming onshore
- Relocation of proposed oil/chemical platforms further away from black abalone habitats

Impacts from modifications are difficult to quantify due to the unpredictability of oil and chemical spills but would include costs from training and contingency planning requirements, which already take place to a large degree, and surveys (aerial, vessel, etc.) prior to or during oil and chemical spill response to

minimize impacts to black abalone critical habitat. Costs could also be incurred from use of an alternate oil and chemical spill response methodology to minimize impacts to black abalone PCEs.

A range of cost estimates for the cleanup of oil spills were calculated using "cleanup cost factor modifiers" presented by Etkin (2000). This model includes various attributes to describe an oil spill, which include: location (i.e. USA), oil type, spill size, location type (i.e. nearshore or offshore), primary cleanup method, and shoreline oiling. For each feature, there were anywhere from 3 to 7 options. The following shows the attributes used for estimates in this analysis:

- Location: USA
- Oil type: light crude (less impact due to more rapid evaporation and dispersal) and heavy crude
- Spill size: varies by area
- Location type: nearshore
- Primary cleanup method: natural cleansing
- Shoreline oiling: lower bound, 0 km; upper bound, varies by area.

The above characteristics were used to present a cost range for each area. These cost results provide a cleanup cost per gallon of oil and chemicals spilled. In general, cleanup costs decrease significantly on a per-ton basis; that is, a larger spill will be much less expensive per ton than a smaller spill, given the costs associated with setting up the response, bringing in equipment, labor, etc. In addition, use of dispersants offshore to prevent impacts to the shoreline is typically less expensive than shoreline cleanup.[72]

Most of the spills documented were within 20 miles of the coast. Spills considered for this analysis incorporated all spills no matter distance from offshore, due to the possibility of the spill reaching the coast. Causes for the spills ranged from collisions (rare), vessel groundings[73], vessel capsizing, oil platforms, and "mystery spills." While such spills are monitored, in nearly all cases, no response to the oil and chemical spill was mounted due to size, location (i.e. little risk to shoreline or marine resources), rapid dissipation or evaporation, or weather.

The low scenario represents costs associated with reported incidents that did have a spill. The high scenario represents costs from both actual and potential incidents. Potential incidents are considered in the high cost scenario because if these areas are designated as black abalone critical habitat, it may then

[72] Etkin 1999.
[73] Impacts of vessel groundings are discussed more in-depth in section 2.8.

require response to incidents that before the designation would not. In other words, the designation could likely increase the number of responses.

Existing Federal, state, and local standards and regulations appear to offer the black abalone critical habitat a high level of baseline protection. Therefore this analysis assumes that approximately 20 percent of impacts may be attributable to black abalone habitat. However, there are limitations to this analysis. If an incident occurs that under status quo conditions wouldn't require a response, the designation of black abalone critical habitat could mandate a response. In such a case, this analysis would assume that approximately 100 percent of impacts may be attributable to black abalone critical habitat. However, at this time, information to identify such a case is not available. Appendix C provides a sensitivity analysis for these assumptions, providing estimates assuming that black abalone critical habitat is responsible for the generation of all project modification costs for all projects.

2.7.4 Summary of Economic Impacts to Oil and Chemical Spills by Area

Table 2.7-3 presents a summary of potential impacts from the cleanup of oil and chemical spills within the specific areas. There are differences due to: occurrence of past oil and chemical spills and incremental scores. When only looking at the low cost scenario, which accounts for actual oil and chemical spills that have occurred in the past, area 4 has the highest cost, with area 5 coming in second. The other areas have zero to minimal costs, due to no reports of actual spills over the 10-year period. When looking at the high cost scenario, which includes both past actual and potential oil and chemical spills, area 4 has the highest costs, with areas 19, 8, and 7 having the next highest costs, respectively. Note that, although the costs presented do not take into account the likelihood of a spill response occurring due to the designation of black abalone critical habitat alone, these costs are particularly useful when comparing total impacts of all activities by area.

Table 2.7-3: Summary of Economic Impacts from Oil and Chemical Spill Cleanup by Area

Area	Estimated # of gallons per year		Incremental Score	Total Annualized Impacts (Discounted at 7%)		
	Actual	Actual + Potential		Low*	Mean	High
4	140	350	0.2	$20,600	$78,100	$135,600
5	70	70	0.2	$10,300	$17,150	$24,000
7	0	200	0.2	$0	$38,750	$77,500
8	0	140	0.2	$0	$47,100	$94,200
9	0	70	0.2	$0	$13,550	$27,100
12	0	1	0.2	$0	$150	$300
15	0	40	0.2	$0	$13,450	$26,900
19	0	180	0.2	$0	$60,600	$121,200
Total				$30,900	$268,850	$506,800

* Note that there are $0 costs, because the historical data used to estimate the probability of an oil spill showed no events in this area. This does not mean that in the future, there will be $0 costs; however, based on the historical data, it is highly unlikely that a spill will occur in this area.

2.8 Economic Impacts of Critical Habitat Designation on Vessel Grounding

2.8.1 Description of Threat

NMFS has identified vessel grounding as a potential threat to the essential features identified for black abalone critical habitat. Due to the uncertainty of the nature of vessel groundings, potential impacts can affect all areas. However, past history of vessel grounding data indicates that there is one area of primary concern: Area 8. This activity may affect the *rocky substrate, food resources, settlement habitat,* and *water quality* PCEs.

Vessel grounding can affect the rocky substrate and have substantial effects on the environment, ranging from minor displacement of sediment to catastrophic damage to reefs. Wave activity may also cause the vessel to roll excessively and do more damage to the ocean floor. Another potential impact of ship grounding is the risk of invasion by foreign species attached to the ship's hull into a local environment (impacts are discussed more in-depth in Section 2.14). The wreck of an ocean-going vessel can result in large masses of steel distributed over substantial areas of seabed, particularly in high energy, shallow water environments. The wreckage may be a chronic source of dissolved iron. Elevated levels of iron may effect water quality and result in an increase of opportunistic algae blooms. Oil leaking from a grounded vessel is also a concern; however this is already covered under the oil spill section (see Section 2.7).

2.8.2 Regulatory Environment & Extent of Activity

The United States Coast Guard (USCG) has the authority to respond to all oil and hazardous substance spills in the offshore/coastal zone, while the EPA has the authority to respond in the inland zone (see Section 2.7.2 for more details). The USCG was mandated by the Oil Pollution Act of 1990 to make participation in the Vessel Traffic Service (VTS) mandatory.[74] The purpose of a Vessel Traffic Service (VTS) is to provide active monitoring and navigational advice for vessels in particularly confined and busy waterways. They encompass a wide range of techniques and capabilities aimed at preventing vessel collisions, rammings, and groundings in the harbor, harbor approach, and inland waterway phase of navigation.[75]

It is difficult to estimate the total number of nuisance vessels, due to changing conditions (i.e., new groundings of some vessels and re-floating of others).[76] Incident data was obtained from NOAA's Office of Response and Restoration for years 1999-2009. Note that this data only includes incidents that NOAA worked on. There is only one reported vessel grounding located in specific area 8 between the years 1999-2009.[77]

Area 8

In September 2001, the NOAA SSC was notified by MBNMS staff of a 45' fishing vessel aground on the rocks about 7 nm south of Pfieffer Point, on the Big Sur coast (USCG district 9). At the time, no other information was known about the type or amount of product onboard the vessel. First light observations did indicate a rainbow sheen about 150' by 1/2 nm long in the vicinity of the vessel.[78] Any damage to rocky substrate or the ocean floor is unknown.

2.8.3 Impacts of Critical Habitat Designation on Vessel Grounding

Black abalone critical habitat could impose modifications related to vessel grounding such as:

- Best management practices (BMP) for oil spill and debris clean-up to reduce trampling;
- Education of USCG, NMS biologists, and others involved in clean-up to raise awareness of black abalone.

[74] U.S. Department of Homeland Security, Navigation Center. History of Vessel Traffic Services. Accessed at: http://www.navcen.uscg.gov/mwv/vts/history.htm, on May 2010.
[75] U.S. Department of Homeland Security, Navigation Center. Vessel Traffic Services. Accessed at: http://www.navcen.uscg.gov/mwv/vts/vts_home.htm, on May 2010.
[76] Boring and Zelo (2008).
[77] There are records of three capsized vessels and one vessel adrift, but no records that these vessels grounded within rocky intertidal habitat.

Existing standards and regulations in the NMS appear to offer the black abalone critical habitat a high level of baseline protection. Therefore this analysis assumes that approximately 20 percent of impacts in areas that overlap a NMS may be attributable to black abalone habitat. In cases outside of the sanctuary, approximately 100 percent of impacts are attributed to black abalone habitat. Appendix C provides a sensitivity analysis for these assumptions, providing estimates assuming that black abalone critical habitat is responsible for the generation of all project modification costs for all projects. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to vessel groundings that may occur as a result of a critical habitat designation. As stated above, NMFS will consider any additional information received in developing the final economic analysis supporting its final determinations to designate or exclude areas from critical habitat for black abalone.

2.8.4 Summary of Economic Impacts to Vessel Grounding by Area

While there is only one known case where a vessel was grounded, the extent of the impact is unknown. This analysis was unable to determine specifically how this threat would be alleviated for the specific area. Due to such uncertainty, NMFS was unable to present a quantitative assessment for possible vessel grounding modifications for this analysis.

2.9 Economic Impacts of Critical Habitat on Power Plants

2.9.1 Description of Threat

NMFS has identified power plants as a potential threat to black abalone critical habitat in one study area: Area 10. This activity may affect the *water quality* PCE, through the power plants' use of coastal waters for cooling and subsequently discharging heated water back into the marine environment.

Coastal power plants, with once-through cooling systems, may affect black abalone habitat by discharging thermal effluent (the potential entrainment of larval abalone in water intake systems is a take-related concern). Currently, the Diablo Canyon Nuclear Power Plant (DCPP) is the only plant located within the occupied specific areas that uses a once-through cooling system; and thus is likely to affect black abalone habitat. The DCPP discharges up to one million gallons of sea water into Diablo Cove. Low-volume wastes generated at the plant are combined with the water used for once-through cooling

[78] NOAA, NOS Office of Response and Restoration. ResponseLINK. Assessed online at: https://responselink.orr.noaa.gov/login, on May 2010.

and discharged through a shoreline outfall into Diablo Cove and out into the Pacific Ocean.[79] The discharge water temperature is about 11°C greater than the ambient water temperature, with a maximum daily mean discharge temperature of 28.7°C or 84°F.[80] The elevated temperature of the discharged water may increase the virulence of withering syndrome in black abalone (elevated water temperatures have been shown to exacerbate the symptoms of this disease.[81] Thermal effluent may also facilitate the introduction and growth of non-native species (discussed in more detail in Section 2.14). In addition, thermal plumes may increase turbidity and sedimentation in the receiving waters and increase toxicity (waters may be chlorinated to reduce fouling or may be contaminated with heavy metals eroded from the cooling pipes).[82] Additional concerns include an increased potential for oil spills with increased barge traffic during maintenance and construction activities, and the potential for soot discharged into the air to settle on intertidal habitats.

2.9.2 Regulatory Environment and Extent of Activity

The Nuclear Regulatory Commission regulates commercial nuclear power plants and other uses of nuclear materials, such as in nuclear medicine, through licensing, inspection and enforcement of its requirements. The California Energy Commission has multiple duties, such as: licensing thermal power plants 50 megawatts or larger and planning for and directing state response to energy emergencies. This analysis uses data provided by the California Energy Commission, to identify power plants that could be affected by the critical habitat designation.[83]

Diablo Canyon Power Plant (DCPP)

The DCPP, which is located in San Luis Obispo County, CA near Avila Beach, is the only nuclear power plant within the areas being considered for designation (Area 10). It is owned and operated by Pacific Gas and Electric Company (PG&E), and is a nuclear-powered, steam-turbine power plant with a rated output of 2,200 MW of electricity. The power plant draws in seawater from a constructed intake cove through a cooling water system to provide cooling for power plant operations. Four circulating water pumps combine to produce a cooling water flow of 1,704,000 gpm. On the ocean side of the intake structure, a concrete curtain wall extends approximately 2.4 m below mean sea level to prevent floating debris from entering the structure. Seawater entering the intake structure passes through one of 16 sets of

[79] Tetra Tech Inc. 2008.
[80] Tenera 1999.
[81] Friedman et al. (1997); Tenera (1999).
[82] Crowe et al. 2000.
[83] California Energy Commission. *California Statewide Plants map*. Accessed at: http://www.energy.ca.gov on April 20, 2008.

bar racks designed to exclude large debris from the forebays. The bar racks consist of vertical rows of steel bars placed about 8.0 cm apart. The underwater portion of the bar racks is approximately 10 m high depending on tide. There are two auxiliary saltwater (ASW) bar racks that are 1.5 m wide, while the other 14 circulating water pump (CWP) bar racks are 3.1 m wide. The cooling water is returned to the ocean via a stair-step weir structure that opens on the eastern end of Diablo Cove.

In order to control biofouling at the DCPP, part of the auxiliary salt water system may be taken out of service and filled with "firewater" (approximately 40,000 gallons), which will be discharged. This takes place approximately once per month for approximately 9 hours. Effects on the receiving water, etc. are being monitored. In addition, the plant may discharge low levels of chemical wastes, low-level radioactive wastes (treated and sampled for compliance with discharge limits) and stormwater runoff. Leakages could occur from operation, maintenance and testing. The plant does have a spill prevention control and countermeasure plan.

2.9.3 Impacts of Critical Habitat Designation on Power Plants

Designation of black abalone critical habitat could, through a section 7 consultation, result in the imposition of modifications related to power plant operations, such as:

- Require cooling of thermal effluent before release to the environment (may require use of different technology).
- Require treatment of any contaminated waste materials.
- Modifications associated with the permit issued under NPDES (any updates from current early 1990s issuance).
- Monitoring of black abalone and rocky intertidal habitats adjacent to the power plant.

Other modifications, according to Tetra Tech Inc. (2008), include:

- Dry cooling systems – these are not as feasible as wet cooling systems due to greater logistical constraints and total costs;
- Modifications to cooling water intake flow by season and operational conditions using variable speed pumps/variable frequency drives, however, benefits depend on the frequency and degree that flow can be reduced without affecting operations; and
- Use of reclaimed water as a source of makeup water for wet cooling towers or as a source for once-through cooling water systems.

Modifications specific to the DCPP include alternative technologies used in place of once-through cooling systems. The California Ocean Protection Council (OPC) recently evaluated the costs and constraints of converting from once-through cooling systems to closed-cycle cooling (e.g., wet cooling towers).[84] Retrofitting the DCPP with a wet cooling system was determined to be feasible. A wet cooling system would reduce the intake volume of seawater by 90 to 95% and would also reduce the extent and size of any thermal plume in the receiving water and better match the discharge temperature with that of the receiving water. A drawback to wet cooling towers is a potential increase in the concentration of pollutants in that discharge, due to the reduced volume of the discharge. Additional treatment prior to discharge or alternative discharge methods may be required. At the DCPP, use of wet cooling towers is predicted to produce a maximum discharge temperature of approximately 78°F, which may be higher than the existing discharge during some periods. However, the extent of the thermal plume in the discharge cove will be reduced substantially compared to the current extent.[85]

This analysis assumes that a low scenario would be similar to that of requiring compliance with the temperature control criteria for major NPDES facilities, which are explained in Section 2.3.3. The high scenario is based off of the OPC 2009 report[86] that provides an analysis of the costs and burdens required to retrofit the DCPP with closed-system wet cooling towers.[87] Using OPC 2009 data, the DCPP is assumed to require significant capital expenses to comply with the closed-system criteria. This analysis assumes that the DCPP facility will incur capital and start-up costs in the first year,[88] annual operations and maintenance (O&M) costs over a 20-year period,[89] and an annual energy penalty.[90] Total annual costs are estimated to be approximately $3.2 billion (adjusted to 2010 dollars) over a 20-year period. The DCPP would be expected to incur almost $300 million annually.

[84] Tetra Tech Inc. 2008.
[85] Ibid.
[86] Ibid.
[87] Note: The report focuses on the use of alternative technology that would reduce and avoid entrainment and impingement of marine organisms. While the use of this alternative technology would also address effects on habitat (thermal effluent and water quality), much of the costs could be attributed to compliance with other existing regulations, including protections under the ESA-listing of black abalone.
[88] Includes all capital, indirect, contingency, and shutdown costs. All costs in this category are incurred in Year 0.
[89] Base cost values for Year 1 and Year 12 are adjusted for subsequent years using a 2 percent year-over-year escalator. Because DCPP is a baseload facility and operates at a relatively high capacity utilization factor, O&M costs for the NPC calculation were estimated at 100 percent of their maximum value.
[90] As a baseload facility, DCPP can be expected to operate at a high capacity utilization rate over its remaining life span. The study uses the 5-year average MWh output (2001–2006) as the basis for calculating the energy penalty in Years 1 through 20, including a year-over-year wholesale price escalation of 5.8 percent (based on the Producer Price Index).

Existing Federal, state, and local standards and regulations appear to offer the black abalone a moderate level of baseline protection. In addition, conservation measures undertaken for green sturgeon critical habitat may offer some additional baseline protections. However, the habitat needs of the species differ and require different conservation measures. For example, the discharge of thermal effluent and contaminants by coastal power plants is the main concern for black abalone critical habitat. These same concerns were identified for green sturgeon critical habitat but primarily for power plants within estuaries and bays, rather than for power plants along the open coast (i.e., Diablo Canyon Nuclear Power Plant). Thus, modifications to address thermal effluent and contaminants at coastal power plants (i.e., the DCNPP) would primarily be driven by black abalone critical habitat, rather than green sturgeon critical habitat. Therefore this analysis assumes that approximately 50 percent of impacts may be attributable to black abalone habitat. Appendix C provides a sensitivity analysis for these assumptions, providing estimates assuming that black abalone critical habitat is responsible for the generation of all project modification costs for all projects. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to power plants that may occur as a result of a critical habitat designation. As stated above, NMFS will consider any additional information received in developing the final economic analysis supporting its final determinations to designate or exclude areas from critical habitat for black abalone.

2.9.4 Summary of Economic Impacts to Power Plants by Area

Table 2.9-1 presents a summary of potential impacts to power plants.

Table 2.9-1: Summary of Economic Impacts to Power Plants by Area

Area	Activity Count (Number of power plants)	Incremental Score	Total Annualized Impacts (Discounted at 7%)		
			Low	Mean	High
10	1	0.5	$26,500	$74,975,150	$149,923,800
Total			$26,500	$74,975,150	$149,923,800

2.10 Economic Impacts of Critical Habitat Designation on Desalination Plants

2.10.1 Description of Threat

NMFS has identified desalination plants as a potential threat in 8 areas: Areas 4, 7, 8, 9, 10, 12, 17, and 19. Desalination plants may pose a threat to black abalone critical habitat by affecting *water quality*.

Hyper-saline water is generated as a byproduct of the desalination process and is generally about twice as saline (ranging from 46 and 80 ppt) as the ambient seawater (usually around 33 ppt).[91] Discharge of this hyper-saline water results in increased salinity and fluctuating salinity conditions that may affect sensitive organisms near the outfall. The impacts of brine effluent are generally more severe in rocky substrate than on sandy seafloor habitats. However, more research is needed on the tolerance level of black abalone for different salinities. Other effects of the discharge on water quality include increased turbidity, concentration of organic substances and metals contained in the feed waters, concentration of metals picked up through contact with the plant components, thermal pollution, and decreased oxygen levels. Entrainment and impingement of black abalone larvae may also occur from water intake at desalination plants, but this is primarily a take issue.

2.10.2 Regulatory Environment & Extent of Activity

Desalination plants require multiple permits from Federal, state, and local agencies. Source water permits may be required from the USACE for the construction of new intake (or discharge) pipes. Potable water permits under the Safe Drinking Water Act would be required from the State for any plant producing drinking water. Finally, NPDES permits would be required for wastewater discharge.[92] Authorization by the Sanctuaries may be required for discharge into Sanctuary waters or for installation of structures on or beneath the ocean floor within the Sanctuary.[93]

The USCG is responsible for approving structures in navigable waters, such as intake and outfall pipelines, to ensure they don't adversely affect navigation. The USCG may also require buoys or markers to be maintained over the structures. The applicant may also be required to submit information about the structures to include on nautical charts.

A desalination facility may require a Section 404 permit under the CWA from the USACE if it involves placing fill in navigable waters, and a Section 10 permit under the RHA if the proposal involves placing a structure in a navigable waterway. Facilities may require review from NMFS and/or USFWS for their potential effects on endangered, threatened, or other sensitive species. They may also require review for effects on essential fish habitat (EFH), protected marine mammals, and migratory birds. Other permits

[91] Monterey Bay National Marine Sencturary (MBNMS). *Resource Management Issues: Desalination*. MBNMS Resource Management Issues. Accessed at: http://montereybay.noaa.gov/resourcepro/resmanissues/desalination.html.
[92] National Research Council 2008

may also be required from the Federal Bureau of Reclamation, EPA (e.g., NPDES permit), Minerals Management Service, etc.

The available consultation data upon which we based our analysis does not indicate that NMFS or the USFWS had 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 CWA requirements, but because there is no past consultation history, it is not clear whether CWA requirements adequately address hypersaline effluent in marine waters for black abalone habitat.

There are three existing coastal desalination plants located within the specific areas (see Table 2.10-1). One of these plants is not currently operating and another is unknown.[94] 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. As water from other sources becomes scarce, desalination becomes a more viable source of drinking water, and desalination plants may be brought online. Seven additional desalination plants have been proposed but have not yet been constructed (see Table 2.10-1 and Figure 2.10-1). 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 and wave energy projects, it is unclear how many projects may ultimately reach construction stage.

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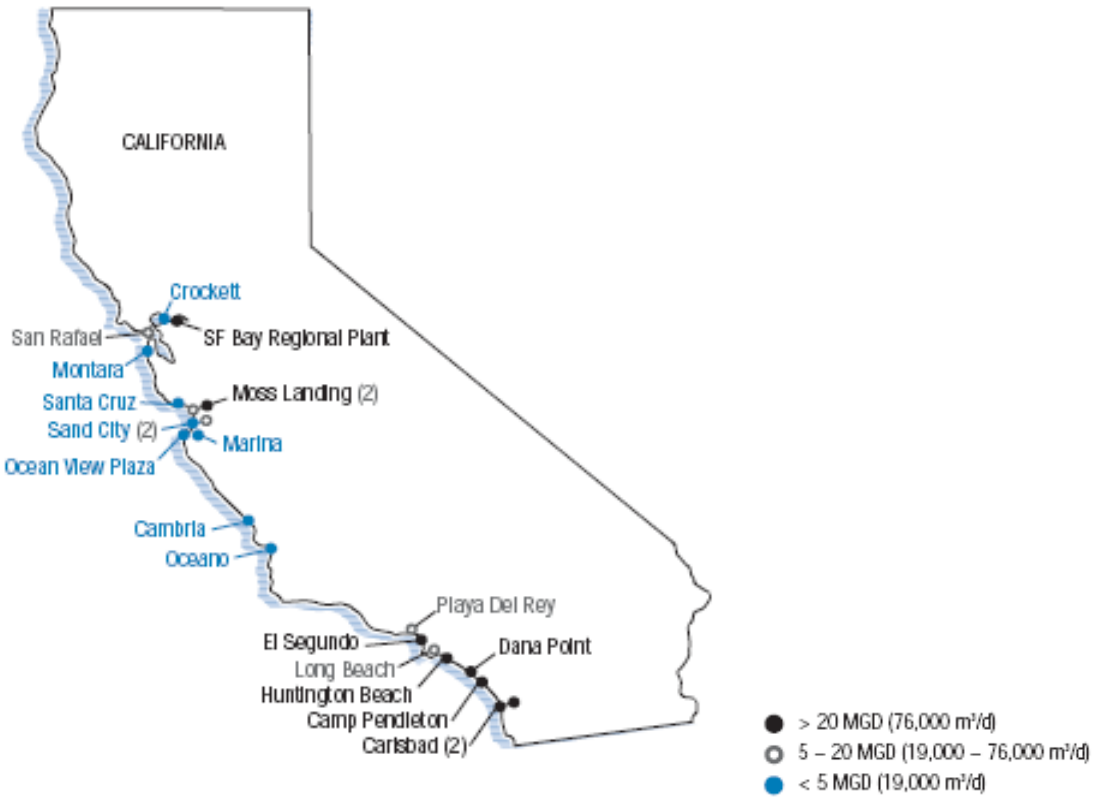
[93] Monterey Bay National Marine Sencturary (MBNMS). *Resource Management Issues: Desalination*. MBNMS Resource Management Issues. Accessed at: http://montereybay.noaa.gov/resourcepro/resmanissues/desalination.html.

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

Table 2.10-1: List of Desalination Plants by Area

Area	Project Name/(Ownership)	Capacity (MGD)	Status
Existing			
8	Monterey Bay Aquarium/(Non-profit)	0.04	Active
17	U.S. Navy/Nicholas Island/(Government)	0.02	Not known
19	Santa Catalina Island/(Public)	0.1	Inactive
Proposed			
4	Montara Water and Sanitary District	N/A	
7	City of Santa Cruz	2.5-4.5	
8	Monterey Peninsula Water Management District	7.5	
8	Ocean View Plaza	0.05	
9	Cambria Community Services District/(Department of the Army)	0.4	
10	Arroyo Grande/Grover Beach/(Ocean Community Services District)	1.9	
12	Municipal Water District of Orange County	25	

Figure 2.10-1: Proposed Desalination Plants in California (2006)



Source: Cooley, Heather, Peter H. Gleick, and Gary Wolff. 2006. "Desalination, with a Grain of Salt: *A California Perspective*." Pacific Institute for Studies in Development, Environment, and Security. Accessed at: www.pacinst.org/reports/desalination/desalination_report.pdf on March 24, 2010.

2.10.3 Impacts of Critical Habitat Designation on Desalination Plants

Black abalone critical habitat could impose modifications related to desalination plants, such as:

- Use of brackish groundwater as a feed water source or certain technologies (injection wells, percolation galleries, open ocean disposal structures with diffusers) to dilute brine.[95]
- Co-location with existing coastal power plants, to use the warmed power plant cooling water as the feedwater for the desalination plant. Another advantage is a reduction of the power plant discharge thermal plume.[96]

The California Coastal Commission (2004) lists other modifications to avoid or minimize entrainment and impingement impacts:

- Use alternative designs and mitigation measures to avoid intake.
- Where subsurface intakes are infeasible, open water intakes may be designed and located so that entrainment and impingement are reduced, but usually not entirely eliminated.

The California Coastal Commission (2004) lists other modifications to avoid or minimize adverse effects caused by desalination discharges:

- Proper location
- Subsurface outfalls
- Structural measures – diffusers or multiport outfalls
- Minimizing chemical use or using alternative treatments
- Wastewater treatment systems or on-land disposal

Under CWA requirements, desalination plants require Federal permits from USACE, EPA, or both. Therefore, should critical habitat be designated for black abalone in areas where these plants operate, a section 7 consultation may be required to determine impacts. 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.

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[95] Monterey Bay National Marine Sencturary (MBNMS). *Resource Management Issues: Desalination*. MBNMS Resource Management Issues. Accessed at: http://montereybay.noaa.gov/resourcepro/resmanissues/desalination.html.

[96] Department of Water Resources. 2003. "Water Desalination: Findings and Recommendations." Accessed at: http://www.water.ca.gov/desalination/pud_pdf/Findings-Recommendations.pdf.

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 desalination plants already choose to be co-located with power plants because co-location can result in construction and energy cost savings.[97]

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 $0.64 per kilogallon, adjusted to 2010 dollars[98]) are presented in Table 2.10-2.

Table 2.10-2: Estimated Costs of Alternative Method of Brine Disposal

Area	Number of Plants	Capacity (kgal/year)	Annual Cost	Average Annual Cost per Plant
4	1	N/A	N/A	N/A
7	1	1,277,500	$817,600	$817,600
8	3	2,770,350	$1,773,000	$591,000
9	1	146,000	$93,400	$93,400
10	1	693,500	$443,800	$443,800
12	1	9,125,000	$5,840,000	$5,840,000
17	1	7,300	$4,700	$4,700
19	1	36,500	$23,400	$23,400

Source: U.S. Department of the Interior Bureau of Reclamation. 2006. *Desalination and Water Purification Research and Development Program Report No. 111: Zero Discharge Seawater Desalination: Integrating the Production of Freshwater, Salt, Magnesium, and Bromine*. Reclamation: Managing Water in the West. University of South Carolina Research Foundation Agreement No. 98-FC-81-0054. Assumes brine is disposed in injection wells. Assumes, on average, costs of $0.64/kgal for alternative brine disposal. Adjusted to 2010 dollars.

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

[97] Poseidon Resources, "Desal 101." Accessed at: http://www.poseidonresources.com/desal_101.html on June 1, 2009.

[98] U.S. Department of the Interior Bureau of Reclamation. 2006. *Desalination and Water Purification Research and Development Program Report No. 111: Zero Discharge Seawater Desalination: Integrating the Production of Freshwater, Salt, Magnesium, and Bromine*. Reclamation: Managing Water in the West. University of South Carolina Research Foundation Agreement No. 98-FC-81-0054; adjusted for inflation using Bureau of Labor Statistics "Inflation Calculator" accessed at http//www.bls.gov on May 4, 2009.

may offer some additional baseline protections. However, the habitat needs of the species differ and require different conservation measures. Therefore this analysis assumes that approximately 50 percent of impacts in areas where green sturgeon critical habitat is present may be attributable to black abalone habitat. In cases where green sturgeon critical habitat is not present, approximately 100 percent of impacts are attributed to black abalone habitat. Appendix C provides a sensitivity analysis for these assumptions, providing estimates assuming that black abalone critical habitat is responsible for the generation of all project modification costs for all projects.

2.10.4 Summary of Economic Impacts to Desalination Plants by Area

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.

Table 2.10-3 presents a summary of our findings.

Table 2.10-3: Summary of Economic Impacts of Desalination Projects by Area

Area	Number of Affected Plants		Incremental Score	Total Annualized Costs (Discounted at 7%)		
	Existing	Proposed		Low	Mean	High
4*	0	1	0.5	N/A	N/A	N/A
7	0	1	0.5	$0	$204,400	$408,800
8	1	2	0.5	$0	$443,250	$886,500
9	0	1	0.5	$0	$23,350	$46,700
10	0	1	1.0	$0	$221,900	$443,800
12	0	1	0.5	$0	$1,460,000	$2,920,000
17	1	0	0.5	$0	$1,150	$2,300
19	1	0	1.0	$0	$11,700	$23,400
Total				$0	$2,365,750	$4,731,500

* Note that there are no costs for area 4, because the plant capacity is unknown. This does not mean that in the future, there will be no costs.

2.11 Economic Impacts of Critical Habitat Designation on Tidal and Wave Energy Projects

2.11.1 Description of Threat

NMFS has identified tidal and wave energy projects as potentially affecting three areas considered for black abalone critical habitat: Areas 1, 10, and 19. This activity may affect the *rocky substrate* and *water quality* PCEs.

Tidal and wave energy projects are designed to harness the kinetic energy of waves, currents, or tides to generate electricity. These projects typically involve placement of structures, such as buoys, cables, and turbines, in the water column. Projects can vary greatly in terms of size and design, and most are not yet fully developed. The potential effects of coastal wave and tidal energy projects on black abalone habitat are uncertain, because these projects are relatively new and the impacts are very site-specific. Wave energy projects may result in reduced wave height by as much as 5 to 13%,[99] which may benefit abalone habitat. Effects on wave height would generally only be observed 1-2 km away from the wave energy device. Another concern is the potential for liquids used in the system to leak or be accidentally spilled, resulting in release of toxic fluids.[100] Toxins may also be released in the use of biocides to control the growth of marine organisms.[101] Impacts on habitat may also result from the installation of power lines to transport power to shore.

2.11.2 Regulatory Environment & Extent of Activity

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) is authorized to issue licenses for the construction, operation, and maintenance of hydropower projects, including alternative energy hydrokinetic projects. For projects on the Outer Continental Shelf (OCS), MMS has jurisdiction to issue leases and FERC has jurisdiction to issue licenses to these projects.[102]

Tidal and wave energy projects are subject to FERC permitting and licensing requirements, and thus may require section 7 consultations on impacts to listed species and critical habitat. Both NMFS and USFWS have commented on several of the preliminary permit applications for these projects. In its comments, NMFS noted affected areas that represent EFH for federally managed species under the Magnuson Stevens Fishery Management Act, 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.[103] Among other environmental statutes applicable to proposed or pilot projects are section 401 of the CWA and the Marine Mammal Protection Act. A proposed project would also likely require a finding of consistency by the relevant state under section 307 (c) of the Coastal Zone Management Act to ensure the project complies with the state's coastal zone management plan.

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[99] Surfrider Foundation. Coastal A-Z, *Alternative Ocean Energy*. Accessed at: http://www.surfrider.org/a-z/alternative_energy.php.
[100] Ibid.
[101] Ibid.
[102] Federal Energy Regulatory Commission (FERC). Accessed at: www.ferc.gov.

To date, four projects within the identified areas have received preliminary permits from FERC. Three of these projects fall within Area 1 and one project is within Area 19. Preliminary permits are issued for up to three years and allow the permit-holder priority to develop that site for the duration of the permit. Preliminary permits, however, do not authorize any construction. In order to construct and operate a hydrokinetic facility, a license must be issued by FERC.

A list of hydrokinetic projects proposed within the study area is presented in Table 2.11-1 and is based on review of information posted on FERC's website (at www.ferc.gov) as of September 9, 2010:

Table 2.11-1: Preliminary Permits Issued by FERC for Tidal and Wave Energy Projects

Area	Docket No.	Project Name	Permittee	Issue Date	Expiration Date	Capacity	Classification
1	P-13376	Del Mar Landing	Sonoma County Water Agency	07/09/09	06/30/12	5,000	Wave
1	P-13377	Fort Ross (South)	Sonoma County Water Agency	07/09/09	06/30/12	5,000	Wave
1	P-13378	Fort Ross (North)	Sonoma County Water Agency	07/09/09	06/30/12	5,000	Wave
10	P-13641	Central Coast WaveConnect	PG & E	04/28/10	03/31/13	100,000	Wave
19	P-13498	SWAVE Catalina Green Wave	Sara, Inc.	09/15/09	08/31/12	6,000	Wave

Source: Federal Energy Regulatory Commission**.** *Issued Hydrokinetic Projects Preliminary Permits.* Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.xls on September 9, 2010

2.11.3 Impacts of Critical Habitat Designation on Tidal and Wave Energy Projects

The technology for hydrokinetic projects is relatively new and is still being actively developed. It is not yet known what number of the proposed projects will be constructed and become operational. Thus the ultimate design, location, and impacts of these projects are difficult to predict. Project modifications that would be required to minimize impacts to black abalone critical habitat are similarly difficult to predict and quantify. Potential modifications to these projects to mitigate adverse impacts may include spatial or temporal restrictions on project installation, operation, and maintenance. In the absence of specific conservation efforts recommended for listed species, the potential impact of black abalone critical habitat, should it be designated, on tidal and wave energy project remains uncertain.

Black abalone critical habitat could impose modifications related to tidal and wave energy projects such as:

[103] See, for example, National Marine Fisheries Service. *Comments on San Francisco Bay Tidal Energy Project*

- Use of non-toxic fluids instead of toxic fluids in systems with working hydraulic fluids.
- When the project requires the use of power lines, use existing power lines instead of constructing new ones and avoid rocky intertidal areas.

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 and wave energy projects (see Table 2.11-2). 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 in the "Economic Analysis of the Impacts of Designating Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon (NMFS 2008)" that license application costs and costs related to environmental review of the projects may increase due to critical habitat designation. While costs of ESA section 7 consultations 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. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to tidal and wave energy projects that may occur as a result of a critical habitat designation, as well as on the consultation costs discussed in Section 1 of this report.

Table 2.11-2: Environmental Measures for Example Wave Energy Project, with Annual Capital and O&M Costs, in 2010$

Project Modification	Annual Capital Cost	Annual O&M Cost
Use horizontal directional drilling 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.	$44,260	$0
Design features to achieve a closed-loop system to prevent any marine life entering pressurized water flow.	$44,260	$22,000
Design features to minimize scale of anchor devices, project footprint on seafloor, and chain/cable sweep of seafloor.	$22,160	$0
Develop a schedule of regular system maintenance that minimizes site visits, disturbance to marine growth, and activity at the site.	$220	$550
Total	$110,900	$22,550
Annual Cost	$133,450	
Source: Cost estimates from the IEc (2009) and adjusted to 2010 dollars (2010$) using the Bureau of Labor Statistics Inflation Calculator.		

(FERC No. 12585), August 12, 2005.

In the absence of specific information about the extent of the regulatory baseline for black abalone, project modification costs for tidal and wave projects are assumed to be attributable to black abalone critical habitat designation. Although some level of protection would already be expected to exist under the listing of black abalone, this analysis is unable to separate those costs from critical habitat costs. In addition, this analysis assumes that conservation measures undertaken for green sturgeon critical habitat may offer some additional baseline protections. However, the habitat needs of the species differ and require different conservation measures. Therefore this analysis assumes that approximately 100 percent of impacts may be attributable to black abalone habitat.

2.11.4 Summary of Economic Impacts to Tidal and Wave Energy Projects by Area

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 speculative.
- Future management and required project modifications for black abalone critical habitat, should it be designated, related to tidal and wave energy projects are uncertain and could vary in scope from project to project.

Table 2.11-3 presents a summary of our findings. Area 1 has the highest costs due to the number of issued preliminary permits. Areas 10 and 19 have the lowest costs since the analysis considers only one preliminary project in each of these areas.

Table 2.11-3: Summary of Economic Impacts to Tidal and Wave Energy Projects by Area

Area	Issued Preliminary Permits	Incremental Score	Total Annualized Costs (Discounted at 7%)
1	3	1.0	$400,350
10	1	1.0	$133,450
19	1	1.0	$133,450
Total			$667,250

2.12 Economic Impacts of Critical Habitat Designation on Liquefied Natural Gas Projects

2.12.1 Description of Threat

NMFS identified liquefied natural gas (LNG) projects as a potential threat to black abalone critical habitat. While there are no identified LNG facilities within the confines of the specific areas, the development of future projects may still pose a threat. This activity may affect the *rocky substrate, food resources, settlement habitat*, and *water quality* PCEs.

LNG terminals may be located onshore or offshore, including: offshore floating terminals, offshore oil platform terminals, and gravity-based offshore ports.[104] One concern for offshore facilities is that construction of pipelines to transport LNG onshore may affect black abalone habitat. For onshore LNG terminals, construction of breakwaters, jetties, or other shoreline structures and the activities associated with construction (e.g., dredging) may affect black abalone habitat (see "in-water construction" and "coastal urban development" in Sections 2.1 and 2.4, respectively). Another concern is the increased potential for oil spills and potential effects on water quality from the presence of vessels transporting and offloading LNG at the terminals.

2.12.2 Regulatory Environment & Extent of Activity

Under the Energy Policy Act of 2005, FERC has exclusive authority to issue licenses for the siting, construction, operation, and modification of LNG import terminals onshore and in state waters. The Maritime Administration (MARAD) and the U.S. Coast Guard (USCG) have siting and permitting jurisdiction for "deepwater ports" in Federal waters, defined as "any fixed or floating man-made structures other than a vessel…located beyond the territorial sea and off the coast of the United States …"[105] Approved LNG terminal projects must also obtain Coastal Zone Management Act, Section 404 (under the CWA) water quality certificate, and Section 404 (under the CWA) dredging permits.[106]

Based on review of FERC's database [107] updated as of April 12, 2010, there are no existing, approved, or proposed LNG facilities within the specific areas. There is one facility that has the potential of being built, however, the exact location of the facility is unknown at this time. It is important to note here that potential projects may never be elevated to a "proposed" status to FERC (see Figures 2.12-1, 2.12-2 and Table 2.12-1 below for more details).

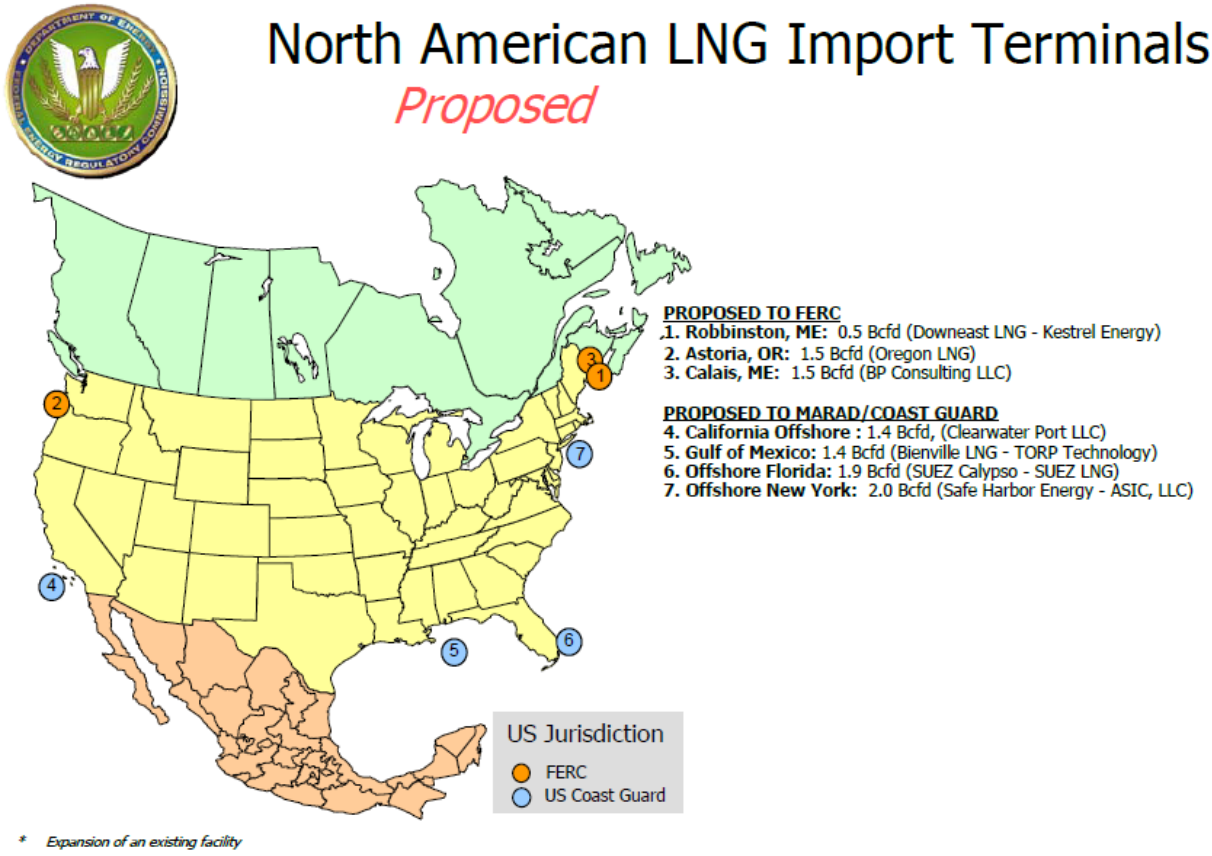
It is difficult to predict the number and location of LNG facilities that will be built within the specific areas. In addition to a rigorous approval process, many of these projects face significant local opposition as has been witnessed in the Pacific Northwest, or are abandoned during the development stages for various reasons. FERC's website indicates that market forces will ultimately dictate the number of

[104] Surfrider Foundation. Coastal A-Z, *LNG*. Accessed at: http://www.surfrider.org/a-z/LNG.php.
[105] 33 U.S.C.S. § 1502(10)
[106] FERC. *LNG Projects*. Accessed at: http://www.ferc.gov/industries/lng.asp. Updated as of February 6, 2010.
[107] Ibid.

facilities constructed. Analysts project that about 30% (12) of the 40 LNG terminals currently being considered will ever be built.[108]

[108] Federal Energy Regulatory Commission (FERC). Accessed at: www.ferc.gov.

Figure 2.12-1: Proposed North American LNG Import Terminals[109]



[109] Federal Energy Regulatory Commission (FERC). *North American LNG Import Terminals, Proposed.* Accessed at http://www.ferc.gov/industries/lng/indus-act/terminals/lng-proposed.pdf. Updated as of April 12, 2010.

Figure 2.12-2: Potential North American LNG Import Terminals[110]

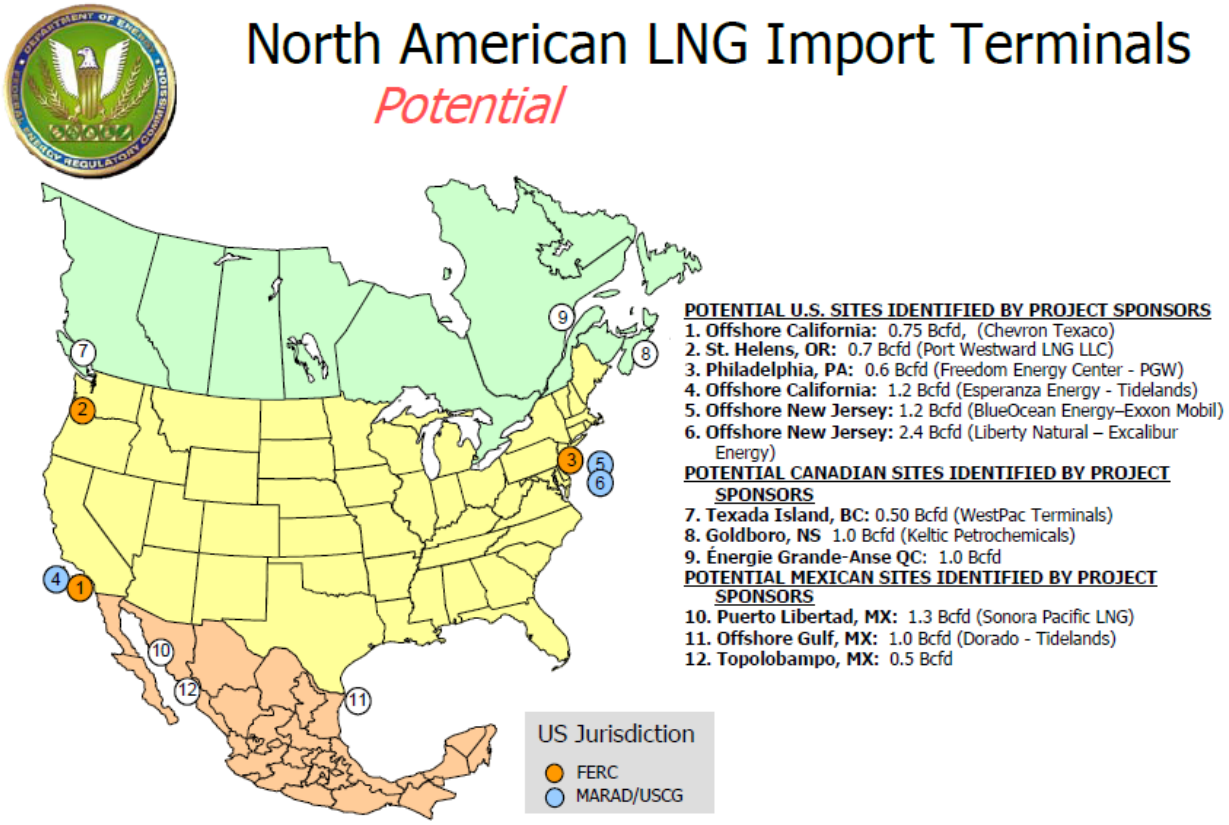


Table 2.12-1: Summary of Known LNG Import Terminals in California

Location	Applicant	Capacity	Comments
Existing			
None	N/A	N/A	N/A
Approved			
None	N/A	N/A	N/A
Proposed			
California Offshore, Clearwater Port, near Ventura County	Clearwater Port LLC (Northern Star Natural Gas)	1.4 Bcfd	The facility and its pipeline are not within the specific areas
Potential			
Offshore CA	Chevron Texaco	0.75 Bcfd	Exact location unknown
Offshore CA, Port Esperanza near Long Beach	Esperanza Energy, LLC	1.2 Bcfd	The facility and its pipeline are not within the specific areas

[110] Federal Energy Regulatory Commission (FERC). *North American LNG Import Terminals, Potential.* Accessed at http://www.ferc.gov/industries/lng/indus-act/terminals/lng-potential.pdf. Updated as of April 12, 2010.

2.12.3 Impacts of Critical Habitat Designation on Liquefied Natural Gas Projects

Based on available data, this analysis cannot forecast how many projects may or may not ultimately be constructed. Since there are no LNG projects under consideration in this analysis, NMFS has yet to make specific recommendations about any project modifications that might be required to mitigate potential adverse impacts on critical habitat for black abalone, should it be designated. Until specific plans for the LNG projects are made available, their potential impact on black abalone habitat will remain uncertain, as will the nature of any project modifications that might be requested to mitigate adverse impacts. Potential modifications may include biological monitoring and specific measures to prevent or respond to catastrophes. 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 species.[111] Since there is a high level of uncertainty associated with anticipating future management efforts for black abalone critical habitat as a result of LNG projects, this analysis presents only a qualitative discussion.

Black abalone critical habitat could impose modifications related to LNG projects such as:

- Offshore facilities: In the installation of pipelines, avoid rocky intertidal habitats or use existing pipelines.
- Onshore siting considerations: Avoid siting LNG projects within or adjacent to rocky intertidal habitats.

Potential modification costs for future onshore LNG facilities might include costs similar to those for in-water construction (i.e., coastal armoring, breakwater, etc.) and dredging (see Section 2.1.3). Potential modification costs for future offshore LNG facilities might include the pipeline project costs, avoidance of rocky areas, or use of existing pipelines onshore, and a requirement that each LNG carrier maintain a shipboard oil pollution plan containing measures to be implemented in the event of a spill or release and prohibit liquid transfer and refueling of vehicles and equipment within 100 ft of waterbodies.[112] Table 2.12-1 summaries possible cost estimates per LNG project, in 2010 dollars.

[111] NMFS (2007), Personal communication with NMFS on July 17, 2008.
[112] FERC. 2008. Final 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.

Table 2.12-1: Cost Estimates per LNG Project (2010$)

Sub-activity	Typical Project Modifications	Estimated Costs
Pipeline projects	• Erosion control (rock lining) • Bypass stream corridor • Riparian planning • Directional drilling ($900-$1,100)	$5,600-$222,000
Outfall structure projects	• Flagged boundaries • Complete site restoration and clean-up • Pollution and erosion control plan • Timing restrictions • Construction monitoring by an on-site biologist • Store and replace native soil upon project completion • Implement construction techniques to avoid sedimentation and conduct a sediment survey.	$111,500
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 2010 dollars using the U.S. Bureau of Economic Analysis, National Economic Accounts, National Income and Product Accounts table, 2010.		

In the absence of specific information about the extent of the regulatory baseline for black abalone, project modification costs for LNG projects are assumed to be attributable to black abalone critical habitat designation. Therefore this analysis assumes that approximately 50 percent of impacts may be attributable to black abalone habitat. Although some level of protection would already be expected to exist under the listing of black abalone, this analysis is unable to separate those costs from critical habitat costs. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to LNG facilities that may occur as a result of a critical habitat designation. As stated above, NMFS will consider any additional information received in developing the final economic analysis supporting its final determinations to designate or exclude areas from critical habitat for black abalone.

2.12.4 Summary of Economic Impacts to Liquefied Natural Gas Projects by Area

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 the specific areas is speculative.
- Future management and required project modifications for LNG terminals are uncertain and could vary in scope from project to project.

NMFS was unable to present a quantitative assessment for possible LNG modifications for this analysis because there are currently no LNG projects or structures associated with LNG projects (i.e., pipelines to transport the LNG onshore) proposed within the specific areas.

2.13 Economic Impacts of Critical Habitat Designation on Mineral and Petroleum Exploration and Extraction

2.13.1 Description of Threat

NMFS identified mineral and petroleum exploration and extraction as a potential threat to the essential features of black abalone critical habitat in one specific area: Area 10. Activities associated with mineral and off-shore oil and gas exploration and production may affect the *rocky substrate, food resources, settlement habitat*, and *water quality* PCEs.

Mineral and petroleum exploration and extraction activities may result in increased sediment input into rocky intertidal habitats and may increase the risk of an oil spill or leak. In a laboratory study, water-based drilling muds from an active platform were found to negatively affect the settlement of red abalone larvae on coralline algae, but fertilization and early development were not affected.[113] See "In-water construction" and "Coastal urban development" for effects of sedimentation in Sections 2.1 and 2.4 of this report, respectively. Also see "Oil and Chemical Spills: Prevention and Clean-up" for the effects of oil spills and leaks in Section 2.7 of this report.

2.13.2 Regulatory Environment & Extent of Activity

The Mineral Management Service (MMS) has two major functions: (1) managing the Nation's offshore energy and mineral resources, including oil, gas, and alternative energy sources, as well as sand, gravel and other hard minerals on the outer continental shelf (OCS); and (2) the collection and disbursement of revenues associated with energy and mineral resource production from all onshore and offshore Federal and Indian lands.[114]

The MMS leases mineral rights (known as "leases") to the submerged lands on the OCS beyond 3-miles from the State's seaward boundary. Each lease covers an area that is no more than 5,760 acres and is generally a square measuring 3 miles by 3 miles. Under a lease, a company has the right to apply for permits to explore and develop the mineral resources within that area. Before approving the permits,

[113] Raimondi et al. 1997, cited in Airoldi 2003

MMS carefully reviews all applications to ensure that the activities will be conducted in a safe and environmentally sound manner and that the interests of key stakeholders are effectively addressed.[115]

The MMS Pacific Region "currently manages 49 Federal oil and gas leases offshore southern California, 43 of which are producing about 24 million barrels of oil and 47 billion cubic feet of gas annually from 23 platforms."[116]

There are two pipelines that come ashore in rocky habitat, both in Area 10: (1) the Tranquillon Ridge Unit (Platform Irene); and (2) the Point Arguello Unit (Platforms Hermosa, Harvest, and Hidalgo) that comes ashore at Pt. Conception. These are drilled crossings, which means the pipeline goes under the rocky intertidal and comes out on land. Consultation occurs during construction and during re-permitting (for replacing or removing a line, which is possible in the next 15-20 years).

There was one pipeline spill in September of 1997, known as the "Torch" oil spill. It was a pipeline break about two miles from shore on the pipeline connecting Platform Irene in Federal waters to the onshore processing facility. The official amount of oil spilled was 167 barrels (bbls). The spill was around 3,000 bbls of an oily water mixture, which was determined to be around 98% water and 2% oil.[117]

2.13.3 Impacts of Critical Habitat Designation on Mineral and Petroleum Exploration and Extraction

Project modifications for the protection of black abalone critical habitat may include[118]:

- Adoption of oil spill clean-up protocols and oil spill prevention plans;
- More Clean Seas boats as first responders to prevent oil spills from coming onshore; and
- Relocation of proposed oil platforms further away from black abalone habitats.

Possible modification costs include pipeline projects, erosion control, and oil spill response (see Sections 2.12.3, 2.1.3, and 2.7.3, respectively). Existing Federal, state, and local standards and regulations appear to offer the black abalone some level of baseline protection. Therefore this analysis assumes that approximately 50 percent of impacts may be attributable to black abalone habitat. We solicit additional

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[114] Mineral Management Service (MMS). *Pacific Outer Continental Shelf*. Minerals Management Service Pacific OCS Region. Accessed at: http://www.mms.gov/omm/pacific/index.htm, on February 2010.
[115] Mineral Management Service (MMS). *Lease Information*. Minerals Management Service Pacific OCS Region. Accessed at: http://www.mms.gov/omm/pacific/lease/lease.htm, on May 2010.
[116] Mineral Management Service (MMS). *Pacific Outer Continental Shelf*. Minerals Management Service Pacific OCS Region. Accessed at: http://www.mms.gov/omm/pacific/index.htm, on February 2010.
[117] Personal communication with Mary-Elaine Helix, Mineral Management Service, on May 24, 2010.

data and comments from the public regarding potential modifications and associated economic costs related to mineral and petroleum exploration and extraction that may occur as a result of a critical habitat designation. As stated above, NMFS will consider any additional information received in developing the final economic analysis supporting its final determinations to designate or exclude areas from critical habitat for black abalone.

2.13.4 Summary of Economic Impacts to Mineral and Petroleum Exploration and Extraction by Area

In addition to the direct costs to undertake consultations and project modifications outlined above, physical changes to habitat areas that may be associated with project modifications may have other indirect economic impacts on local industries and enterprises in the future. The potential regional impact is the restriction of pipeline construction. As such, any modifications to regulations or ensuing changes to oil spill prevention for oil and gas exploration are unknown at this time; therefore, this analysis does not attempt to quantify impacts. However, costs may include training for oil spill response and insurance associated with oil spill response. Table 2.13-1 presents a summary of our findings.

Table 2.13-1: Summary of Economic Impacts to Mineral and Petroleum Exploration and Extraction by Area

Area	Number of Structures	Incremental Score
10	2	0.5

2.14 Economic Impacts of Critical Habitat Designation on Non-Native Species: Prevention and Management

2.14.1 Description of Threat

NMFS identified non-native species introduction prevention and non-native species management as potential threats to black abalone critical habitat in five areas: Areas 2, 4, 8, 10, and 11. The most important mechanism for the introduction of aquatic species is transport in ship ballast tanks. Other mechanisms of introduction include: improper disposal of aquarium materials, bait and seafood packing materials, aquaculture operations, and research activities.[119] These activities may affect the *food resources* and *settlement habitat* PCEs.

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[118] Note that Mineral/oil exploration is prohibited in the National Marine Sanctuaries and new California MPAs.
[119] MBNMS. *Resource Management Issues: Invasive Species. MBNMS Resource Management Issues*. Accessed at: http://montereybay.noaa.gov/resourcepro/resmanissues/invasive.html.

The release of wastewater, sewage, and ballast water from commercial shipping presents a risk to kelp and other macro-algal species by the potential introduction of exotic species. Non-native species may displace native organisms by preying on them or out-competing them for resources such as food, space, or both. Non-native species may introduce disease-causing organisms and can cause substantial population, community, and habitat changes. Other possible consequences of non-native species introductions could be impacts on flow patterns, sediment and nutrient dynamics, and impacts on native bioengineering species.

2.14.2 Regulatory Environment & Extent of Activity

Commercial Shipping

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 USCG to establish national voluntary ballast water management guidelines. If the guidelines were deemed inadequate, NISA directed the USCG 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 USCG found the rate of compliance to be inadequate, and vessel operators often failed to submit the ballast water reports to the USCG. The voluntary program became mandatory in 2004, and the USCG 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.[120]

U.S. waterborne foreign trade by unit in metric tons (mt) is summarized in Table 2.14-1. Priority areas include area 11 (Los Angeles) and area 4 (San Francisco). The Los Angeles port receives the most incoming waterborne foreign trade, at just under 78 million metric tons in 2006. The San Francisco port receives the next highest incoming waterborne foreign trade, at about 5 million metric tons in 2006. Secondary areas include transit to the main west coast ports, which include areas 8 and 10.

[120] USCG. *Aquatic Nuisance Species*. Accessed at: http://www.uscg.mil/hq/cg5/cg522/cg5224/ans.asp, on May 2010.

Table 2.14-1: U.S. Waterborne Foreign Trade by U.S. Custom Ports (metric tons)

Area	U.S. Custom Ports	2003	2004	2005	2006
4	San Francisco, CA	1,715,797	4,879,903	4,589,269	5,123,602
8	Monterey, CA	212	877	189	104
10	Port San Luis Harbor, CA	8,396	3,550	2,679	1,678
11	Los Angeles, CA	54,190,481	61,143,996	64,663,218	77,808,057
Total		55,914,886	66,028,325	69,255,355	82,933,441

Source: U.S. 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, April 2009.

Aquaculture

Offshore aquaculture operations may be subject to a variety of Federal and State water quality standards, affording black abalone and their habitat a level of baseline protection. In addition, all of the proposed offshore areas are considered to contain EFH for salmon as well as a variety of other fish species. However, NMFS has yet to make specific conservation recommendations related to aquaculture for these areas.

Structures in navigable waters, such as cages or net pens, may require approval from the USCG to ensure they don't adversely affect navigation. The USCG may also require buoys or markers to be maintained over the structures. The applicant may be required to submit information about the structures to include on nautical charts. An aquaculture facility may require a Section 404 permit (under the CWA) from the USACE if it involves placing fill in navigable waters, and a Section 10 permit under the RHA if the proposal involves placing a structure in a navigable waterway. Facilities may require review from the NMFS and USFWS for their potential effects on endangered, threatened, or other sensitive species. They may also require review for effects on EFH, marine mammals, and migratory birds. Other permits may also be required from the EPA (e.g., NPDES permit), Minerals Management Service, and others.

Seventeen aquaculture facilities were identified in Area 2, primarily in Drakes Bay and Tomales bay.

2.14.3 Impacts of Critical Habitat Designation on Non-Native Species

Modifications to prevent impacts on black abalone critical habitat from commercial shipping include:

- Safe (non-contaminated) ballast disposal.
- Rinse anchors and anchor chains when retrieving the anchor to remove organisms and sediments at their place of origin.

- Remove hull fouling organisms from hull, piping, propellers, sea chests, and other submerged portions of a vessel, on a regular basis, and dispose of removed substances in accordance with local, state, and federal law.

Modifications to prevent impacts on black abalone critical habitat from aquaculture include:

- Inspect aquaculture facilities to prevent non-native species transport in packing materials.

Existing Federal, state, and local standards and regulations appear to offer the black abalone a high level of baseline protection. Therefore this analysis assumes that approximately 10 percent of impacts may be attributable to black abalone critical habitat. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to non-native species introduction prevention and management that may occur as a result of a critical habitat designation. As stated above, NMFS will consider any additional information received in developing the final economic analysis supporting its final determinations to designate or exclude areas from critical habitat for black abalone.

2.14.4 Summary of Economic Impacts to Non-Native Species by Area

Any modifications to USCG 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. However, costs may include costs of treating ballast disposal and other disposal outside of state waters. The majority of ships will face costs associated with the use of ballast pumps, although these costs are usually quite small. A very small number of ships may have additional costs associated with an extension of their voyage. Options for treating ballast water that may add additional costs are: filtration systems, oxidizing and non-oxidizing biocides, thermal techniques, electric pulse and pulse plasma techniques, ultraviolet treatment, acoustic systems, magnetic fields, deoxygenation, biological techniques, and anti-fouling coatings.

Possible modifications to aquaculture facilities may include: education, Best Management Practices, enforcement to prevent bilge water influx/introduction, and inspection (additional inspections by CDFG and NOAA for aquaculture to prevent importing hitchhikers in packing materials with shipped organisms/live fish or epibionts). However, potential impacts related to non-native species introduction prevention and management are unclear. Due to this uncertainty, this analysis does not quantify impacts associated with non-native species.

Table 2.14-2 presents a summary of activities associated with non-native species prevention and management by specific area.

Table 2.14-2: Summary of Economic Impacts to Non-Native Species by Area

Area	Commercial Shipping (2006 metric tons)	# of Aquaculture Facilities	Incremental Score
2		17	0.1
4	5,123,602		0.1
8	104		0.1
10	1,678		0.1
11	77,808,057		0.1

2.15 Economic Impacts of Critical Habitat Designation on Kelp Harvesting

2.15.1 Description of Threat

NMFS identified kelp harvesting as a threat to black abalone critical habitat in 14 areas: Areas 7-20. This activity may affect the *food resources* PCE, since kelp is the primary source of food for black abalone. Kelp is harvested for algin, which is used as a binder, emulsifier, and molding material in a broad range of products, and as a food source in abalone aquaculture operations.[121] The harvest is small, but the kelp grows quickly, and harvest could generate drift (which can potentially be beneficial to black abalone).

2.15.2 Regulatory Environment & Extent of Activity

The volume and area of kelp harvesting activities are currently regulated by the California Fish and Game Commission. Kelp harvesting is regulated by the state and does not require a Federal permit.

GIS data was collected from the California Administrative Kelp Bed Boundaries. Table 2.15-1 displays the acreage of kelp under each status type (closed, leased, leasable, and open). A "closed" kelp bed means that harvesting is not permitted. A "leased" kelp bed means that mechanical harvesting can occur. A "leasable" kelp bed may be harvested by anyone with a kelp harvesting license, until the bed is leased. There is an opportunity to become the sole harvester. An "open" kelp bed may be harvested by anyone with a kelp harvesting license; however, there is no opportunity to become the sole harvester.

[121] Weinstein, Anna. "Socioeconomic Uses: IV Mariculture and Kelp Harvesting." Watershed Institute, CSU Monterey Bay. Accessed at: http://montereybay.noaa.gov/sitechar/soci4.html.

Table 2.15-1: Total Acres of Kelp Harvest Beds, by status and area

Areas	Closed	Leased	Leasable	Open
1	79,741			
2	125,289			
3				
4	37,568			
5	35,619			
6	119			
7	27,623	27,755		24,897
8			39,544	87,152
9		16,342	66,598	8,241
10	40,772	7,826	76,238	39,692
11				24,218
12	8,221			12,906
13				56,505
14				97,269
15			42,835	86,464
16				37,245
17			60,900	
18			28,214	
19				113,057
20			49,978	60,731
Total	354,952	51,922	364,308	648,377

2.15.4 Summary of Economic Impacts to Kelp Harvesting by Area

Potential impacts related to kelp harvesting are unclear. This analysis was unable to determine specifically how this threat would be alleviated for any area (i.e., what type of special management might be required). There is currently no federal nexus for kelp harvesting, thus there are no costs that can be attributed to this activity. Therefore, this analysis does not quantify impacts associated with kelp harvesting. However, if a federal nexus were to be in place with regard to kelp harvesting, this analysis assumes that approximately 100 percent of impacts may be attributable to black abalone habitat. Table 2.15-2 presents a summary of our findings.

Table 2.15-2: Summary of Economic Impacts to Kelp Harvesting by Area

Area	Total Acres of Harvestable Kelp	Incremental Score
7	52,652	1.0
8	126,696	1.0
9	91,181	1.0
10	123,755	1.0
11	24,218	1.0
12	12,906	1.0
13	56,505	1.0
14	97,269	1.0
15	129,300	1.0
16	37,245	1.0
17	60,900	1.0
18	28,214	1.0
19	113,057	1.0
20	110,710	1.0
Total	1,064,607	

2.16 Economic Impacts of Critical Habitat Designation on Activities that Lead to Global Climate Change

NMFS identified activities that lead to global climate change (e.g. fossil fuel combustion) as a threat to black abalone critical habitat in all areas identified. These activities may affect all PCEs. There is little information on these effects, however. Global warming is predicted to accelerate sea level rise and result in the inundation of many existing intertidal areas. Sea level rise would alter habitat availability and distribution for black abalone, and result in increased in-water construction (coastal armoring) to protect coastal structures from inundation. Sea surface water temperatures that exceed 25ºC may increase risks to black abalone. Ocean warming can cause increased virulence of withering syndrome and affect water quality as changes in temperature, pH and salinity occur. Ocean pH values that are outside of the normal range for seawater (i.e., pH less than 7.5 or greater than 8.5) may cause reduced growth and survivorship in abalone as has been observed in other marine gastropods.[122] Increasing partial pressure of carbon dioxide may reduce abundance of coralline algae and thereby affect the survival of newly settled black abalone.[123]

Potential actions to address this threat may include the organization of a task force and development of a plan that offers recommendations for ways to minimize the impacts of global warming on black abalone

[122] Shirayama and Thornton, 2005
[123] Feely et al., 2004; Hall-Spencer et al., 2008

and other ESA-listed species. However, this analysis was unable to determine specifically how activities that lead to global climate change (e.g., fossil fuel combustion) may be affected by the black abalone critical habitat designation (i.e., what type of special management might be required), or if a Federal nexus is present. Therefore, this analysis does not quantify impacts associated with activities that lead to global climate change. Existing Federal, state, and local standards and regulations (e.g., the California Global Warming Solutions Act of 2006, Environmental Protection Agency and National Highway Traffic Safety Administration initiatives to improve fuel efficiency and reduce greenhouse gas emissions and fuel use for cars and trucks) may offer black abalone baseline protection. However, due to the uncertainty in the effectiveness of measures currently in place to regulate activities that lead to global climate change, as well as uncertainty regarding how the designation may affect these activities, this analysis is unable to determine an incremental impact of this critical habitat designation on those activities at this time. We solicit additional data and comments from the public regarding potential modifications and associated economic costs related to activities that lead to global climate change that may occur as a result of a critical habitat designation. As stated above, NMFS will consider any additional information received in developing the final economic analysis supporting its final critical habitat determination for black abalone.

SECTION 3: SUMMARY OF RESULTS

3.1 Summary of Results

This section presents seven tables that summarize the results of this analysis.

Tables 3-1a and 3-1b present the level of economic activity, by area and by threat, and the metric used to estimate the level of activity, which varies by threat. For example, an approximate number of facilities currently in place is used to estimate the number of power plants, while the potential number of projects is used to estimate the number of tidal and wave energy projects.

Table 3-2 presents the estimated annualized cost by activity. 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 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).

Table 3-3 presents the incremental scores by activity and area. The incremental score is used to develop an estimate of the share of impacts that may be attributed to black abalone critical habitat. The scores vary both by activity and by area depending on the level of baseline protection provided by Federal, state and local standards and regulations as well as the presence of other listed species and other listed critical habitat. The incremental scores range from 0.1 for activities that exist in areas with a large amount of current protections, such as national marine sanctuary areas and areas with critical habitat designations for other species, to 1.0 for activities that have little to no existing protections afforded to black abalone habitat.

Tables 3-4a and 3-4b present total estimated impacts (costs) by area and by activity for both the low and high scenarios for the 10 activity types where a quantitative assessment was possible.

Table 3-5 presents total impacts summarized by area under the low, mean, and high scenarios. In the low cost scenario, Area 7 has the highest annual impacts at about $253,300, while Areas 10 has the next highest annualized impacts at $54,800. In the high cost scenario, Area 10 has the highest annual impacts at about $151.1 million, while Areas 12, 8, and 7 have the next highest annualized impacts at $3.1 million, $1.6 million, and $1.56 million, respectively. Areas 6, 13, 14, and 18 have the lowest impacts,

$0, since the only activities identified in these areas being considered for designation can only be discussed qualitatively. However, this does not mean that in the future, there will be $0 costs.

Table 3-1a: Summary of the Estimated Level of Activities, by Areas 1-10

Activities	Metric \ Areas	1	2	3	4	5	6	7	8	9	10
In-water construction	# of JDs										0.6
Sand replenishment	# of projects		0.2		0.1			0.3			
NPDES: Minor	# of facilities (high buffer estimates)	4	23	22	22	1		6	4	2	2
NPDES: Major	# of facilities (high buffer estimates)		19	19	22	1		4	4	1	7
Coastal development	# of JDs		5		1			3	1		0.8
Side-casting	# of cubic yards							30,000	N/A		
Agricultural Activities	acres of farmland (high buffer estimates)	4,988	7,568	1,848	6,596			20,751	19,386	5,608	22,576
Oil & chemical spills: prevention & clean-up	# gallons (actual + potential)				350	70		200	140	70	
Vessel grounding	# of vessels								1		
Power plants	# of plants										1
Desalination plants	# of plants				1			1	3	1	1
Tidal and wave energy projects	# of projects	3									1
Mineral and petroleum exploration and extraction	# of structures										2
Non-native species: Commercial shipping	metric tons				5,123,602				104		1,678
Non-native species: Aquaculture	# of farms		17								
Kelp harvesting	# of acres							52,652	126,696	91,181	123,755

Table 3-1b: Summary of the Estimated Level of Activities, by Areas 11-20

Activities	Metric \ Areas	11	12	13	14	15	16	17	18	19	20
In-water construction	# of JDs							0.2		0.4	0.2
Sand replenishment	# of projects	0.1									
NPDES: Minor	# of facilities (high buffer estimates)	50	2				1	1			
NPDES: Major	# of facilities (high buffer estimates)	11	5				2			2	
Coastal development	# of JDs							0.2		0.6	0.2
Side-casting	# of cubic yards										
Agricultural Activities	acres of farmland (high buffer estimates)		5,054				728				
Oil & chemical spills: prevention & clean-up	# gallons (actual + potential)		1			40				180	
Vessel grounding	# of vessels										
Power plants	# of plants										
Desalination plants	# of plants		1					1		1	
Tidal and wave energy projects	# of projects									1	
Mineral and petroleum exploration and extraction	# of structures										
Non-native species: Commercial shipping	metric tons	77,808,057									
Non-native species: Aquaculture	# of farms										
Kelp harvesting	# of acres	24,218	12,906	56,505	97,269	129,300	37,245	60,900	28,214	113,057	110,710

Table 3-2: Summary of Estimated Annualized Costs by Activity and Area

Activity	Cost Category	Cost Range	Present Value	Timeframe	Metric	2010 Annualized Costs (Discounted at 7%)
	Low	$38,000	$28,364			$4,750
	Mean	$66,000	$49,263			$8,250
In-water construction	High	$94,000	$70,163	8	per project	$11,750
	Low	$0	$0			$0
	Mean		$340,808			$71,500
Sand replenishment	High	$858,000	$681,615	6	per project	$143,000
	Low	$0	$0			$0
	Mean	$151,000	$79,985			$7,550
NPDES: Minor	High	$302,000	$159,970	20	per plant	$15,100
	Low	$1,058,800	$560,847			$52,940
	Mean	$1,377,800	$729,822			$68,890
NPDES: Major	High	$1,696,800	$898,796	20	per plant	$84,840
	Low	$40,000	$21,188			$2,000
	Mean	$163,000	$86,341			$8,150
Coastal development	High	$286,000	$151,494	20	per project	$14,300
	Low: Area 7	$240,000	$224,299			$240,000
	Mean: Area 7	$292,500	$273,364			$292,500
Side-casting	High: Area 7	$345,000	$322,430	1	per project	$345,000
	Low	Varies by area depending on acreage				$0-$16,800
Agriculture: Irrigation	High					$21,900-$677,300
Oil & chemical spills:	Low	Varies by a number of factors described in Section 2.7.3				$51,400-$102,900
prevention & clean-up	High				per gallon	$1,700-$678,000
	Low	$998,951	$529,145			$49,948
	Mean	$2,998,975,244	$1,588,559,323			$149,948,762
Power plants	High	$5,996,951,536	$3,176,589,500	20	per plant	$299,847,577
	Low	Varies by plant capacity				$0
Desalination plants	High				per plant	$4,700-$5,840,000
	Low	$0	$0			$0
Tidal and wave energy	Mean	$2,001,750	$827,993			$66,725
projects	High	$4,003,500	$1,655,987	30	per project	$133,450

Table 3-3: Summary of Incremental Scores

Activities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
In-water construction										0.5							1.0		1.0	1.0
Sand replenishment		1.0		1.0			1.0				1.0									
NPDES-permitted activities	0.1	0.1	0.2	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1				0.2	0.2		0.2	
Coastal development		0.5		0.5			0.5	0.5		0.1							1.0		1.0	1.0
Side-casting							0.5	0.5												
Agriculture: Pesticide application	0.1	0.1	0.1	0.1			0.1	0.1	0.1	0.1		0.1				0.1				
Agriculture: Irrigation	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0		1.0				1.0				
Oil & chemical spills: prevention & clean-up				0.2	0.2		0.2	0.2	0.2			0.2			0.2				0.2	
Vessel grounding								0.2												
Power plants										0.5										
Desalination plants				0.5			0.5	0.5	0.5	1.0		0.5					0.5		1.0	
Tidal and wave energy projects	1.0									1.0									1.0	
Mineral and petroleum exploration and extraction										0.5										
Non-native species introduction and management		0.1		0.1				0.1		0.1	0.1									
Kelp harvesting							1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Table 3-4a: Total Estimated Economic Impacts, Areas 1-9

Activity		1	2	3	4	5	6	7	8	9
In-water construction	Low									
	High									
Sand replenishment	Low		$0		$0			$0		
	High		$28,600		$14,300			$42,900		
NPDES: Minor	Low	$0	$0	$0	$0	$0		$0	$0	$0
	High	$6,600	$38,000	$72,700	$36,400	$1,700		$9,900	$6,600	$3,300
NPDES: Major	Low		$0	$0	$15,000	$0		$5,000	$5,000	$0
	High		$155,500	$311,000	$180,100	$8,200		$32,700	$32,700	$8,200
Coastal development	Low		$5,000		$1,000			$3,000	$1,000	
	High		$35,800		$7,200			$21,400	$7,200	
Side-casting	Low							$240,000	$0	
	High							$345,000	$0	
Agricultural Irrigation	Low	$3,300	$10,100	$0	$400			$5,300	$2,300	$5,000
	High	$149,600	$227,000	$55,400	$197,900			$622,500	$581,600	$168,200
Oil & chemical spills: prevention & clean-up	Low				$20,600	$10,300		$0	$0	$0
	High				$135,600	$24,000		$77,500	$94,200	$27,100
Power plants	Low									
	High									
Desalination plants	Low				$0			$0	$0	$0
	High				$0			$408,800	$886,500	$46,700
Tidal and wave energy projects	Low	$0								$0
	High	$400,350								$133,450

Table 3-4b: Total Estimated Economic Impacts, Areas 10-20

Activity		10	11	12	13	14	15	16	17	18	19	20
In-water construction	Low	$1,400							$950		$1,900	$950
	High	$3,500							$2,350		$4,700	$2,350
Sand replenishment	Low		$0									
	High		$14,300									
NPDES: Minor	Low	$0	$0	$0				$0	$0			
	High	$3,300	$82,600	$3,300				$3,300	$3,300			
NPDES: Major	Low	$10,000	$40,000	$10,000				$0			$20,000	
	High	$57,300	$90,000	$40,900				$32,700			$32,700	
Coastal development	Low	$1,600							$400		$1,200	$400
	High	$11,400							$2,900		$8,600	$2,900
Side-casting	Low											
	High											
Agricultural Irrigation	Low	$16,800		$900				$0				
	High	$677,300		$151,600				$21,900				
Oil & chemical spills: prevention & clean-up	Low			$0			$0				$0	
	High			$300			$26,900				$121,200	
Power plants	Low	$25,000										
	High	$149,923,800										
Desalination plants	Low	$0		$0					$0		$0	
	High	$443,800		$2,920,000					$2,300		$23,400	
Tidal and wave energy projects	Low										$0	
	High										$133,450	

Table 3-5: Mean-Ranked Impacts

Area	Annualized Impacts (7% Discount Rate)			Activities with only a qualitative analysis (NOT included in the estimated costs)*
	Low	Mean	High	
10	$55,400	$75,655,525	$151,255,650	Agricultural pesticide application, Mineral and petroleum exploration and extraction, Non-native species introduction and management, and Kelp harvesting
12	$11,500	$1,564,400	$3,117,300	Agricultural pesticide application and Kelp harvesting
7	$253,600	$907,350	$1,561,100	Agricultural pesticide application, Vessel grounding, Non-native species introduction and management, and Kelp harvesting
8	$8,600	$809,000	$1,609,400	Agricultural pesticide application and Kelp harvesting
1	$3,300	$279,625	$555,950	Agricultural pesticide application and Non-native species introduction and management
2	$15,100	$317,925	$620,750	Agricultural pesticide application and Non-native species introduction and management
4	$37,900	$306,350	$574,800	Agricultural pesticide application
3	$0	$222,100	$444,200	Agricultural pesticide application
11	$42,400	$179,475	$316,550	Kelp harvesting
19	$24,300	$174,775	$325,250	Agricultural pesticide application and Kelp harvesting
9	$5,000	$129,250	$253,500	Non-native species introduction and management and Kelp harvesting
16	$0	$29,400	$58,800	Agricultural pesticide application and Kelp harvesting
5	$10,300	$22,150	$34,000	
15	$0	$13,450	$26,900	Kelp harvesting
17	$1,350	$5,950	$10,550	Kelp harvesting
20	$1,350	$3,300	$5,250	Kelp harvesting
6	$0	$0	$0	
13	$0	$0	$0	Kelp harvesting
14	$0	$0	$0	Kelp harvesting
18	$0	$0	$0	Kelp harvesting
Totals**	$470,000	$79,916,925	$159,363,850	Agricultural pesticide application, Vessel grounding, Mineral and petroleum exploration and extraction, Non-native species introduction and management, and Kelp harvesting

*Note: Activities that lead to global climate change (e.g. fossil fuel combustion) are also discussed qualitatively in this analysis and are recognized as potential threats to black abalone in all areas (see Section 2.16).

**Note: Totals are adjusted for double-counting of outfalls and acres that overlap multiple areas.

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APPENDIX A: NON-COST SUMMARY INFORMATION

Appendix A provides a table showing non-cost summary information for the 17 activities identified in the report. Table A-1 shows the economic activities, by area, that may require special management to accommodate black abalone critical habitat. The "Y" stands for yes, that the activity is present in the respective area.

Table A-1: Summary of Potential Threats within Areas Considered for Black Abalone Critical Habitat Designation

Activities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Dredging																				
In-water construction										Y							Y		Y	Y
Sand replenishment		Y		Y			Y				Y									
NPDES-permitted activities	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y				Y	Y		Y	
Coastal development		Y		Y			Y	Y		Y							Y		Y	Y
Side-casting							Y	Y												
Agricultural Activities	Y	Y	Y	Y			Y	Y	Y	Y		Y				Y				
Oil & chemical spills: prevention & clean-up				Y	Y		Y	Y	Y			Y			Y				Y	
Vessel grounding								Y												
Power plants										Y										
Desalination plants				Y			Y	Y	Y	Y		Y					Y		Y	
Tidal and wave energy projects	Y									Y									Y	
Liquefied natural gas (LNG)																				
Mineral and petroleum exploration and extraction										Y										
Non-native species introduction and management		Y		Y				Y		Y	Y									
Kelp harvesting							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Activities that lead to global climate change	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table A-2 provides the area(s) in which the activity is located, the PCE(s) the activity could affect and the nature of that threat, the ESA Section 7 nexus for that activity, and the possible modifications to the activity due to the black abalone critical habitat designation.

Table A-2: Summary of Activities: Nature of Threat, ESA Section 7 Nexus, and Possible Modifications

Activity	Areas	PCE and nature of the threat	Section 7 nexus	Possible modification(s) to the activity
Dredging	Uncertain	*Rocky substrate* PCE—Dredging that does occur near rocky intertidal areas may increase sedimentation into the rocky habitat. A variety of harmful substances, including heavy metals, oil, TBT, PCBs and pesticides, can be absorbed into the seabed sediments and contaminate them. *Water quality* PCE—Dredging and disposal processes can release contaminants into the water column, affecting water quality, and making them available to be taken up by animals and plants, which could cause morphological or reproductive disorders.	The USACE issues permits pursuant to Section 404 of the Clean Water Act (CWA), among several others. The USACE must then consult with NMFS under section 7 of the ESA.	Restrictions on the spatial and temporal extent of dredging activities and the deposition of dredge spoil. Requirements to treat (detoxify) dredge spoil.
In-water construction	10, 17, 19, and 20	*Rocky substrate* PCE— Increased sedimentation, a side effect of some in-water construction projects, can reduce the quality and/or quantity of rocky substrate. *Food resources* PCE— The presence of in-water structures may affect black abalone habitat by affecting the distribution and abundance of algal species that provide food for abalone or the distribution and abundance of other intertidal invertebrate species. *Settlement habitat* PCE—Changes in algal communities could affect settlement of larval abalone (believed to be influenced by the presence of coralline algae). *Nearshore circulation pattern* PCE—Nearshore circulation patterns may affect intertidal communities by providing stepping-stones between populations, resulting in range extensions for species with limited dispersal distances. Artificial structures, like	The USACE issues permits pursuant to Section 10 of the Rivers and Harbors Act of 1899 (RHA) among several others. Although in-water construction projects are commonly undertaken by private or non-Federal parties, in most cases they must obtain a USACE permit. The USACE must then consult with NMFS under section 7 of the ESA.	Bank stabilization measures and more natural erosion control.

		breakwaters, may also alter the physical environment by reducing wave action and modifying nearshore circulation and sediment transport.		
Sand replenishment	2, 4, 7, and 11	*Rocky substrate* PCE —Sand movements could cover up rocky substrate thereby reducing its quality and/or quantity.	The USACE is responsible for administering Section 404 permits under the CWA, which are required for sand replenishment activities.	Monitor the water quality (turbidity) during and after the project. Place a buffer around pertinent areas within critical habitat that sand replenishment projects have to work around. Ensure any dredge discharge pipelines are sited to avoid rocky intertidal habitat. Construct training dikes to help retain the sand at the receiving location, which should minimize movement of sand into the rocky intertidal areas.
NPDES-permitted activities	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 16, 17, and 19	*Food resources* PCE—Sewage outfalls may affect food resources by causing light levels to be reduced to levels too low to support *Macrocystis* germination and growth. Eutrophication occurs around southern California sewage outfalls where phytoplankton crops and primary production exceed typical levels and approach values characteristic of upwelling periods. W*ater quality* PCE—Exposure to heavy metals can affect growth of marine organisms, either promoting or inhibiting growth depending on the combination and concentrations of metals. There is little information on these effects on black abalone, however.	Issuance of CWA permits. State water quality standards are subject to an ESA section 7 consultation between NOAA and the EPA and NOAA can review individual NPDES permit applications for impacts on ESA-listed species.	Where federal permits are necessary, ensure discharge meets standards other than existing federal standards and regulations (EPA, CWA). Require measures to prevent or respond to a catastrophic event (i.e., using best technology to avoid unnecessary discharges).
Coastal development	2, 4, 7, 8, 10, 17, 19, and 20	*Rocky substrate* PCE— Increased sediment load that may result from urbanization of the coast and of watersheds (increased transport of fine sediments into the coastal zone by rivers or runoff) can reduce the quality and/or quantity of rocky substrate. For example, in a study on San Nicolas Island, black abalone "dominated areas where rock contours provided a refuge from sand deposition" (Littler *et al.* 1983, cited in Airoldi 2003). Overall, there has been little study of the effects of increased sedimentation on	The USACE permits construction or expansion of stormwater outfalls, discharge or fill of wetlands, flood control projects, bank stabilization, and in-stream work	Stormwater pollution prevention plan; permanent stormwater site plan; and stormwater best management practice operations and maintenance.

		rocky shoreline communities (Airoldi 2003). In addition, construction of coastal armoring is often associated with coastal urban development to protect structures from wave action or prevent erosion (see "in-water construction" in Section 2.1). *Food resources* PCE— Increased sedimentation may also affect feeding by covering up food resources, altering algal communities (including algal communities on the rocky reef and the growth of kelp forests that supply drift algae), and altering invertebrate communities (affecting biological interactions). Ephemeral and turf-forming algae were found to be favored in rocky intertidal areas that experience intermittent inundation (Airoldi 1998, cited in Thompson *et al.* 2002). *Settlement habitat* PCE—Increased sedimentation may affect settlement of larvae and propagules by covering up settlement habitat as well as affecting the growth of encrusting coralline algae (see Steneck *et al.* 1997, cited in Airoldi 2003), thought to be important for settlement.		
Sidecasting	7 and 8	*Rocky substrate* and *settlement habitat* PCEs— Increased likelihood of sediment input into rocky intertidal habitats may reduce its quality and quantity. *Food resources* PCE—Sidecasting may result in possible reductions or changes to food resources. See sedimentation effects as described under "Coastal development", above.	NMS regulations prohibit discharge of materials within its boundaries, as well as outside its boundaries if the material may enter the sanctuary and harm sanctuary resources. However, under certain circumstances, a permit may be obtained from the MBNMS to allow for a prohibited activity.	Haul away (or store locally) excess material from road maintenance activities, rather than sidecast; place excess material at a stable site at a safe distance from rocky intertidal habitats; and use mulch or vegetation to stabilize the material.
Agricultural activities (including pesticide application, irrigation, and livestock farming)	1, 2, 3, 4, 7, 8, 9, 10, 12, and 16	*Rocky substrate* PCE—Soil erosion from intensive irrigated agriculture or livestock farming in areas adjacent to the coast can cause increased sedimentation thereby reducing the quality and quantity of rocky substrate. *Food resources* PCE—Herbicides are designed to kill plants, thus herbicide contamination of water could have devastating effects on aquatic plants.	*Irrigation*—any water supplier providing water via contract with USBR or using infrastructure owned or maintained by the USBR is subject to section 7 consultation under ESA. Privately owned diversions may require a Federal permit from USACE under sections 401 or 404 of the CWA.	For irrigated agriculture: conservation crop rotation, underground outlets, land smoothing, structures for water control, subsurface drains, field ditches, mains or laterals, and toxic salt reduction.

		Settlement habitat PCE—Laboratory experiments showed that the presence of pesticides (those examined in the study were DDT, methoxychlor, dieldrin, and "2,4-D") interfered with larval settlement. Presence of pesticides had a much lesser effect on survival of larvae. W*ater quality* PCE—Pesticides alter the chemical properties of sea water such that they can interfere with settlement cues emitted by coralline algae and associated diatom films and/or they may inhibit growth of marine algae upon which black abalone depend for food. There is little information on these effects on black abalone or related species, however, especially for pesticides that are currently in use.	*Pesticide Application*—EPA consultation on FIFRA, pesticide registration program, and NPDES permits for aquatic pesticides. *Livestock farming*— Bureau of Land Management (BLM) and the U.S. Forest Service (USFS).	For pesticides application: restrictions on application of some pesticides within certain distances streams would provide protection for black abalone habitat. For livestock farming: Fencing riparian areas; Placing salt or mineral supplements to draw cattle away from rivers; Total rest of allotments when possible; and Frequent monitoring.
Oil & chemical spills& clean-up	4, 5, 7, 8, 9, 12, 15, and 19	*Rocky substrate* and *settlement habitat* PCEs—Oil spill clean-up activities may be as destructive, or more destructive, than the oil spill itself. Oil spill clean-up may involve application of toxic dispersants and the use of physical cleaning methods such as the use of high pressure and/or high temperature water to flush out oil which may decrease the quality of rocky substrate abd settlement habitat in an area. Oil, oil/dispersant mixtures, and dispersants used in oil spill clean-up may adversely affect grazing mollusks like abalone in rocky intertidal areas, although less-toxic dispersants have been developed in recent years. *Food resources* PCE—The use of dispersants and physical cleaning methods may affect black abalone food resources (algal community). Chemical spills could also affect food resources, if the chemicals kill algae or affect algal growth. *Water quality* PCE—Effects of oil spills vary from no discernable differences to widespread mortality of marine invertebrates over a large area and reduced densities persisting a year after the spill.	Review of oil spill response plan from USCG. Regulations under the Water Pollution Control Act.	Restrict or minimize the use or type of response to oil spills (e.g. boom, dispersants, *in situ* burning) in areas where black abalone habitat exists. Mitigation measures include adoption of oil/chemical spill clean-up protocols and oil/chemical spill prevention plans, more Clean Seas boats as first responders to prevent oil/chemical spills from coming onshore, and relocation of proposed oil/chemical platforms further away from black abalone habitats
Vessel grounding	8	*Rocky substrate* and *settlement habitat* PCEs—Vessel grounding can affect the rocky substrate and have	The United States Coast Guard (USCG) has the authority to respond to all oil and	Best management practices (BMP) for oil spill and debris

		substantial effects on the environment, ranging from minor displacement of sediment to catastrophic damage to reefs. Wave activity may also cause the vessel to roll excessively and do more damage to the ocean floor. *Food resources* and *water quality* PCEs—The risk of invasion by foreign species attached to the ship's hull into a local environment. The wreck of an ocean-going vessel can result in large masses of steel distributed over substantial areas of seabed, particularly in high energy, shallow water environments. The wreckage may be a chronic source of dissolved iron. Elevated levels of iron may affect water quality and result in an increase of opportunistic algae blooms	hazardous substance spills in the offshore/coastal zone, while the EPA has the authority to respond in the inland zone.	clean-up to reduce trampling. Education of USCG, NMS biologists, and others involved in clean-up to raise awareness of black abalone.
Power plants	10	*Water quality* PCE—The power plants' use of coastal waters for cooling and subsequently discharging of heated water back into the marine environment may raise water temperatures and introduce contaminants into the water. Elevated water temperatures have been linked to increased virulence of the withering syndrome disease.	The Diablo Canyon Nuclear Power Plant, located in specific area 10, is licensed through the Nuclear Regulatory Commission.	Require cooling of thermal effluent before release to the environment (may require use of different technology). Require treatment of any contaminated waste materials. Modifications associated with permit issued under NPDES (any updates from current early 1990s issuance). Dry cooling systems (not as feasible as wet cooling systems due to greater logistical constraints and total costs). Modifications to cooling water intake flow by season and operational conditions using variable speed pumps/variable frequency drives (benefits depend on the frequency and degree that flow can be reduced without affecting operations). Use of reclaimed water as a source of makeup water for wet

				cooling towers or as a source for once-through cooling water systems.
Desalination plants	4, 7, 8, 9, 10, 12, 17, and 19	*Water quality* PCE—Discharge of hyper-saline water results in increased salinity and fluctuating salinity conditions that may affect sensitive organisms near the outfall. The impacts of brine effluent are generally more severe in rocky substrate than on sandy seafloor habitats. However, more research is needed on the tolerance level of black abalone for different salinities. Other effects of the discharge on water quality include increased turbidity, concentration of organic substances and metals contained in the feed waters, concentration of metals picked up through contact with the plant components, thermal pollution, and decreased oxygen levels. Entrainment and impingement of black abalone larvae may also occur from water intake at desalination plants, but this is primarily a take issue.	A desalination facility may require a Section 404 permit under the CWA from the USACE if it involves placing fill in navigable waters, and a Section 10 permit under the RHA if the proposal involves placing a structure in a navigable waterway.	Potential conservation efforts to mitigate desalination impacts may include the treatment of hyper-saline effluent to ensure that salinity levels are restored to normal values. The costs of treating hyper-saline effluent or finding an alternate manner of brine disposal can vary widely across plants depending on plant capacity and design.
Tidal and wave energy projects	1, 10, and 19	*Rocky substrate* PCE—Impacts on rocky substrate may result from the installation of power lines to transport power to shore. These projects typically involve placement of structures, such as buoys, cables, and turbines, in the water column. *Water quality* PCE—Alternative energy projects may result in reduced wave height by as much as 5 to 13%, which may benefit abalone habitat. Effects on wave height would generally only be observed 1-2 km away from the wave energy device. Another concern is the potential for liquids used in the system to leak or be accidentally spilled, resulting in release of toxic fluids. Toxins may also be released in the use of biocides to control the growth of marine organisms. The potential effects of coastal wave and tidal energy projects on black abalone habitat are uncertain, because these projects are relatively new and the impacts are very site-specific.	Subject to FERC permitting and licensing requirements, as well as requirements under Section 401 of the CWA.	Use of non-toxic fluids instead of toxic fluids. When the project requires the use of power lines, use existing power lines, instead of constructing new ones, and avoid rocky intertidal areas.
Liquefied natural gas (LNG) projects	Uncertain	*Rocky substrate* PCE—Onshore LNG terminals, construction of breakwaters, jetties, or other shoreline structures and the activities associated with construction (e.g., dredging) may affect black abalone	CWA permits under section 401 (water quality certificate) and/or section 404 (a dredge and fill permit) and Clean Air Act permits under section 502 may be	Offshore facilities: In the installation of pipelines, avoid rocky intertidal habitats or use existing pipelines.

		habitat. Offshore LNG terminals involve construction of pipelines to transport LNG onshore and may affect rocky habitat. See sedimentation effects described under "dredging", "in-water construction", and "coastal development". *Food resource* and *water quality* PCEs—There is an increased potential for oil spills and potential effects on water quality from the presence of vessels transporting and offloading LNG at the terminals.	required.	Onshore siting considerations: Avoid siting LNG projects within or adjacent to rocky intertidal habitats.
Mineral and petroleum exploration and extraction	10	*Rocky substrate* PCE—This activity may result in increased sedimentation into rocky intertidal habitats. See sedimentation effects described under "dredging", "in-water construction", and "coastal development". *Food resources* and s*ettlement habitat* PCE—In a laboratory study, water-based drilling muds from an active platform were found to negatively affect the settlement of red abalone larvae on coralline algae, but fertilization and early development were not affected. *Water quality* PCE—The activity may cause an increased risk of oil spills or leaks and increased sedimentation thereby affecting water quality.	The Mineral Management Service manages the Nation's offshore energy and mineral resources, including oil, gas, and alternative energy sources, as well as sand, gravel and other hard minerals on the outer continental shelf.	Adoption of erosion control measures. Adoption of oil spill clean-up protocols and oil spill prevention plans; more Clean Seas boats as first responders to prevent oil spills from coming onshore; and relocation of proposed oil platforms further away from black abalone habitats.
Non-native species introduction and management	2, 4, 8, 10, and 11	*Food resources* PCE—The release of wastewater, sewage, and ballast water from commercial shipping presents a risk to kelp and other macroalgal species because of the potential introduction of exotic species. *Settlement habitat* PCE—Non-native species may displace native organisms by preying on them or out-competing them for resources such as food, space or both. Non-native species may introduce disease-causing organisms and can cause substantial population, community, and habitat changes. Other possible consequences of non-native species introductions could be impacts on flow patterns, sediment and nutrient dynamics, and impacts on native bioengineering species.	The National Invasive Species Act of 1996 (NISA) and the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 under the USCG.	For commercial shipping: Safe (non-contaminated) ballast disposal; Rinse anchors and anchor chains when retrieving the anchor to remove organisms and sediments at their place of origin; Remove hull fouling organisms from hull, piping, propellers, sea chests, and other submerged portions of a vessel, on a regular basis, and dispose of removed substances in accordance with local, state, and federal law. For aquaculture: Inspect

				aquaculture facilities to prevent non-native species transport in packing materials.
Kelp harvesting	7-20	*Food resources* PCE—Kelp is the primary source of food for black abalone. Kelp is harvested for algin, which is used as a binder, emulsifier, and molding material in a broad range of products, and as a food source in abalone aquaculture operations. The harvest is small, but the kelp grows quickly, and harvest could generate drift (which can potentially be beneficial to black abalone). Potential impacts related to kelp harvesting are unclear.	None	None
Activities that lead to global climate change	1-20	Affects all PCEs. There is little information on these effects, however. We solicit the public for more information (see "Public Comments Solicited"). *Water quality* PCE- Sea surface water temperatures that exceed 25ºC may increase risks to black abalone. Ocean pH values that are outside of the normal range for seawater (i.e., pH less than 7.5 or greater than 8.5) may cause reduced growth and survivorship in abalone as has been observed in other marine gastropods (Shirayama and Thornton, 2005). *Food resources and settlement habitat* PCE-Increasing partial pressure of carbon dioxide may reduce abundance of coralline algae and thereby affect the survival of newly settled black abalone (Feely *et al.*, 2004; Hall-Spencer *et al.*, 2008).	Uncertain	Potential actions to address this threat may include the organization of a task force and development of a plan that offers recommendations for ways to minimize the impacts of global warming on black abalone and other ESA-listed species. However, this analysis was unable to determine specifically how activities that lead to global climate change (e.g., fossil fuel combustion) may be affected by the black abalone critical habitat designation (i.e., what type of special management might be required), or if a Federal nexus is present.

APPENDIX B: LAWS AND REGULATIONS THAT MAY PROVIDE BASELINE PROTECTION FOR BLACK ABALONE

The Endangered Species Act (16 U.S.C. 1531 et seq.)
Section 7 of the Act and implementing regulations (50 CFR Part 402) require Federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species, or destroy or adversely affect its critical habitat.

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 of dredged 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 black abalone concerns. These reductions in pollution may benefit black abalone 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 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 activities 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.

Marine Protection, Research, and Sanctuaries Act of 1972
This Act authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or aesthetic qualities as national marine sanctuaries. The Act also directs the Secretary to facilitate all public and private uses of those resources that are compatible with the primary objective of resource protection. Four sanctuaries have been designated within the areas considered for designation as black abalone critical habitat: Channel Islands, Gulf of Farallones, and Monterey Bay.

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, including alternative energy hydrokinetic projects. The FERC is an independent Federal agency governing approximately 2,500 licenses for non-Federal hydropower facilities and has responsibility for national energy regulatory issues. This Act may provide protection by requiring consideration of the potential effects to black abalone 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.

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 areas being considered for designation as black abalone critical habitat. 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 areas considered for designation as black abalone critical habitat for activities that have Federal involvement, if alternatives are considered and selected that are less harmful to black abalone habitat than other alternatives.

The National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.)
Section 106 of the Act and implementing regulations (36 CFR Part 800) require the Regional Administrator, before issuing a license, to adopt measures when feasible to mitigate potential adverse effects of the licensed activity and properties listed or eligible for listing in the National Register of Historic Places. The Act's requirements are to be implemented in cooperation with State Historic Preservation Officers and upon notice to, and when appropriate, in consultation with the Advisory Council on Historic Preservation.

The Oil Pollution Act of 1990 (33 U.S.C. 2701-2761)
The Oil Pollution Act of 1990 amended the Clean Water Act and addressed the wide range of problems associated with preventing, responding to, and paying for oil pollution incidents in navigable waters of the United States. It created a comprehensive prevention, response, liability, and compensation regime to deal with vessel- and facility-caused oil pollution to U.S. navigable waters. OPA greatly increased federal oversight of maritime oil transportation, while providing greater environmental safeguards by:

- Setting new requirements for vessel construction and crew licensing and manning,
- Mandating contingency planning,
- Enhancing federal response capability,
- Broadening enforcement authority,
- Increasing penalties,
- Creating new research and development programs,
- Increasing potential liabilities, and
- Significantly broadening financial responsibility requirements.

The Sikes Improvements Act (16 USC §670 1997)
The Sikes Improvement Act (SIA) 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 the SIA may provide protection to areas considered for designation as black abalone critical habitat that are located within military training ranges.

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.

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 was distributed through the California Resources Agency to fiscal year 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.

Ocean Dumping Act
The Ocean Dumping Act prohibits any person from dumping, or transporting for the purpose of dumping, sewage sludge or industrial waste into ocean waters without a permit (16 USC §1411b). No permits can be issued to dump radiological, chemical, and biological warfare agents, high-level radioactive waste, and medical waste (16 USC §1412). The EPA has responsibility for regulating the dumping of all material except dredged material.

National Park System Act
The National Park System Act authorizes the Secretary of the Department of the Interior to recommend areas to Congress for inclusion in the National Park system, and authorizes the Secretary to administer designated parks, including through promulgation of regulations. Black abalone are found in the Channel Islands National Park (CINP), Golden Gate National Recreation Area (GGNRA), and Point Reyes National Seashore (PRNS), which are managed by the National Park Service. The CINP encompasses five of the California Channel Islands: Anacapa, Santa Cruz, Santa Rosa, San Miguel, and Santa Barbara. The GGNRA encompasses several areas in the region surrounding the mouth of San Francisco Bay where the bay meets the Pacific Ocean. The PRNS encompasses Point Reyes Peninsula, just north of San Francisco Bay. Certain regulations apply in all three areas that may provide protections to areas being considered for designation as black abalone critical habitat, including: prohibitions on the introduction of wildlife, fish, or plants into a park ecosystem (36 CFR 2.1); prohibitions on polluting or contaminating park waters or water courses (36 CFR 2.14); restrictions on landing in and public access to specific areas within the parks (36 CFR 1.5); and regulations on mining and mineral exploration (36 CFR Part 9). In the CINP, regulations specifically prohibit the taking of any invertebrates in waters less than 5 m depth, the taking of abalone for commercial purposes on Anacapa and Santa Barbara Islands, and the transport or

delivery of certain types of materials that may carry invasive species to any of the islands (36 CFR 1.5 and 7.84)

National Wildlife Refuge Administration Act
The National Wildlife Refuge Administration Act directs the U.S. Fish and Wildlife Service to manage the Refuge System as a national system of lands and waters devoted to conserving and, where appropriate, restoring fish, wildlife, and plant resources and their habitats (15 USC § 668dd). The law also declared that compatible wildlife-dependent recreational uses are acceptable activities on refuges. Black abalone are found at the Farallon National Wildlife Refuge, encompassing the Farallon Islands. This refuge is closed to the public.

Water Resources Development Act
The Water Resources Development Act (33 USC §§ 2201 et seq.) authorizes the construction or study of USACE projects and applies to all features of water resources development and planning, including environmental assessment and mitigation requirements.

Act to Prevent Pollution from Ships
The Act to Prevent Pollution from Ships (APPS), as amended by the Marine Plastic Pollution Research and Control Act (MPPRCA), protects coral reefs by requiring all U.S. ships and all ships in U.S. navigable waters or the exclusive economic zone (EEZ) to comply with the International Convention for the Prevention of Pollution from Ships (33 USC §§ 1901 et seq.). Under the regulations implementing APPS as amended by MPPRCA, the discharge of plastics, including synthetic ropes, fishing nets, plastic bags, and biodegradable plastic, into the water is prohibited. Discharge of floating dunnage, lining, and packing materials is prohibited in the navigable waters and in areas offshore less than 25 nautical miles from the nearest land. Food waste or paper, rags, glass, metal, bottles, crockery, and similar refuse cannot be discharged in navigable waters or in waters offshore inside 12 nautical miles from the nearest land. Finally, food waste, paper, rags, glass, and similar refuse cannot be discharged in navigable waters or in waters offshore inside three nautical miles from the nearest land. USCG has the primary responsibility of enforcing regulations under the APPS, and the APPS applies to all vessels, including cruise ships, regardless of flag, operating in U.S. navigable waters and the EEZ.

The Lacey Act
The Lacey Act, as amended in 1981 (16 USC §§ 3372 et seq.), prohibits the trade of fish, wildlife, or plants taken in violation of any foreign, state, tribal or other U.S. law. For example, it is a violation of the Lacey Act for an individual to illegally possess or attempt to sell black abalone shells or meat.

Marine Debris Research, Prevention, and Reduction Act
The Marine Debris Research, Prevention and Reduction Act (MDRPRA) was passed to establish programs within the National Oceanic and Atmospheric Administration (NOAA) and the United States Coast Guard (USCG) to help identify, determine sources of, assess, reduce, and prevent marine debris and its adverse impacts on the marine environment and navigation safety. MDRPRA also reactivates the Interagency Marine Debris Coordinating Committee, which EPA co-chairs with NOAA.

The General Mining Law of May 10, 1872, as amended (30 U.S.C. §§ 22-54 and §§ 611-615)
The General Mining Law is the major Federal law governing locatable minerals. This law allows citizens of the United States the opportunity to explore for, discover, and purchase certain valuable mineral deposits on those Federal lands that are open for mining claim location and patent (open to mineral entry). These mineral deposits include most metallic mineral deposits and certain nonmetallic and industrial minerals. The law sets general standards and guidelines for claiming the possessory right to a valuable mineral deposit discovered during exploration. The General Mining Law allows for the enactment of

State laws governing location and recording of mining claims and sites that are consistent with Federal law. The Federal regulations implementing the General Mining Law are found at Title 43 of the Code of Federal Regulations (CFR) in Groups 3700 and 3800.

Natural Gas Act of 1938
Under the Natural Gas Act of 1938, approval by FERC, is required for the siting, construction, and operation of onshore LNG import and export facilities.

Federal Deepwater Port Act of 1974
The Federal Deepwater Port Act of 1974 gives the U.S. Coast Guard and U.S. Maritime Administration authority to issue licenses for the ownership, construction, and operation of deepwater ports, including deepwater LNG facilities.

Atomic Energy Act of 1954
Under the Atomic Energy Act of 1954, the Nuclear Regulatory Commission (NRC) regulates the licensing, safety, and operations of nuclear power plants (i.e., Diablo Canyon Power Plant)

Other Statues and Regulations that Apply to Land Use Activities
While the following statutes and regulations may apply to lands and waters that fall within areas being considered for designation as black abalone critical habitat, they are unlikely to provide significant baseline protections and are not considered in the analysis.

• *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.

• *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"). Black abalone are not currently listed under the CESA, but white abalone (*Haliotis sorenseni*) are.

APPENDIX C: SENSITIVITY ANALYSIS

Section 2 of this analysis presents estimated annualized impacts by area and economic activity. These estimated impacts assume that a certain baseline level of protection is afforded black abalone from existing Federal, state, and local regulations, as well as the presence of other listed marine species and other designated critical habitat. However, a degree of uncertainty exists regarding this level of baseline protection and future actions likely to be undertaken specifically for the benefit of the black abalone critical habitat.

Due to this level of uncertainty, this appendix presents impacts without applying the "incremental scores," in order to inform decision-makers about the range of potential impacts. Table C-1 presents total un-scaled impacts by area, as well as the difference between these impacts and those estimated in previous chapters, which applied incremental scores. When comparing the means of the low and high scenarios, the ranking of total area impacts changes slightly, when comparing costs that incorporate incremental scores compared to costs without incremental scores. Under this sensitivity analysis, Areas 1, 3, 9, 16, and 19 bump up to a higher ranking. For Areas 1, 3, and 16, this increase is solely due to the incremental score attributed to NPDES-permitted facilities. For Area 19, there is some change in the major NPDES-permitted facilities, however the main reason Area 19's rank increased is due to the incremental score attributed to oil and chemical spills. For Area 9, there are some changes to the impacts from desalination plants, however there are noticeable differences in the impacts of NPDES-permitted facilities and oil and chemical spills with a change in the incremental score.

Tables C-2 through C-12 displays the estimated economic impacts without attributing incremental scores.

Table C-1: Summary of Estimated Annualized Impacts by Area (Discounted at 7 percent)

Area	No Incremental Scores			With Incremental Scores			Difference		
	Low	Mean	High	Low	Mean	High	Low	Mean	High
1	$3,300	$306,850	$610,400	$3,300	$279,625	$555,950	$0	$27,225	$54,450
2	$20,100	$1,153,250	$2,286,400	$15,100	$317,925	$620,750	$5,000	$835,325	$1,665,650
3	$0	$999,800	$1,999,600	$0	$222,100	$444,200	$0	$777,700	$1,555,400
4	$264,100	$1,378,550	$2,493,000	$37,900	$306,350	$574,800	$226,200	$1,072,200	$1,918,200
5	$51,400	$135,650	$219,900	$10,300	$22,150	$34,000	$41,100	$113,500	$185,900
6	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	$544,200	$1,788,730	$3,033,260	$253,600	$907,350	$1,561,100	$290,600	$881,380	$1,472,160
8	$57,200	$1,648,550	$3,239,900	$8,600	$809,000	$1,609,400	$48,600	$839,550	$1,630,500
9	$5,000	$258,600	$512,200	$5,000	$129,250	$253,500	$0	$129,350	$258,700
10	$177,000	$150,960,900	$301,744,800	$55,400	$75,655,525	$151,255,650	$121,600	$75,305,375	$150,489,150
11	$423,500	$1,063,000	$1,702,500	$42,400	$179,475	$316,550	$381,100	$883,525	$1,385,950
12	$106,800	$3,277,250	$6,447,700	$11,500	$1,564,400	$3,117,300	$95,300	$1,712,850	$3,330,400
13	$0	$0	$0	$0	$0	$0	$0	$0	$0
14	$0	$0	$0	$0	$0	$0	$0	$0	$0
15	$0	$67,300	$134,600	$0	$13,450	$26,900	$0	$53,850	$107,700
16	$0	$103,350	$206,700	$0	$29,400	$58,800	$0	$73,950	$147,900
17	$1,350	$13,200	$25,050	$1,350	$5,950	$10,550	$0	$7,250	$14,500
18	$0	$0	$0	$0	$0	$0	$0	$0	$0
19	$56,000	$458,450	$860,900	$24,300	$174,775	$325,250	$31,700	$283,675	$535,650
20	$1,350	$3,300	$5,250	$1,350	$3,300	$5,250	$0	$0	$0

Table C-2: Summary of Economic Impacts to In-Water Construction by Area

Area	Total Annualized Costs (Discounted at 7%)		
	Low	Mean	High
10	$2,800	$4,950	$7,100
17	$950	$1,650	$2,350
19	$1,900	$3,300	$4,700
20	$950	$1,650	$2,350

Table C-3: Summary of Economic Impacts to Sand Replenishment by Area

Area	Total Annualized Impacts (Discounted at 7%)
2	$28,600
4	$14,300
7	$42,900
11	$14,300

Table C-4: Summary of Economic Impacts to Minor NPDES-permitted Facilities by Area

Area	Total Annualized Impacts (Discounted at 7%)		
	Low	Mean	High
1	$0	$30,200	$60,400
2	$0	$173,650	$347,300
3	$0	$166,100	$332,200
4	$0	$166,100	$332,200
5	$0	$7,550	$15,100
7	$0	$45,300	$90,600
8	$0	$30,200	$60,400
9	$0	$15,100	$30,200
10	$0	$15,100	$30,200
11	$0	$377,500	$755,000
12	$0	$15,100	$30,200
16	$0	$7,550	$15,100
17	$0	$7,550	$15,100

Table C-5: Summary of Economic Impacts to Major NPDES-permitted Facilities by Area

Area	Total Annualized Impacts (Discounted at 7%)		
	Low	Mean	High
2	$0	$806,000	$1,612,000
3	$0	$806,000	$1,612,000
4	$158,800	$1,012,660	$1,866,500
5	$0	$42,400	$84,800
7	$52,900	$196,150	$339,360
8	$52,900	$196,170	$339,400
9	$0	$42,400	$84,800
10	$105,900	$349,890	$593,900
11	$423,500	$678,360	$933,200
12	$105,900	$265,040	$424,200
16	$0	$84,850	$169,700
19	$52,900	$68,870	$84,800

Table C-6: Summary of Economic Impacts to Coastal Urban Development by Area

Area	Total Annualized Costs (Discounted at 7%)		
	Low	Mean	High
2	$10,000	$40,750	$71,500
4	$2,000	$8,150	$14,300
7	$6,000	$24,450	$42,900
8	$2,000	$8,150	$14,300
10	$1,600	$6,500	$11,400
17	$400	$1,650	$2,900
19	$1,200	$4,900	$8,600
20	$400	$1,650	$2,900

Table C-7: Summary of Economic Impacts to Side-Casting by Area

Area	Total Annualized Costs (Discounted at 7%)		
	Low	Mean	High
7	$480,000	$585,000	$690,000
8	N/A	N/A	N/A

Table C-8: Summary of Economic Impacts to Agricultural Irrigation by Area

Area	Total Annualized Impacts (Discounted at 7%)		
	Low	Mean	High
1	$3,300	$76,450	$149,600
2	$10,100	$118,550	$227,000
3	$0	$27,700	$55,400
4	$400	$99,150	$197,900
7	$5,300	$313,900	$622,500
8	$2,300	$291,950	$581,600
9	$5,000	$86,600	$168,200
10	$16,800	$347,050	$677,300
12	$900	$76,250	$151,600
16	$0	$10,950	$21,900

Table C-9: Summary of Economic Impacts of Oil and Chemical Spills by Area

Area	Total Annualized Impacts (Discounted at 7%)		
	Low	Mean	High
4	$102,900	$85,350	$67,800
5	$51,400	$85,700	$120,000
7	$0	$193,700	$387,400
8	$0	$235,600	$471,200
9	$0	$67,800	$135,600
12	$0	$850	$1,700
15	$0	$67,300	$134,600
19	$0	$302,950	$605,900

Table C-10: Summary of Economic Impacts to Power Plants by Area

Area	Total Annualized Impacts (Discounted at 7%)		
	Low	Mean	High
10	$49,900	$149,948,750	$299,847,600

Table C-11: Summary of Economic Impacts to Desalination Projects by Area

Area	Total Annualized Costs (Discounted at 7%)		
	Low	Mean	High
4	N/A	N/A	N/A
7	$0	$408,800	$817,600
8	$0	$886,500	$1,773,000
9	$0	$46,700	$93,400
10	$0	$221,900	$443,800
12	$0	$2,920,000	$5,840,000
17	$0	$2,350	$4,700
19	$0	$11,700	$23,400

Table C-12: Summary of Economic Impacts to Tidal and Wave Energy Projects by Area

Area	Total Annualized Costs (Discounted at 7%)		
	Low	Mean	High
1	$0	$200,175	$400,350
10	$0	$66,725	$133,450
19	$0	$66,725	$133,450

APPENDIX D: 3 PERCENT DISCOUNT RATE EXHIBITS

As mentioned in Section 1.4.7, the OMB Circular A-94 states that a 7 percent discount rate should be used as a base-case for regulatory analysis.[124] However, to test the sensitivity of this assumption a 3 percent discount rate is applied. Appendix D provides detailed tables for the impacts discussed in Section 2 of this economic analysis. Present values and annualized costs are estimated based on a discount rate of 3 percent, as opposed to seven percent, which is used in Section 2.

For most activities, estimated impacts are based on an assumed annual cost applied evenly across all relevant years. Since 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 facilities 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.

Table D-1 shows the total cost estimates, by area, using a three percent discount rate. Tables D-2, D-3 and D-4 show costs for minor NPDES-permitted facilities, major NPDES-permitted facilities, and power plants, respectively, since these are the only activities where a change in discount rate will change the cost estimates.

[124] U.S. Office of Management and Budget. 1992. "Circular A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs." October 29, 1992. Accessed at: http://www.whitehouse.gov/omb/assets/a94/a094.pdf.

Table D-1: Summary of Estimated Annualized Impacts by Area

Area	Annualized Impacts (3% Discount Rate)			Activities with only a qualitative analysis (NOT included in the estimated costs)*
	Low	Mean	High	
1	$3,300	$279,825	$556,350	Agricultural pesticide application
2	$15,100	$304,225	$593,350	Agricultural pesticide application and Non-native species introduction and management
3	$0	$261,225	$522,450	Agricultural pesticide application
4	$33,200	$287,900	$542,600	Agricultural pesticide application and Non-native species introduction and management
5	$10,300	$21,400	$32,500	
6	$0	$0	$0	
7	$252,000	$903,750	$1,555,500	Agricultural pesticide application and Kelp harvesting
8	$7,000	$805,300	$1,603,600	Agricultural pesticide application, Vessel grounding, Non-native species introduction and management, and Kelp harvesting
9	$5,000	$128,550	$252,100	Agricultural pesticide application and Kelp harvesting
10	$45,800	$68,410,925	$136,776,050	Agricultural pesticide application, Mineral and petroleum exploration and extraction, Non-native species introduction and management and Kelp harvesting
11	$29,800	$100,350	$170,900	Non-native species introduction and management and Kelp harvesting
12	$8,300	$1,559,000	$3,109,700	Agricultural pesticide application and Kelp harvesting
13	$0	$0	$0	Kelp harvesting
14	$0	$0	$0	Kelp harvesting
15	$0	$13,450	$26,900	Kelp harvesting
16	$0	$26,400	$52,800	Agricultural pesticide application and Kelp harvesting
17	$1,350	$6,050	$10,750	Kelp harvesting
18	$0	$0	$0	Kelp harvesting
19	$18,000	$168,525	$319,050	Kelp harvesting
20	$1,350	$3,300	$5,250	Kelp harvesting
Total**	$430,400	$72,615,925	$144,801,450	Agricultural pesticide application, Vessel grounding, Mineral and petroleum exploration and extraction, Non-native species introduction and management, and Kelp harvesting

*Note: Activities that lead to global climate change (e.g. fossil fuel combustion) are also discussed qualitatively in this analysis and are recognized as potential threats to black abalone in all areas (see Section 2.16).

**Note: Totals are adjusted for double-counting of NPDES outfalls and acres of agricultural lands that overlap multiple areas. See sections 2.3 and 2.6 for more details.

Table D-2: Summary of Economic Impacts to Minor NPDES-permitted Facilities by Area

Area	Low buffer	High buffer	Incremental Score	Total Annualized Costs (Discounted at 3%)		
				Low	Mean	High
1	0	4	0.1	$0	$3,200	$6,400
2	1	23	0.1	$0	$18,550	$37,100
3	0	22	0.2	$0	$35,450	$70,900
4	0	22	0.1	$0	$17,750	$35,500
5	0	1	0.1	$0	$800	$1,600
7	3	6	0.1	$0	$4,850	$9,700
8	1	4	0.1	$0	$3,200	$6,400
9	2	2	0.1	$0	$1,600	$3,200
10	0	2	0.1	$0	$1,600	$3,200
11	16	50	0.1	$0	$40,300	$80,600
12	1	2	0.1	$0	$1,600	$3,200
16	0	1	0.2	$0	$1,600	$3,200
17	1	1	0.2	$0	$1,600	$3,200
Total				$0	$82,350	$164,700

*Note: Totals are adjusted for double-counting of outfalls that overlap multiple areas.

Table D-3: Summary of Economic Impacts to Major NPDES-permitted Facilities by Area

Area	Low buffer	High buffer	Incremental Score	Total Annualized Costs (Discounted at 3%)		
				Low	Mean	High
2	0	19	0.1	$0	$65,700	$131,400
3	0	19	0.2	$0	$131,350	$262,700
4	3	22	0.1	$11,200	$81,650	$152,100
5	0	1	0.1	$0	$3,450	$6,900
7	1	4	0.1	$3,700	$15,700	$27,700
8	1	4	0.1	$3,700	$15,700	$27,700
9	0	1	0.1	$0	$3,450	$6,900
10	2	7	0.1	$7,400	$27,900	$48,400
11	8	11	0.1	$29,800	$52,900	$76,000
12	2	5	0.1	$7,400	$21,000	$34,600
16	0	2	0.2	$0	$13,850	$27,700
19	2	2	0.2	$14,900	$21,300	$27,700
Total				$78,100	$268,400	$458,700

*Note: Totals are adjusted for double-counting of outfalls that overlap multiple areas.

Table D-4: Summary of Economic Impacts to Power Plants by Area

Area	Activity Count (Estimated number of power plants)	Incremental Score	Total Annualized Impacts (Discounted at 3%)		
			Low	Mean	High
10	1	0.5	$18,600	$67,736,800	$135,455,000
Total			$18,600	$67,736,800	$135,455,000

APPENDIX E: INITIAL REGULATORY FLEXIBILITY ANALYSIS

This analysis considers the extent to which the potential economic impacts associated with the designation of critical habitat for the black abalone 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) and U.S. Census Bureau.

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). For this rulemaking, this analysis takes the form of an initial regulatory flexibility analysis (IRFA). Under 5 U.S.C., Section 603(b) of the RFA, an IRFA is required to contain:

i. A description of the reasons why action by the agency is being considered;
ii. A succinct statement of the objectives of, and legal basis for, the proposed rule;
iii. A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;
iv. A description of the projected reporting, recordkeeping and other compliance requirements of the proposed 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;
v. An identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap or conflict with the proposed rule;
vi. Each initial regulatory flexibility analysis shall also contain a description of any significant alternatives to the proposed rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the proposed rule on small entities.

Needs and Objective of the Rule

The black abalone was listed as endangered throughout its range under the Endangered Species Act (ESA) on January 14, 2009 (74 FR 1937). 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."

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 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 the black abalone has the potential to be affected by the critical habitat designation. As described in the main text of this analysis, NMFS identified 17 categories of economic activity as potentially requiring modification to avoid destruction or adverse modification of the black abalone critical habitat. These "activities" include the operation of some facilities, such as water temperature controls, where special management of operations may be required for the black abalone. The following are the economic activities assessed in this IRFA:

i. Dredging
ii. In-water construction
iii. Sand replenishment
iv. NPDES-permitted facilities
v. Coastal urban development
vi. Side-casting
vii. Agriculture (including pesticide use, irrigation, and livestock farming)
viii. Oil & chemical spills: prevention & clean-up
ix. Vessel groundings
x. Power plants
xi. Desalination plants
xii. Tidal and wave energy projects
xiii. Liquefied natural gas (LNG) projects
xiv. Mineral and petroleum exploration and extraction
xv. Non-native species: prevention and management

xvi. Kelp harvesting

xvii. Activities that lead to global climate change

As discussed earlier in this report, a great deal of uncertainty exists with regard to how potentially regulated entities will attempt to avoid the destruction or adverse modification of critical habitat. This is because relatively little data exist on the effects to black abalone and their food resource from aspects of the activities identified (i.e., water quality, water temperature, etc.) In addition, while baseline protections are expected to be afforded due to current listing-related conservation measures and existing regulations, the economic analysis attempts to estimate the incremental impacts resulting specifically from the critical habitat designation. As discussed earlier in this report, however, often this analysis was unable to separate the costs associated with protections under the listing of black abalone from the costs associated with the designation of critical habitat.

This IRFA estimates the potential number of small businesses that may be affected by this rule, and the average annualized impact per entity for a given area 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. Table E-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 IRFA does not consider all types of small businesses that could be affected by the critical habitat designation due to lack of information. Impacts to small businesses involved in 10 activities are discussed below.

Table E-1: Major Relevant Activities and a Description of the Industry Sectors Engaged in those Activities

Activity	Description of included industry sectors	NAICS code	SBA size standard
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	$33.5 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	
	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	
NPDES	**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	$7.0 million average annual receipts
	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
Coastal urban development	**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	$33.5 million average annual receipts
	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 system may include pumping stations, aqueducts, and/or distribution mains. The water may be used for drinking, irrigation, or other uses.	221310	$7.0 million average annual receipts

Activity	Description of included industry sectors	NAICS code	SBA size standard
Agriculture: Pesticides	**Farm Supplies Merchant Wholesalers** This industry comprises establishments primarily engaged in the merchant wholesale distribution of farm supplies, such as animal feeds, fertilizers, agricultural chemicals, pesticides, plant seeds, and plant bulbs.	424910	100 employees
Oil and Chemical Spills	**Deep Sea, Coastal, and Great Lakes Water Transportation** This industry comprises establishments primarily engaged in providing deep sea, coastal, Great Lakes, and St. Lawrence Seaway water transportation. Marine transportation establishments using the facilities of the St. Lawrence Seaway Authority Commission are considered to be using the Great Lakes Water Transportation System.	48311	500 employees
	Marinas This industry comprises establishments, commonly known as marinas, 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	$7.0 million average annual receipts
Power Plants	**Nuclear Electric Power Generation** This U.S. industry comprises establishments primarily engaged in operating nuclear electric power generation facilities. These facilities use nuclear power to produce electric energy. The electric energy produced in these establishments is provided to electric power transmission systems or to electric power distribution systems.	221113	4 million megawatts for the preceding year[1]
	Electric Power Transmission, Control, and Distribution This industry comprises establishments primarily engaged in operating electric power transmission systems, controlling (i.e., regulating voltages) the transmission of electricity, and/or distributing electricity. The transmission system includes lines and transformer stations. These establishments arrange, facilitate, or coordinate the transmission of electricity from the generating source to the distribution centers, other electric utilities, or final consumers. The distribution system consists of lines, poles, meters, and wiring that deliver the electricity to final consumers.	22112	
Tidal & Wave Energy	**Hydroelectric Power Generation** This U.S. industry comprises establishments primarily engaged in operating hydroelectric power generation facilities. These facilities use water power to drive a turbine and produce electric energy. The electric energy produced in these establishments is provided to electric power transmission systems or to electric power distribution systems.	221111	4 million megawatts for the preceding year[1]
	Other Electric Power Generation This U.S. industry comprises establishments primarily engaged in operating electric power generation facilities (except hydroelectric, fossil fuel, nuclear). These facilities convert other forms of energy, such as solar, wind, or tidal power, into electrical energy. The electric energy produced in these establishments is provided to electric power transmission systems or to electric power distribution systems.	221119	
LNG	**Natural Gas Liquid Extraction** This U.S. industry comprises establishments primarily engaged in the recovery of liquid hydrocarbons from oil and gas field gases. Establishments primarily engaged in sulfur recovery from natural gas are included in this industry.	211112	500 employees

Activity	Description of included industry sectors	NAICS code	SBA size standard
Mineral & Petroleum Exploration	**Crude Petroleum and Natural Gas Extraction** This U.S. industry comprises establishments primarily engaged in (1) the exploration, development and/or the production of petroleum or natural gas from wells in which the hydrocarbons will initially flow or can be produced using normal pumping techniques or (2) the production of crude petroleum from surface shales or tar sands or from reservoirs in which the hydrocarbons are semisolids. Establishments in this industry operate oil and gas wells on their own account or for others on a contract or fee basis.	211111	500 employees
	Drilling Oil and Gas Wells This U.S. industry comprises establishments primarily engaged in drilling oil and gas wells for others on a contract or fee basis. This industry includes contractors that specialize in spudding in, drilling in, redrilling, and directional drilling.	213111	500 employees
	Support Activities for Nonmetallic Minerals (except Fuels) Mining This U.S. industry comprises establishments primarily engaged in providing support activities, on a fee or contract basis, for the mining and quarrying of nonmetallic minerals (except fuel) and for the extraction of nonmetallic minerals (except site preparation and related construction activities). Exploration for minerals is included in this industry. Exploration (except geophysical surveying and mapping services) includes traditional prospecting methods, such as taking core samples and making geological observations at prospective sites.	213115	$7.0 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 represents 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.
Sources:
Definitions complied from U.S. Census Bureau. North American Industry Classification System (NAICS). Accessed at: http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007; SBA size standards complied from U.S. Small Business Administration. Table of Small Business Size Standards Matched to North American Industry Classification System Codes. Accessed at:
http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf.

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 the Del Mar Landing Ecological Reserve to Dana Point in California, including several offshore islands. NMFS defined the specific areas in Section 1 and identified activities in Section 2 of this report, both water and land based, that could be affected by the designation. Although the areas of concern include marine areas off the coast, the small business analysis is focused on land based areas, which is consistent with Section 2 of this report, where most economic activities occur and which could be affected by the designation.

Ideally, this analysis would directly identify the number of small entities that are located within the coastal areas adjacent to the specific areas. However, it is not possible to directly determine the number of firms in each industry sector within these areas because business activity data is maintained at the county level. Therefore, this analysis provides a maximum number of small businesses that could be affected. This number is most likely inflated since all of the identified small businesses are unlikely to be located in close proximity of the specific areas.

After determining the number of small entities, this analysis estimates the impact per entity for each area and industry sector. The following steps were used to provide these estimates:

- Total impact for every area 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 area for every activity type;
- The impact to small businesses for every area 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 is estimated by taking the ratio of the total estimated impacts to the total number of small businesses.

Discussion of Results

The eleven counties that make up the specific areas along the California coast and may be affected by the black abalone critical habitat designation represent a range of urban and rural environments. The list of counties, industry sectors (identified by NAICS codes), and the SBA-specified small business size

thresholds was used to search the U.S. Census Bureau database.[125] An estimate of the total number of small entities that could be potentially affected by the designation is summarized in Tables E-2, E-3a, E-3b, E-3c, and E-4.

Demographic Data

Table E-2 shows the socioeconomic profile of the applicable counties along the California coast. Note that some counties are adjacent to more than one area and some of the counties are adjacent to the coastline where there are no specific areas identified.

Los Angeles County is the most populous county of the eleven with a population of nearly 10 million in 2008, representing about 26.8 percent of the population of California. Orange County has the second largest population, with a little over 3 million people in 2008. Orange County contained 8.2 percent of California's population. Marin and Santa Cruz Counties have the smallest populations of the eleven counties with 249,000 and 253,000 people, respectively, in 2008.

The populations of all but one of the West Coast Counties analyzed have been growing between 2000 and 2008. The largest growth has been in San Luis Obispo County where population increased 7.5 percent. Santa Cruz is the only county to have a negative growth rate of 1.0 percent between 2000 and 2008.

Median per capita income in three of the eleven counties is lower than median per capita income for the state. The poverty rate in two of the eleven counties exceeds the poverty rate of the state. In Los Angeles County, the poverty rate is the highest among the eleven counties with 15.3 percent of residents below the poverty threshold.

Eight of these counties are more densely populated compared to the statewide population density. Notice that San Francisco County has a large population density of nearly 10,000 people per square mile, but only holds 2 percent of the population of California. In short, the counties adjacent to the specific areas range from rural, lightly populated counties with as few as 75 persons per square mile to urban, heavily populated counties with as many as 10,000 persons per square mile. The spectrum of economic welfare

[125] NAICS codes can be accessed from the US Census Bureau website: http://www.census.gov/epcd/www/naics.html; and the U.S. Census Bureau. *Number of Firms, Number of Establishments, Employment, Annual Payroll, and Receipts by Receipt Size of the Enterprise for the United States, All Industries -2002*. Accessed at: http://www2.census.gov/csd/susb/2002/usalli_r02.xls.

across the eleven counties is equally diverse encompassing counties with a median per capita income of about $20,000 in Monterey County to Marin County with a per capita income of about $45,000.

Table E-2: Socioeconomic profile of counties bordering the specific areas

Area(s)	County	Population (2008)	% of Statewide Population	% Change (2000-2008)	Per Capita Income (1999)	Poverty Rate (2008)	Population Density (persons/sq mi)
1	Sonoma	466,741	1.3%	1.8%	$25,724	10.4%	291
2	Marin	248,794	0.7%	0.6%	$44,962	7.1%	475.6
3 & 4	San Francisco	808,976	2.2%	4.2%	$34,556	11.2%	9,999.90
4, 5, 6, & 7	San Mateo	712,690	1.9%	0.8%	$36,045	6.5%	1,575.00
7	Santa Cruz	253,137	0.7%	-1.0%	$26,396	13.3%	574.4
8 & 9	Monterey	408,238	1.1%	1.6%	$20,165	12.7%	120.9
9 & 10	San Luis Obispo	265,297	0.7%	7.5%	$21,864	12.1%	74.7
10, 13, 14, 15, & 18	Santa Barbara	405,396	1.1%	1.5%	$23,059	12.7%	145.9
16 & 17	Ventura	797,740	2.2%	5.9%	$24,600	8.7%	408.2
11, 19, & 20	Los Angeles	9,862,049	26.8%	3.6%	$20,683	15.3%	2,344.10
12	Orange	3,010,759	8.2%	5.8%	$25,826	9.9%	3,607.50

Source: U.S. Census Bureau. *State and County QuickFacts, Census 2006.* Accessed at: http://quickfacts.census.gov/qfd on July 2008.

Small Business Analysis

Tables E-3a, E-3b, and E-3c present the distribution of small businesses by area and by county for businesses with employee, revenue, and capacity constraints, respectively. There is a maximum of 3,671 small businesses involved in activities most likely to be affected by this rule.[126] A majority of the impacts is concentrated in Los Angeles County with the maximum number (2,067) of the estimated small affected businesses. Orange and Ventura Counties contain about 200 or more small businesses that may be affected by this rule.

[126] This is based on the assumption that all small businesses counted across areas 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 areas and activity types. Hence, total small business estimates across areas and activity types are likely to be overestimated.

Table E-3a: Estimated Number of Regulated Entities that are Small, with Employee Constraints (by area, county, and activity type)

Max. # of employees to be considered small:		500 employees	500 employees	500 employees	500 employees	500 employees	500 employees	750 employees	100 employees	500 employees
Area	**NAICS Code – Category (Activity)**	211111— Crude Petroleum and Natural Gas Extraction (Mineral & Petroleum)	211112— Natural Gas Liquid Extraction (LNG)	212321— Construction Sand and Gravel Mining (Dredging and In-Water Construction)	213111— Drilling Oil and Gas Wells (Mineral & Petroleum)	311— Food Manufacturing (NPDES)	321— Wood Product Manufacturing (NPDES)	322— Paper and Pulp Mills (NPDES)	424910— Farm Supplies Merchant Wholesalers (Agriculture: Pesticides)	48311— Deep Sea, Coastal, and Great Lakes Water Transportation (Oil & Chemical)
1	Sonoma	N/A	N/A	N/A	N/A	79	39	2	11	N/A
2	Marin	N/A	N/A	N/A	N/A	24	10	0	3	N/A
3 & 4	San Francisco	N/A	N/A	N/A	N/A	118	14	6	8	3
4, 5, 6, & 7	San Mateo	N/A	N/A	N/A	N/A	91	9	8	3	2
7	Santa Cruz	N/A	N/A	N/A	N/A	43	13	0	5	0
8 & 9	Monterey	N/A	N/A	N/A	N/A	76	8	4	27	1
9 & 10	San Luis Obispo	3	N/A	1	1	23	4	3	8	0
10, 13, 14, 15, & 18	Santa Barbara	13	N/A	2	4	33	13	2	22	N/A
16 & 17	Ventura	N/A	N/A	3	N/A	53	13	11	17	N/A
11, 19, & 20	Los Angeles	N/A	N/A	16	N/A	1100	257	191	N/A	45
12	Orange	N/A	N/A	N/A	N/A	259	98	71	21	11

Table E-3b: Estimated Number of Regulated Entities that are Small, with Revenue Constraints (by area, county, and activity type)

Max. # of revenue to be considered small:		$7.0 million average annual receipts	$7.0 million average annual receipts	$7.0 million average annual receipts	$33.5 million average annual receipts	$33.5 million average annual receipts	$33.5 million average annual receipts	$33.5 million average annual receipts	$33.5 million average annual receipts	$7.0 million average annual receipts
Area	**NAICS Code –Category (Activity)**	213115— Support Activities for Nonmetallic Minerals (Mineral & Petroleum)	221310— Water Supply and Irrigation Systems (Coastal Development)	221320— Sewage Treatment Facilities (NPDES)	237110— Water and Sewer Line and Related Structures Construction (Dredging and In-Water Construction)	237120— Oil and Gas Pipeline and Related Structures Construction (Dredging and In-Water Construction)	237130— Power and Communication Line and Related Structures Construction (Dredging and In-Water Construction)	237310— Highway, Street and Bridge Construction (Coastal Development)	237990— Other Heavy and Civil Engineering Construction (Dredging and In-Water Construction)	713930— Marinas (Oil & Chemical)
1	Sonoma	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A
2	Marin	N/A	4	0	N/A	N/A	N/A	6	N/A	N/A
3 & 4	San Francisco	N/A	1	0	N/A	N/A	N/A	7	N/A	5
4, 5, 6, & 7	San Mateo	N/A	9	1	N/A	N/A	N/A	19	N/A	7
7	Santa Cruz	N/A	3	0	N/A	N/A	N/A	14	N/A	1
8 & 9	Monterey	N/A	16	1	N/A	N/A	N/A	6	N/A	3
9 & 10	San Luis Obispo	0	13	1	23	3	7	17	4	3
10, 13, 14, 15, & 18	Santa Barbara	0	5	0	21	0	5	7	6	N/A
16 & 17	Ventura	N/A	29	0	29	5	7	26	10	N/A
11, 19, & 20	Los Angeles	N/A	72	3	104	19	48	94	64	44
12	Orange	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A	17

Table E-3c: Estimated Number of Regulated Entities that are Small, with Capacity Constraints (by area, county, and activity type)

Max. capacity to be considered small:		4 million megawatts for the preceding year[1]	4 million megawatts for the preceding year[1]	4 million megawatts for the preceding year[1]	4 million megawatts for the preceding year[1]
Area	**NAICS Code – Category (Activity)**	221111—Hydroelectric Power Generation (Tidal & Wave Energy)	221113—Nuclear Electric Power Generation (Power Plant)	221119—Other Electric Power Generation (Tidal & Wave Energy)	22112—Electric Power Transmission, Control, and Distribution (Power Plant)
1	Sonoma	0	N/A	0	N/A
2	Marin	N/A	N/A	N/A	N/A
3 & 4	San Francisco	N/A	N/A	N/A	N/A
4, 5, 6, & 7	San Mateo	N/A	N/A	N/A	N/A
7	Santa Cruz	N/A	N/A	N/A	N/A
8 & 9	Monterey	N/A	N/A	N/A	N/A
9 & 10	San Luis Obispo	0	0	0	1
10, 13, 14, 15, & 18	Santa Barbara	0	0	0	2
16 & 17	Ventura	N/A	N/A	N/A	N/A
11, 19, & 20	Los Angeles	3	N/A	8	N/A
12	Orange	N/A	N/A	N/A	N/A

Table E-4 sums the information displayed in Tables E-3a, E-3b, and E-3c, and presents the total number of small businesses by area. The study area for Area 19 contains a maximum of 1,083 potentially affected small entities. Efforts associated with Areas 11 and 12 are expected to impact a maximum of 776 and 478 small entities, respectively. Areas 6, 13, 14, and 18 have no impacts to small entities.

Small businesses receiving National Pollutant Discharge Elimination System (NPDES) permits represent the largest number (2,673) of the potentially affected small entities. This group includes the manufacturing sector (e.g., food processing facilities, paper and pulp mills or sewage treatment plants). Another 158 and 125 small businesses involved in oil and chemical spills and agricultural pesticide use, respectively, are also expected to be affected by this rule. Thus, water quality concerns are expected to be the reason that 81 percent of the small entities will be affected. As identified earlier in this report, 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 black abalone.

Table E-5 estimates for every activity type the proportion of businesses that are small within an area. As can be seen, the proportion of businesses that are small in most areas and for most activity types are above 97 percent. Thus, of the considered activity types, most businesses in the study area can be considered to be small.

Table E-6 combines the annualized cost estimtes from previous section of this report and the information from Table E-5 to estimate the total annualized impacts that may be borne by small entity by activity and by unit. As discussed above based on information from Table E-4, Area 19 would be most heavily impacted, if the criteria selected was the total number of small businesses. However, as Table E-6 indicates, if per small entity annualized impacts are considered, Area 10 would be affected most heavily with potential costs as high as $75 million. This is mainly due to the impacts of the three facilities that are associated with power plants, which are estimated to be 97.5 percent of the total costs. It is important to note here that these costs are likely overestimated, due to the fact that the modification costs for power plants are based solely on the closed cooling system retrofit. Specific areas 3, 4, and 2 have potential annualized small business impacts of about $614,850, $407,050, and $325,300, respectively.

Table E-7 combines information from Tables E-4 and E-6 to generate for every area 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 business impacts, and the total number of small businesses estimated, multiplied by the proportion of businesses that are small, as presented in Table E-4.

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 black abalone. The alternative of not designating critical habitat for the black abalone was considered and rejected because such an approach does not meet the legal requirements of the ESA. Although the benefits of exclusion for particular areas appear to outweigh the benefits of designation, NMFS is considering the alternative of designating all specific areas (i.e., no areas excluded), and will evaluate comments received. Should NMFS determine to exercise its discretion to designate all areas, the Final Regulatory Flexibility Analysis will address the appropriate impacts.

An alternative to designating critical habitat within all 20 areas is the designation of critical habitat within a subset of these areas. 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 areas would be excluded.

Table E-4: Estimated Number of Regulated Entities Classified as Small (by area and activity)

Area	Dredging & In-water Construction	NPDES[1]	Coastal Urban Development	Agriculture: Pesticides	Oil & Chemical Spills[2]	Power Plants	Tidal & Wave Energy	LNG	Mineral & Petroleum	Total
1		120		11			0			131
2		34	10	3						62
3		69		4						73
4		105	22	6	11					143
5		27			2					30
6										0
7		92	30	7	4					133
8		44	22	14	2					81
9		60		18	5					82
10	33	63	41	26		3	0		17	184
11		776								776
12		429		21	28					478
13										0
14										0
15					2					2
16		39		17						56
17	54	39	56							148
18										0
19	125	776	83		89		11			1,083
20	125		83							208
Total	338	2,673	346	125	158	3	11	0	17	3,671

[1] Note that due to lack of county revenue data, national data was used to attribute percentages of small businesses. Source: U.S. Census Bureau. *Number of Firms, Number of Establishments, Employment, Annual Payroll, and Receipts by Receipt Size of the Enterprise for the United States, All Industries -2002*. Accessed at: http://www2.census.gov/csd/susb/2002/usalli_r02.xls.

[2] Ibid.

Table E-5: Percentage of Businesses that are Classified as Small (by area and activity type)

Area	Dredging & In-water Construction	NPDES	Coastal Urban Development	Agriculture: Pesticides	Oil & Chemical Spills	Power Plants	Tidal & Wave Energy	LNG	Mineral & Petroleum	Total
1		99%		100%			0%			99%
2		100%	98%	100%						133%
3		100%		100%						100%
4		100%	98%	100%	98%					99%
5		99%			98%					99%
6										
7		100%	98%	100%	98%					99%
8		100%	98%	100%	98%					99%
9		99%		100%	97%					99%
10	98%	100%	98%	100%		100%	0%		100%	99%
11		100%								100%
12		100%		100%	98%					100%
13										
14										
15					97%					97%
16		100%		94%						98%
17	98%	100%	98%							99%
18										
19	98%	100%	98%		97%		100%			99%
20	98%		98%							98%
Total	98%	100%	98%	99%	98%	100%	100%		100%	100%

Table E-6: Estimated Annualized Impacts Borne bt Small Entities by area and activity type

Area	Dredging & In-water Construction	NPDES: Minor	NPDES: Major	Coastal Urban Development	Oil & Chemical Spills	Power Plant	Tidal & Wave Energy	Total
1		$3,300	$0				$0	$3,300
2		$54,550	$253,750	$20,000				$328,300
3		$107,400	$507,450					$614,850
4		$53,600	$272,950	$4,000	$76,500			$407,050
5		$850	$4,100		$16,750			$21,700
6								$0
7		$4,900	$18,800	$12,000	$37,800			$73,500
8		$3,300	$18,800	$4,000	$46,000			$72,100
9		$1,650	$4,100		$13,200			$18,950
10	$2,400	$1,650	$33,600	$6,400		$74,974,400	$0	$75,018,450
11		$41,200	$64,800					$106,000
12		$1,650	$25,400		$150			$27,200
13								$0
14								$0
15					$13,000			$13,000
16		$1,650	$16,350					$18,000
17	$1,600	$1,650	$0	$1,600				$4,850
18								$0
19	$3,200	$0	$26,300	$4,800	$59,000		$34,500	$127,800
20	$1,600			$1,600				$3,200
Total	$8,800	$277,350	$1,246,400	$54,400	$262,400	$74,974,400	$34,500	$76,858,250

Table E-7: Estimated Annualized Impacts per Small Entity by area and activity type

Area	Dredging & In-water Construction	NPDES: Minor	NPDES: Major	Coastal Urban Development	Oil & Chemical Spills	Power Plant	Tidal & Wave Energy
1		$30	$0				$0
2		$1,600	$7,500	$2,000			
3		$1,600	$7,400				
4		$500	$2,600	$200	$7,100		
5		$30	$150		$7,600		
6							
7		$50	$200	$400	$9,700		
8		$75	$400	$200	$23,550		
9		$30	$70		$2,700		
10	$75	$25	$500	$150		$24,991,500	$0
11		$50	$85				
12		$5	$60		$5		
13							
14							
15					$6,700		
16		$40	$400				
17	$30	$40	$0	$30			
18							
19	$25	$0	$35	$60	$650		$3,100
20	$15			$20			

APPENDIX F: 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."[127]

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.[128]

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 power plants, tidal and wave energy projects and LNG facilities. The following sections describe the potential for these impacts in greater detail.

[127] 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.
[128] Ibid.

Power Plants

As discussed in Section 2.9, there is currently only one power plant, the Diablo Canyon Power Plant (DCPP), located within an area that could be affected by black abalone critical habitat. The DCPP is a nuclear power plant and is described in more detail in Section 2.9.2. Future management and required project modifications for black abalone critical habitat related to power plants include: cooling of thermal effluent before release to the environment, treatment of any contaminated waste materials, retrofitting to a wet cooling system, and modifications associated with permits issued under NPDES.

These modifications could affect energy production; however, the potential impact of possible black abalone conservation efforts on the project's energy production and the associated cost is unknown.

As shown in Table F-1, the DCPP has a production capacity of 2,200 megawatts and therefore, if about half of this capacity is affected by black abalone critical habitat, it would be higher than the 500 megawatts of installed capacity threshold. It is unlikely that any project modifications would have a large impact on the amount of electricity produced. It is more likely that any additional cost of black abalone conservation efforts would be passed on to the consumer in the form of slightly higher energy prices. Without information about the effect of power plants on future electricity prices and more specific information about how recommended conservation measures for black abalone would effect electricity production, this analysis is unable to forecast potential energy impacts resulting from changes to power plants.

Table F-1: Summary of Capacity of Power Plants

Area	Estimated number of affected power plants	Capacity (MW)
	Diablo Canyon Power Plant	2,200
Total Capacity		**2,200**

Tidal and Wave Energy Projects

As discussed in Section 2.11, the number of future tidal and wave energy projects that will be constructed within the specific areas is unknown. Currently there are no actively-generating wave or tidal energy projects located within the study area. However, as described in Section 2.11, five projects have received preliminary permits from the Federal Energy Regulatory Commission (FERC).[129]

Future management and required project modifications for black abalone critical habitat related to tidal

[129] FERC. *Issued and Valid Hydrokinetic Projects Preliminary Permit.* Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.xls on April 5, 2010.

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 black abalone conservation efforts on the project's energy production and the associated cost of that energy are unclear.

As shown in Table F-2, proposed tidal and wave energy projects within the study area have a combined production capacity of 121 megawatts. It is more likely that any additional cost of black abalone 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 black abalone conservation would have to be balanced against changes in energy price resulting from 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 black abalone, this analysis is unable to forecast potential energy impacts resulting from changes to tidal and wave energy projects.

Table F-2: Summary of Capacity at Proposed Tidal and Wave Energy Projects

Area	Docket No.	Project Name	Classification	Capacity (MW)
1	P-13376	Del Mar Landing	Wave	5
1	P-13377	Fort Ross (South)	Wave	5
1	P-13378	Fort Ross (North)	Wave	5
10	P-13641	Central Coast WaveConnect	Wave	100
19	P-13498	SWAVE Catalina Green Wave	Wave	6
Total Known Capacity				121

Source: Federal Energy Regulatory Commission**.** *Issued Hydrokinetic Projects Preliminary Permits*. Accessed at: http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.xls, on April 5, 2010

LNG Projects

Similar to tidal and wave energy projects, the number of future LNG projects that will be built within the specific areas is unknown. As described in Section 2.12, many LNG projects are likely to be abandoned during the development stages for reasons unrelated to black abalone critical habitat. In addition, the potential impact of LNG facilities on black abalone habitat remains uncertain, as is the nature of any project modifications that might be requested to mitigate adverse impacts. Since there are no LNG projects in the development stage, the potential impact of possible black abalone conservation efforts on the project's energy production and the associated cost of that energy are unclear.

As discussed in Section 2, project modifications may include biological monitoring, spatial restrictions on project installation, and specific measures to prevent or respond to catastrophes. Out of these project modifications, spatial restrictions on project installation could have effects on energy production. This modification could increase LNG construction costs, which may result in higher natural gas 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 black abalone conservation measures or future forecasts of energy prices that reflect future markets with increased energy supplies from LNG projects.