Commercial and recreational fishing grounds and their relative importance off the North Coast of California

Report to the California Marine Life Protection Act Initiative

In partial fulfillment of Contract No. #2009-0006M,
Resources Legacy Fund Foundation

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1. Introduction

Ecotrust was retained by the Marine Life Protection Act Initiative (MLPAI) on May 1, 2009 to collect, compile and analyze fishery data in support of the North Coast Project (see Appendix C for Scope of Work). From June through October of 2009, our research team developed and deployed an interactive, custom computer interview instrument to collect geo-referenced information from local fishermen about the extent and relative importance of North Coast Study Region (NCSR) commercial, commercial passenger fishing vessel (CPFV) and recreational fisheries. We compiled these data in a geographic information system (GIS) that we delivered to the MLPAI for integration into a central geodatabase. We also analyzed the fishery data in combination with additional data provided to us by the California Department of Fish and Game (CDFG) to estimate first order maximum potential impacts of proposed marine protected area networks developed as part of the Marine Life Protection Act (MLPA) process.

This report, which details the approach and methods we used to collect, compile and analyze commercial, CPFV and recreational fisheries data in NCSR, completes our deliverables to the MLPAI under the terms of the contract. It is important to note, however, that the work conducted under the scope of this contract is not the sum total of everything that could be done with the MLPAI geodatabase and the information contained therein. Indeed, the analysis conducted to date suggests additional questions and research that we were not able to address under this contract. That being said, we hope this project not only made a useful contribution to the MLPA process, but also opens the door to further inquiry that draws on the expert knowledge of fishermen.

Conducting research in coastal communities is as challenging as it is rewarding. We have learned a tremendous amount from the commercial, CPFV and recreational fishermen who participated in this study and from the countless other community members, stakeholders and observers of the MLPA process.

We are deeply thankful to the 219 commercial, 22 CPFV and 574 recreational fishermen who participated in our data collection effort—making time in their busy schedules, overcoming sometimes considerable reservations and sharing their knowledge and experience with us. We also thank all the members of the North Coast Regional Stakeholder Group and the MLPAI staff.

We believe that this project has made a significant contribution to the knowledge base on the coast—not only by informing marine protected area planning, but also by enhancing the public's and decision-makers' understanding of the importance of the coastal ocean to individual commercial and recreational fishermen and to coastal communities and economies.

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In addition to serving as the Principal Investigator on this study, Astrid Scholz is also a member of the Master Plan Science Advisory Team of the Marine Life Protection Act Initiative (http://www.dfg.ca.gov/mlpa/satmain.asp).

2. Background

In California, as elsewhere on the Pacific Coast, commercial, CPFV and recreational fisheries support coastal communities and economies. These fisheries are prosecuted by vessels of all shapes and sizes using a variety of gear types and fishing strategies and covering a large part of the coastal ocean.

In general, the spatial component of fishing activities is poorly understood. While a variety of data are collected by state and federal agencies to monitor and enforce fishery regulations and to set harvest allocations, the thematic, temporal and spatial resolution of these data vary considerably. Data types include agency observer data, voluntary reports, mandatory daily logbooks with detailed location information and landing receipts using large statistical reporting blocks, among others. With marine and fisheries management becoming more focused on ecosystem-based approaches and the use of tools such as time and area closures, accurate spatial information about coastal fisheries is central to inform intelligent policy decisions.

Basing fisheries management decisions on the spatial information contained in existing data sources is problematic. The alternative is to collect new information on the spatial extent of fishing activities and the fishermen who are actively engaged in these fisheries. In the absence of comprehensive observer coverage, vessel monitoring systems or other fishery-independent data collection devices, by far the best source of information about the fishing grounds is the fleet itself.

In this project, we built on existing approaches to collecting fishermen's expert knowledge about their fishing grounds. The overarching project goal was to develop maps of the fishing grounds in the North Coast Study Region (NCSR) and to characterize the relative importance of various fisheries.

In order to conduct an analysis of the relative effects of MPA proposals on commercial, CPFV and recreational fisheries in the NCSR, we used data layers characterizing the spatial extent and relative stated importance of fishing grounds for target commercial, CPFV and recreational fisheries. This information was collected during interviews with commercial, CPFV and recreational fishermen from the NCSR whose individual responses were standardized using a 100-point scale and normalized to the reported fishing grounds for each fishery.

The following sections contain detailed descriptions of the survey methods used to address the spatial information gaps in fisheries in the context of the Marine Life Protection Act and its implementation in the NCSR.

3. Methods

In this project, we built on methods developed in previous projects on the coast (Scholz et al. 2004; 2005; 2006a; 2008; 2010). More specifically, we used a computer interface to administer a survey and collect information from fishermen, and analyzed the responses in a geographic information system (GIS). As in the Central Coast Study Region (Scholz et al. 2006b), the North Central Coast Study Region (Scholz et al. 2008) and the South Coast Study Region (Scholz et al. 2010), a key innovation in this project was working with CDFG staff and regional experts to define the North Coast Study Region's fisheries in terms of how they are managed. To that end, we differentiated fisheries in terms of practices and/or species (group)-gear configurations and used port groups to classify participants and design a representative sample.

While the use of GIS technology and analysis in marine and fishery management has expanded steadily over the past decade (Meaden 1996; Kruse et al. 2001; Breman 2002; Valavanis 2002; Fisher and Rahel 2004), its use for socioeconomic research is still somewhat limited. Many of the applications reviewed in the recent literature focus on urban populations or natural resource use in developing countries (e.g., Gimblett 2002; Goodchild and Janelle 2004; Anselin et al. 2004). Nevertheless, a growing body of literature has examined GIS-enabled approaches to community-based MPA design (e.g., Aswani and Lauer 2006; Hall and Close 2006; St. Martin et al. 2007; Ban et al. 2009) and there are several good examples to build on for improving the spatial specificity of the West Coast knowledge base and data landscape.

Some of the most pertinent applications of GIS technology to socioeconomic questions in fisheries concern the spatial extent of fishing effort and intensity (Caddy and Carocci 1999; Green and King 2003) and use participatory methods similar to the ones employed here (Wedell et al. 2005; St. Martin 2004; 2005; 2006). We built on these approaches and adapted them for the California context, following best practices for the use of participatory GIS in natural resource management (Quan et al. 2001), as described in the remainder of this section.

3.1. Study Region

The study region of this project was congruent with the North Coast Project of the MLPAI, extending from the California/Oregon border to Alder Creek near Point Arena in Mendocino County (for details of the North Coast project, see http://www.dfg.ca.gov/mlpa/northcoast.asp).

Unlike the MLPAI North Coast Project, however, the western extent of our study region was not bounded by the state water boundary (i.e., three miles offshore). Rather, we considered the entire Exclusive Economic Zone (EEZ) (although in reality most fisheries are confined to within 50 miles offshore). Similarly, we did not impose the southern and northern extent boundaries of the North Coast Project. Methodologically, this means that we did not "cut off" the area for fishermen to consider, but asked them to draw their fishing grounds irrespective of political boundaries.

In keeping with the convention adopted by the MLPAI, we stratified the study region for commercial, CPFV and recreational fisheries, respectively. For commercial fisheries, we divided the study region into six port groups: Crescent City, Trinidad, Eureka, Shelter Cove, Fort Bragg and Albion. Commercial passenger fishing vessel and recreational ports were the same, with the exception of the removal of Albion.

The MLPAI Scientific Advisory Team (SAT) requested that all evaluation reports submitted to the SAT used the same common names when referring to NCSR fisheries (see Appendix A.7).

3.2. Survey Methods and Summary Statistics

From June through October of 2009, Ecotrust personnel and field staff surveyed 219 commercial, 22 CPFV and 574 recreational fishermen from the North Coast study region. Additionally, from January to February 2010, Ecotrust personnel and field staff interviewed five shellfish companies (these results can be found in Appendix A.8).

In an effort to provide the data we collected to community members, stakeholders and observers of the MLPA NCSR process in a timely manner, we submitted an initial report containing methods and summary statistics to the MLPAI on December 4, 2009 and a revised final version of the report on

March 13, 2010, including Appendices A.8 and A.9, entitled *Survey Methods and Summary Statistics for Ecotrust's North Coast Study Region Fishery Uses and Values Project*. The revised final report is attached as Appendix A.

The report contains details on our methods for data collection, including sample design, selection of fisheries, identification of commercial, CPFV and recreational fishermen, interview protocols and steps for conducting quality assurance and quality control. The report also contains summary statistics highlighting the following survey findings:

Commercial

- Percentage the sample represents based on ex-vessel revenue (2000–07) for each port-fishery combination (Table A.1).
- Survey representation by home port grouping—both mean and median (number responding, age, years experience, percentage income from fishing) (Table A.3).
- Survey results by gear type and fishery (number sampled, age, gender, years experience, percentage of income from fishing, percentage income from specific fishery, vessel length and haul capacity) (Table A.4).
- Number of fishermen interviewed for each port-fishery combination (total number interviewed, number actually used) (Table A.2).
- List of commercial fishing maps available in MarineMap (Appendix A.2).

CPFV

- Mean summary statistics by port and for the NCSR (number of respondents, age, vessel length, number of vessels operated, number of years operating, number of vessels owned, number of years owned, years of experience, days fishing per year, number of passengers, percentage out of state passengers, number of crew) (Table A.6).
- CPFV related income and operating costs by port and for the NCSR—both mean and median (percentage income, percentage operating costs, percentage labor costs, percentage fuel costs) (Table A.7).
- Percentage of trips associated with major fishing strategies by port and for the NCSR (California halibut, Dungeness crab, Pacific halibut, rockfish, salmon) (Table A.8).
- Trip type and trip length by port and for the NCSR (number of respondents) (Tables A.8 and A.9).
- Number of respondents per port and species (Appendix A.3).
- Datasets available in MarineMap (Appendix A.3).

Recreational

- Number of user group surveys completed per respondent (Table A.10).
- Number of surveys by user group (Table A.11).

Dive

- Dive survey response statistics—both mean and median (age, years experience, average annual number of days diving to fish, percentage time by dive type, primary mode of diving, primary access method) (Table A.12).
- Number of dive respondents by port and species (Appendix A.4).
- Datasets available in MarineMap (Appendix A.4).

Kayak

- Kayak survey response statistics—both mean and median (age, years experience, average annual number of days kayaking to fish) (Table A.13).
- Top kayak launch/access sites (number of respondents for each site-ranking combination) (Table A.14).
- Number of kayak angler respondents by port and species (Appendix A.5).
- Datasets available in MarineMap (Appendix A.5).

Motor powered private vessels

- Private vessel survey response statistics—both mean and median (age, number of years operating a vessel, years of vessel ownership, vessel length, years experience, average annual number of days fishing) (Table A.15).
- Top private vessel launch sites (number of respondents for each site-ranking combination) (Table A.16).
- Number of recreational private vessel anglers respondents by port and species (Appendix A.6).
- Datasets available in MarineMap (Appendix A.6).

3.3. Evaluation Methods

In an effort to provide information on the evaluation methods we used to asses commercial, CPFV, and recreational fishery impacts in a timely manner, we submitted a report to the MLPAI in February 2010 entitled *Draft Methods Used to Evaluate MPA Proposals in the MLPA North Coast Study Region*. This report is attached as Appendix B.[1]

The report describes how we evaluated and summarized the first-order maximum potential impacts on commercial, CPFV and recreational fishing grounds associated with each of the MPA proposals (in terms of both total area and total value affected) and how we conducted a potential impact assessment for commercial and CPFV fisheries. Appendix B.1 details six steps in the impact assessment:

1. Generate baseline estimates of gross economic revenue (commercial only).
2. Generate gross economic revenue for the various MPA alternatives (commercial only).
3. Generate baseline estimates of net economic revenue (commercial only).
4. Generate estimates of net economic revenue for the various MPA alternatives (commercial only).
5. Generate estimate of the potential first-order economic impact for the various MPA alternatives (commercial only).
6. Generate estimate of the potential first-order gross economic impact for the various MPA alternatives (commercial and CPFV).

For the results of these analyses, please see the *Summary of Potential Impacts of the North Coast Enhanced Compliance Alternative and Revised Round 3 North Coast Regional Stakeholder Group Marine Protected Area Proposals on Commercial and Recreational Fisheries* (Appendix D).

3.3.1. Disproportionate Impacts

We also used the results of our analyses to evaluate whether there were port-fishery combinations that might be disproportionately affected by the proposals considered.

[1] The final submission was February, 2010 and the SAT approved these methods on Feb. 11, 2010.

To assess these impacts, we used a box plot analysis to identify outliers within each fishery. In a box plot analysis, outliers are defined as extreme values that deviate significantly from the rest of the sample. Box plot analysis results, presented in the *Summary of Potential Impacts of the North Coast Enhanced Compliance Alternative and Revised Round 3 North Coast Regional Stakeholder Group Marine Protected Area Proposals on Commercial and Recreational Fisheries in the North Coast Study Region* (Appendix D), can also inform convergence among MPA proposals within a fishery and relative potential impacts between fisheries.

4. Results and Deliverables

To date, there have been two data products and one analytical product resulting from this study, all of which have been submitted to the MLPAI. The two data products were two sets of maps of the port-fishery specific (including port-user group aggregations) and study region aggregations of the North Coast commercial (43 maps), CPFV (19 maps) and recreational (39 maps) fishing grounds. All commercial and CPFV maps were made available to North Coast Regional Stakeholder Group (RSG) members and external stakeholders through MarineMap on February 2, 2010. All recreational maps were made available on March 10, 2010. The information depicted on the maps was also provided as raster data sets for all fisheries examined at the 100m-cell size, and which served as the basis for the impact analysis. All datasets were accompanied by metadata conforming to the Federal Geographic Data Committee (FGDC) standards (http://www.fgdc.gov/standards).

The analytical product was the *Summary of Potential Impacts of the North Coast Enhanced Compliance Alternative and Revised Round 3 North Coast Regional Stakeholder Group Marine Protected Area Proposals on Commercial and Recreational Fisheries in the North Coast Study Region* (Appendix D).

4.1. Analytical Products

During the summer and fall of 2010, Ecotrust staff conducted a series of analyses on the various MPA proposals considered as part of the MLPAI process. The goal was to assess the first-order maximum potential impacts of proposals both in terms of the area of fishing grounds affected and the stated importance of those areas. As expected, our analysis showed that not all areas of the ocean are valued equally and that some areas are more important to a fishery or fisheries than other areas. Such findings suggested that even a small closure could have a large impact on fishermen (expressed in units of stated importance). The summary of our analyses, which was forwarded to the California Fish and Game Commission on January 14th, 2011is included as Appendix D.

Ecotrust is committed to keeping in the public domain as much information as possible about the methods and tools we use. Researchers interested in replicating our analysis may contact us to obtain the specific Arc Macro Language (AML) code we used.

As we discuss further in the next section, the products we produced and delivered to the MLPAI under the terms of this contract are not an exhaustive list of products that could be created using the fishing grounds data we collected.

5. Discussion and Conclusion

This section reflects on several methodological and process lessons we learned in the hope of informing future iterations and/or applications of our approach. We also describe some opportunities for further analysis.

5.1. Weighting of Participants' Shapes

For the North Coast, we used the same analytical methods as those developed and used in the North Central Coast (Scholz et al. 2008) and South Coast (Scholz et al., 2010). More specifically, we multiplied the stated importance of each fisherman's fishing grounds by the proportion of his/her average ex-vessel revenue (2000–07) from CDFG landing receipts. Our approach, which has been praised in several reviews, gives greater weight to successful, experienced fishermen with higher revenues. For example, if fisherman A has higher landing receipts than fisherman B, fisherman A's 100 "pennies" are worth more than fisherman B's in determining the overall value of the fishery. Further discussion on these methods can be found in our article titled *Incorporation of spatial and economic analysis of human-use data in the design of marine protected areas* (Scholz et al. In Press).

The time period of 2000–07 was chosen for consistency across all fisheries due to limitations in categorizing CDFG landing receipts prior to 2000 for the nearshore and deep nearshore fisheries.[2] Information for 2008 was not available when the analysis was conducted.

5.2. Timing

Conducting detailed fieldwork and participatory research concurrently with a sometimes contentious policy process is ambitious—especially when the work period coincides with the summer fishing season. Ideally, detailed information about the fishing grounds and their relative importance would be available to decision-makers prior to the beginning of the policy process.

Timing was often a constraint in the MLPAI process, especially when trying to gain a statistical representation of the region's fishing fleet. In the case of this project, we were able to collect data in the field, verify our results with the fishing community and present our analysis and datasets via Marine Map to the North Coast Study Region External MPA proponents and later to the North Coast Regional Stakeholder Group (RSG) in a timely manner, which assisted them in their process of siting potential MPAs.

The exact timing of when data were collected in the field and delivered to the process is outlined below:

- Data collected from commercial fishermen: June – October 2009
- Data collected from recreational fishermen: June – October 2009
- Data collected form shellfish operations: January – February 2010
- Commercial and recreational fishing grounds presented and used by the North Coast External MPA proponent groups: November 2009
- Commercial and recreational fishing grounds presented and used by the North Coast RSG: February 2010
- Commercial shellfish operations presented and used by North Coast RSG: March 2010

[2] The CDFG Nearshore Fisheries Management Plan was designed, drafted and implemented in 2001–02.

- Final proposals developed and presented to the Blue Ribbon Task Force: October and December 2010

5.3. Scale and Stratification of Fisheries

One notable improvement made to the commercial fisheries sample for the North Coast, North Central Coast and South Coast processes when compared to the work done in the Central Coast process was the stratification of fisheries by geographical port groups and the examination of each fishery for each port individually (rather than just for the entire study region). More specifically, for each of the major commercial ports in the region (i.e., Crescent City, Trinidad, Eureka, Shelter Cove, Fort Bragg and Albion) we used CDFG landing receipts to identify fishermen to interview so that we could create maps of the fishing grounds that characterized the value and spatial extent of each fishery in each port where that fishery occurs. We used these maps to analyze and report the potential economic impacts of the various MPA alternatives for each fishery not only at the study region level, but also at each port.

Another improvement to our commercial fisheries sample was to group species based on how they are targeted or managed (where applicable). For example, in the Central Coast, we collected information for specific species that made up the nearshore and deep nearshore fisheries. In the North Coast, we targeted fishermen who held nearshore and/or deep nearshore fishery permits and asked them to provide their fishing grounds for nearshore species and deep nearshore species collectively (rather than for each species individually). Ecotrust field staff collected data on deeper nearshore, nearshore and lingcod fisheries; however, at the recommendation of the fishing community, we combined these fisheries into a single rockfish – fixed gear fishery. For a list of fisheries included in each species grouping, please see Appendix A.7.

The mapping of commercial seaweed harvesting and shellfish aquaculture areas was another improvement to the project. In the North Central Coast, data on these two types of uses were not collected. For the North Coast, Ecotrust engaged seaweed harvesters from the onset of the project and worked with them to design a survey to capture information pertaining to seaweed harvesting and mapped harvest areas for each seaweed species. Ecotrust also worked with shellfish aquaculture farms to design a survey to capture information about these operations and the spatial extent of their aquaculture lands.

5.4. Quality Assurance and Quality Control

This project used valuable lessons learned in the Central Coast, North Central Coast and South Coast related to protection of confidentiality and verification of information collected.

With respect to the issue of confidentiality, we used strict protocols conforming to human subject standards used at the University of California and elsewhere in academic research. Given the sensitive nature of fishing grounds data, we took numerous measures to protect each fisherman's information. These measures included training field staff on confidentiality protocols, masking all names and identifying characteristics of Open OceanMap shapefiles; incorporating new security features into OceanMap; showing draft aggregated maps of each fishery to no one outside the fishing community for review; incorporating information into MarineMap at sufficiently aggregated levels; and displaying our results in a format that maintained information content without making visible any individual fisherman information. As in the South Coast, field staff were instructed to

never use actual Open OceanMap shapes for demonstration purposes. Because of these protocols, no breaches of confidentiality were reported in the North Coast.

With respect to data verification, we provided multiple opportunities for fishermen to review the information they provided and verify its accuracy. As field staff collected data from the recreational, CPFV and commercial fleets, Ecotrust staff edited the data to create "clean" datasets. We then mailed each fisherman a copy of his/her individual fishing grounds, a letter asking him/her to respond if any changes needed to be made and an addressed, stamped envelope. If a fisherman did not respond after a three week time period, we assumed that the information he/she provided was correct.

Following this process, we created aggregated maps for each port-fishery. We then reviewed these maps for accuracy and discussed intended use at meetings in ports throughout the NCSR with key members of the fishing community in each port as well as North Coast RSG members. Those that could not attend review sessions in person and requested to review the maps were sent aggregate maps electronically. In many cases, this provided detailed verification and sign-off on the extent and relative importance of the fishing grounds for each fishery. Internally at Ecotrust, we also employed several QA/QC protocols designed to catch inconsistencies and other problems with the data. For example, we ran an automated check to make sure each respondent's shapes and weights added up to 100 pennies.

5.5. Further Analysis

We are actively exploring several avenues for further analysis. As we already found in the Central Coast region, fishermen-derived information can be used in other computer-based, decision support systems to explore the range of best options for balancing ecological and socioeconomic objectives of MPA design (Klein et al. 2008a; 2008b).

We performed an assessment where we examined the trade-offs between minimizing impacts to eight commercial fisheries and representing the range of marine ecosystems in the North Central Coast Study Region. We produced a zoning configuration that entailed value losses of less than 9% for every fishery, without compromising conservation goals. We found that a spatial numerical optimization tool that allows for multiple zones outperforms a tool that can identify marine reserves in two ways. First, the overall impact on the fishing industry is reduced. Second, there is a more equitable impact on different fishing sectors (Klein et al. 2009).

As mentioned earlier, all fishing grounds datasets were made available to the North Coast Study Region External MPA proponents and North Coast RSG through MarineMap. Additionally, the NCRSG had access through MarineMap to both array level and MPA level potential impact reports.

The MPA level reports provided impact assessment for individual species from each port by sector (i.e., commercial, CPFV and recreational). These reports provided stakeholders with the potential impacts of each MPA as: 1) percentage of total fishing grounds area affected by the proposed MPA; and 2) percentage of total fishing grounds value affected by the proposed MPA.

The array level reports provided the potential impacts of each array at the individual port and species level and aggregated by port for the commercial sector as: 1) potential net and gross economic impact assessment in dollars; and 2) potential net and gross economic impact assessment as a percentage of revenue.

The array level reports provided the potential impacts of each array aggregated by port for the CPFV sector as: 1) potential net and gross economic impact assessment as a percentage of revenue.

The array level reports provided the potential impacts of each array at the individual port and species level for the recreational sector as: 1) potential impact as a percentage of total value (stated importance).

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Appendix A: Survey Methods and Summary Statistics

Survey Methods and Summary Statistics for Ecotrust's North Coast Study Region Fishery Uses and Values Project

March 13, 2010

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A.1. BACKGROUND

In California, as elsewhere on the Pacific Coast, commercial and recreational fisheries support coastal communities and economies. Fisheries are a complex system comprised of fishermen from varying backgrounds, vessels of all shapes and sizes, and numerous gear types and fishing strategies. It is well known that fisheries utilize a large portion of the coastal ocean; however, how to differentiate use areas related to specific fisheries and/or communities and connecting these areas to the human and economic dimensions of fisheries is still not well understood.

In order to make informed marine planning decisions, there is a need to measure and determine the importance of ocean areas. While a variety of data are collected by state and federal agencies to monitor and enforce fishery regulations and set harvest allocations, the thematic, temporal and spatial resolution of these data vary considerably. Data types include agency observer data, voluntary reports, mandatory daily logbooks with detailed location information, and landing receipts using large statistical reporting blocks, among others. With marine and fisheries management becoming more focused on ecosystem-based approaches and the use of tools such as time and area closures, accurate spatial information about coastal fisheries is central to informing policy and management decisions.

Basing these decisions on the spatial information contained in existing data sources is problematic. The alternative is to collect new information on the spatial extent of fishing activities from fishermen who are actively engaged in these fisheries. In the absence of comprehensive observer coverage, vessel monitoring systems or other fishery-independent data collection devices, by far the best source of information about the fishing grounds is the fleet itself.

Therefore, in this project, we went directly to the fishing community to solicit their expert knowledge. During interviews with Ecotrust staff, hundreds of commercial, Commercial Passenger Fishing Vessel (CPFV) and recreational fishermen mapped the spatial extent of their fishing grounds and designated or weighted (using a 100-point system) the relative importance of these areas. We used this knowledge to create data layers (maps) with the intent of (1) helping stakeholders minimize the potential impact of marine protected area (MPA) designations and (2) analyzing the relative effects of alternative MPA proposals on fisheries conducted in the state waters of the North Coast Study Region (NCSR).

The following sections contain detailed descriptions of the survey methods used to address the spatial information gaps as they pertain to commercial and recreational fisheries in the context of the Marine Life Protection Act (MLPA) and its implementation in the NCSR.

A.2. METHODS

In June 2009, before commencing interviews, Ecotrust staff conducted a series of outreach meetings with members of the NCSR fishing community to provide a project overview, answer questions, raise general awareness, and solicit potential interview participants and port liaisons. In addition, Ecotrust staff made follow-up phone calls, met with port liaisons, and provided information (i.e., handouts, Frequently Asked Questions (FAQs) and PowerPoints) for fishing organizations/associations to use at meetings and/or post on blogs, websites, and discussion boards. We also described the project on a web page (http://www.ecotrust.org/mlpa), which included an online form for submitting questions and a FAQ page where submitted questions were answered by Ecotrust staff.

A.2.1. Survey Design

Given the expert nature of the information we were interested in for this project, the use of a random sample for the commercial fisheries was not the most desirable sampling method. Instead, we constructed a purposive, proportional quota sample designed to be representative of the commercial fisheries overall. To create our sample, we used California Department of Fish and Game (CDFG) ex-vessel revenue landings data to identify fishermen in each target commercial fishery so that respondents for each fishery would represent (region wide and by port):

- At least 50% of the total landings and/or ex-vessel revenue from 2000–07[3]; and
- At least five fishermen, except in cases where the sample population was fewer than five.

In consultation with Marine Life Protection Act Initiative (MLPAI), CDFG staff, and fishermen in the NCSR, we selected ten key commercial fisheries and five key recreational/Commercial Passenger Fishing Vessel (CPFV) fisheries on which to focus our efforts. The target commercial fishery groupings in alphabetical order were: anchovy/sardine – lampara net, Dungeness crab – trap, herring – gillnet, rockfish – fixed gear, salmon – troll, seaweed – hand harvest, shrimp – trap, smelt – brail (dip net), surfperch – hook and line, and urchin – dive. The five target species and/or species groupings for recreational and CPFV in alphabetical order were: California halibut, Dungeness crab, Pacific halibut, rockfish/bottomfish and salmon. Further details on species targeted can be found in Appendix A.7. These fisheries are all predominately conducted in state waters, are of economic importance in the study region, mostly involve fishing gear that is expected to have some benthic habitat interactions, and are not well captured spatially by existing fisheries-independent data sets.

Based on landings data, port groups were defined (from north to south) as Crescent City, Trinidad, Eureka, Shelter Cove, Fort Bragg and Albion. After target commercial fishermen were identified in these ports, port liaisons and Ecotrust staff initiated contact with individual fishermen to ask for their participation in the process and to schedule interview times. During the interviews, commercial fishermen were asked if they knew other commercial fishermen who they felt either should be interviewed or would be interested in being interviewed.

It should be noted that Ecotrust field staff collected data on the deeper nearshore, nearshore, and lingcod fisheries; however, at the recommendation of the fishing community we combined these fisheries into a single rockfish – fixed gear fishery. Furthermore, to account for the relatively recent Rockfish Conservation Area (RCA) spatial closure, Ecotrust collected additional data on rockfish fishing grounds (commercial, CPFV, and recreational) both prior to (pre) and after (post) the

[3] When considering landings revenue, we omit the landings revenue of deceased fishermen in order to more accurately represent the active fishing population.

establishment of the RCA. The RCA was established to rebuild key rockfish populations and may re-open to fishing if fish stocks improve. This additional data on pre and post RCA fishing grounds may be useful in determining the relative impact of the RCA and the possible impact of MPA designation if the RCA were to re-open. Further investigation on stratifying the rockfish landings pre-RCA is necessary, however, before we are able to provide pre-RCA economic importance maps. Currently, the maps and the landings associated with those fishing grounds are all post-RCA (2001–07).

Ecotrust identified Commercial Passenger Fishing Vessel (CPFV) operators by networking in each port. Through advertisements of fishing trips, CPFV operations are often highly visible in a harbor and widely known. Using this method, Ecotrust field staff compiled a list of CPFV operations in each port, and later confirmed and added to this list as each CPFV operator was interviewed.

Recreational fishermen were selected through a solicitation for volunteers. More specifically, Ecotrust staff conducted a series of outreach meetings, worked with key leaders in the recreational community, and met with port and sector liaisons, etc. A number of factors, including the unknown overall size of the NCSR recreational fishing community by mode, geography, and demographics and the time constraints imposed on the project, made the use of this sampling methodology the most practical. Recreational fishermen interested in participating in the interview process were asked to sign up online or by contacting Ecotrust staff.

A.2.2. Data Collection

The interview process varied by sector. Commercial fishermen were interviewed in-person using a desktop version of a custom-built Geographic Information System (GIS) application known as Open OceanMap[4], as were CPFV operators. Recreational interviews were done either in-person, by phone, or using a web-based version of Open OceanMap.

As mentioned above, recreational fishermen interested in participating were asked to sign up in-person, online, or by phone. Signup was open both before and during the survey process. An initial email communication was sent in June 2009 to individuals who had already expressed interest to let them know about the process. Those who had signed up online were then sent an email containing account activation information (i.e., an individual username and password). Throughout the process, Ecotrust staff responded to questions by phone and email and posted frequently asked questions to a FAQ page specific to the web-based tool.

The majority of recreational interviews were completed in-person with field staff; however, approximately 5% of recreational surveys were completed online (17 respondents) or over the phone (8 respondents). Over the course of collecting data, we found that some participants felt the online survey was cumbersome or difficult to complete. Ecotrust staff responded quickly to requests for help and/or complaints about the online survey; however, we realize that some participants may not have completed the survey for various reasons, including complications, connection speed, or the general difficulty of the software, among others. Our rationale for offering the online survey option was to increase participation. Based on our experience in the North Central Coast Study Region (NCCSR) in 2007 and the South Coast Study Region (SCSR) in 2008, we felt we had two options for the North Coast Study Region (NCSR): in-person and online interviews. In the NCCSR, the use of in-person interviews only resulted in a limited number of recreational respondents. The success of the online tool in the SCSR to help reach a greater number of individuals led to our decision to continue

[4] For more information on Open OceanMap, see http://www.ecotrust.org/ocean/OpenOceanMap.html.

to offer this option in the NCSR. We were also able to incorporate suggestions from the SCSR into the tool for the NCSR. We are using feedback received during the NCSR interview process to continue to improve our methods and the online interview tool.

Data were entered directly into a spatially enabled, Open Source GIS database using Open OceanMap, which is programmed to allow fishermen to draw shapes in their natural sizes (polygons) rather than confining responses to a statistical grid or to political boundaries. We are then able to standardize this information across respondents or fisheries. Although data are later summarized to a variety of different raster outputs for the subsequent analysis, the raw data are entered in natural shapes and at whatever spatial scale makes sense to respondents limited to the base information (nautical charts, 1:200,000) used to guide their responses.

All interviews followed a shared protocol:

1. Maximum extent: Using electronic and paper nautical charts of the area, fishermen were asked to identify the maximum extent north, south, east, and west they would forage or target each fishery in which they participate.
2. Scaling: Fishermen were then asked to identify, within this maximum forage area, which areas are of critical economic importance over their cumulative fishing experience and to rank these using a weighted percentage—an imaginary "bag of 100 pennies" that they distributed over the fishing grounds.
3. Non-spatial information pertaining to demographics and basic operations was also collected.

The first step established the maximum extent of the fleet in each fishery. This differed for all fisheries, some of which range far along the entire Pacific Coast, and others of which are confined to inshore waters. In the subsequent analysis, this allowed us to distinguish between fisheries that take place wholly in the NCSR and those that take place both inside and outside. When respondents provided the extent of their fishing grounds, they were not constrained to just state waters or to any other political or management boundary. This allowed for further analysis regarding which fisheries occur wholly or partially in a given area regardless of its designation.

The second step scaled respondents' reporting of the relative importance of the fishing grounds to a common scale. This was important for making inter- and intra-fishery comparisons. We chose to use the term "a bag of 100 pennies" to represent an intuitive, common sum scale and percentage allocation for scoring the relative importance of sub-areas within the larger fishing grounds. It also provided us with a convenient accounting unit for aggregating the stated importance per unit area in the intermediary steps of our analyses.

The third step collected non-spatial information related to demographics and basic operations that was helpful in creating summary statistics and estimating basic operating costs (a necessary component of the impact assessment).

A.2.3. Map Products

Once interviews were complete, the fishing areas of all respondents with landings revenue during our study period were aggregated to create relative economic importance maps for each fishery in each port and region wide (see Appendix A.2 for the availability of these maps). These aggregate maps were created by simply weighing each individual's fishing grounds by his or her average ex-vessel revenues for that fishery during 2000–07. These weighted fishing grounds were then summed or overlaid together to create a "heat map" of economic importance (red areas are of high economic

importance, orange areas are of moderate economic importance, yellow areas of lower economic importance and grey areas are of lowest economic importance).

To supply additional information on locating economically important fishing grounds, we also provided percent volume contour (PVC) lines on each of the economic importance aggregate maps. These lines delineate the area(s) that contain the top 25%, 50%, and 75% relative economic value or importance (recreational) of each map. For example, for the commercial Dungeness crab map for Crescent City, the 25% PVC line delineates the fishing grounds that contain the top 25% of the economic revenue for the Dungeness crab fishery in Crescent City. The PVCs are useful as it is not always easy to determine from the color gradations ("heat maps") the areas of importance other than the red areas. PVC lines give the eye a definitive marker that delineates areas of importance.
In addition to region and port scale fishery maps, Ecotrust also created cross-sector aggregate maps for each port. These maps highlight areas of importance across all sectors and fisheries. In order to combine all fishery maps from each sector we performed a max normalization on each map dataset. This step was executed so that each dataset would be transformed into an index on the same scale (0 – 1) and therefore comparable to each other. For the max normalization we used the following equation:

$X_{iy} = (X_y - X_{min}) / (X_{max} - X_{min})$
where, i = index value for a particular grid cell value (y) in the dataset
and X_{min} *and* X_{max} *are the minimum and maximum value grid cells in each dataset*

Applying the max normalization allowed us to compare data and create a single map for each port which depicts the footprint of the fishing grounds as well as the high valued areas across sectors (commercial, CPFV, and recreational).

A.2.4. Confidentiality and Quality Assurance and Quality Control

Throughout the project, we took every step possible to protect the confidentiality of information provided by fishermen. In addition to obtaining the explicit consent of individual participants, we undertook several additional steps for protecting sensitive information. These included training field staff on confidentiality protocols; masking all names and identifying characteristics of shapefiles; incorporating new security features into Open OceanMap; showing draft aggregated maps for each fishery to no one outside the fishing community for review; developing a mechanism for incorporating the information into the MarineMap at sufficiently aggregated levels; and devising a display format for stakeholder group meetings that maintained the information content without making individual fishermen's information visible. MarineMap is a web-based decision support tool developed to enable stakeholders to visualize geospatial data layers, draw prospective MPA boundaries with attributed information, assemble prospective MPA boundaries into arrays, share MPA boundaries and arrays with other users and generate graphs and statistics to evaluate MPAs using science-based guidelines.

Quality assurance and quality control (QAQC) involved a four step process:

1. Editing of shapes by Ecotrust staff based on notes from interviews and/or when required to standardize the data (e.g., clipping a shape to the shoreline);
2. Opportunities for each participant to review his/her individual maps and information[5];

[5] Individual maps were mailed only to commercial and CPFV respondents.

3. Review by the fishing community though multiple group meetings to verify aggregated results; and
4. Coordination with the fishing community to ensure confidentiality of any publicly displayed information.

A.3. SUMMARY STATISTICS

During the summer and fall months of 2009 (June through October), Ecotrust personnel and field staff interviewed 219 commercial fishermen, and 22 commercial passenger fishing vessel (CPFV) operators. Additionally, 574 NCSR recreational fishermen participated via in-person, phone, and online interviews. The following sub-sections highlight survey findings.

A.3.1. Commercial

Overall, survey respondents represented the majority of the total NCSR ex-vessel fishing revenue (2000–07) for target fisheries. We reached and often exceeded our sampling goal of representing at least 50% of the ex-vessel revenue in each target fishery[6]. Salmon – troll was the only fishery for which we did not reach our overall sampling goal (sampled at 34%), due to the hundreds of fishermen who are involved in this fishery. For example, by interviewing 17 rockfish – fixed gear fishermen in Fort Bragg, we achieved 60% representation of that fishery in that port, yet by interviewing 63 salmon – troll fishermen in Fort Bragg, we achieved only 32% representation in that port.

It is notable that even though hundreds of fishermen participate in the Dungeness crab fishery, we were able to represent approximately 59% of the ex-vessel revenue for this fishery within the study region, exceeding our sampling goal. This is an important achievement as Dungeness crab is the most economically important fishery in the NCSR.

Table A.1 captures the percentage of ex-vessel revenue (2000–07) that our sample represents for each fishery in each port. The overall representation for the study region was highest for anchovy/sardine – lampara net (100%), followed by herring – gillnet (80%), and smelt – brail (dip net) (71%). By port, the highest representation was in Trinidad (81%), followed by Shelter Cove (76%), Eureka (68%), Albion (65%), Crescent City (49%), and Fort Bragg (47%). It was easier to achieve a greater percentage of the ex-vessel landings revenue in the smaller ports of Trinidad and Shelter Cove and in the smaller fisheries like anchovy/sardine – lampara net and herring – gillnet because the overall pool of potential respondents was smaller.

As mentioned above, Ecotrust collected data on the nearshore, deeper nearshore, and lingcod fisheries for all fixed gear types; however, at the recommendation of the rockfish fishing community we combined the data into one fishery entitled rockfish – fixed gear.

[6] Target fisheries do not include sablefish or hagfish.

Table A.1: Percentage of ex-vessel revenue the sample represents (2000–07)[7]

Fishery	Crescent City	Trinidad	Eureka	Shelter Cove	Fort Bragg	Albion	NCSR
Anchovy/Sardine (Lampara Net)	—	—	100%	—	—	—	100%
Dungeness Crab (Trap)	49%	81%	70%	98%	69%	74%	59%
Hagfish (Trap)	6%	—	37%	—	—	—	35%
Herring (Gillnet)	54%	—	85%	—	—	—	80%
Rockfish (Fixed Gear)[8]	61%	95%	77%	93%	60%	6%	62%
Sablefish (Longline)	50%	—	45%	—	77%	—	57%
Sablefish (Trap)	46%	—	—	—	40%	—	41%
Salmon (Troll)	40%	66%	44%	67%	32%	75%	34%
Seaweed (Hand Harvest)[9]	—	—	—	—	—	—	69%
Shrimp (Trap)	50%	—	—	—	—	—	50%
Smelt (Brail – Dip Net)	60%	—	73%	—	—	—	71%
Surfperch (Hook and Line)	43%	—	56%	—	—	—	53%
Urchin (Dive)	—	—	—	—	55%	69%	59%
Total	**49%**	**81%**	**68%**	**76%**	**47%**	**65%**	—

Table A.2 summarizes the number of fishermen interviewed who landed at least 10% of their catch for each fishery (2000–07) in each port. For example, we interviewed 57 fishermen who landed Dungeness crab in Eureka, which comprises 70% of the ex-vessel revenue (2000–07) for that fishery in Eureka, compared to one fisherman who landed Dungeness Crab in Albion, which comprises 74% of the ex-vessel revenue for that same period. In both cases, we exceeded our sampling criteria, but because there are considerably more landings and fishermen in Eureka, it took a greater number of interviews to reach our target of 50%.

As mentioned previously, in total, we interviewed 219 commercial fishermen. The following fisheries received the highest number of responses: Dungeness crab – trap (145), salmon – troll (99), rockfish – fixed gear (61), and urchin – dive (35). These numbers and those in Table A.2 are not mutually exclusive, in that a fisherman often participates in more than one fishery. In general, the breakdown of fishermen interviewed per fishery matches the overall distribution of fishermen and value of the fisheries in the NCSR (Appendix A.1).

For analytical purposes, we chose to group fishermen by their port(s) of landing (Table A.2) rather than their homeport(s) (Table A.3). We did this because CDFG landings information is limited to where fishermen land their catch, thus making it difficult to estimate the total number of fishermen per homeport; however, we can estimate the total number of fishermen and ex-vessel revenue for each fishery based on landing port and these values are what we use to derive our sample. Additionally, when fishermen provided their fishing grounds during the interview, their responses were not restricted to landing or homeport, but rather, we asked them to base their responses on the entire extent of their fishing grounds and cumulative fishing experience. During the interview process, we asked each fisherman to identify his/her homeport, which is summarized in Table A.3. For example, when comparing the number of fishermen per homeport versus landing port, out of the

[7] Blank areas in the table indicate that the fishery does not occur in a particular port.
[8] Rockfish – fixed gear includes nearshore, deeper nearshore and lingcod using hook and line, longline, and trap fishing gear.
[9] CDFG landings data of seaweed harvesting is provided only by pounds landed on a region wide scale. It cannot be determined what percentage of gross revenue (by port and region wide) seaweed harvester respondents represent. The percent we report is the percentage of poundage represented by our seaweed harvester respondents.

219 commercial fishermen whose information we used, 23 considered Trinidad to be their homeport, but according to the landings receipts, only 20 of the 219 fishermen landed in Trinidad in the 2000–07 period.

It should also be noted that not all of the information collected from the 219 respondents was used. There are cases where a fisherman provided information for a particular fishery but his/her landings were not detected when compared to the CDFG landing receipts (2000–07). Since ex-vessel value from in-study region CDFG landing receipts forms the basis for weighting an individual fisherman's fishing grounds in the aggregated fishing grounds analysis, including those without landings information would effectively decrease the value of the aggregated grounds. This difference in total number of fishermen interviewed and the number actually used is reflected in Table A.2, Columns NCSR and NCSR used. For example, we interviewed 35 fishermen who provided information for the urchin – dive fishery but we only considered 32 of them in our analysis due to lack of CDFG landings information for three fishermen who provided harvest areas for this fishery.

Table A.2: Summary of the number of fishermen interviewed by landing port

Fishery	Crescent City	Trinidad	Eureka	Shelter Cove	Fort Bragg	Albion	NCSR[10]	NCSR used
Anchovy/Sardine (Lampara Net)	–	–	1	–	–	–	1	1
Dungeness Crab (Trap)	59	15	57	2	30	1	145	141
Hagfish (Trap)	1	–	5	–	–	–	9	6
Herring (Gillnet)	1	–	1	–	–	–	3	2
Rockfish (Fixed Gear)[11]	15	7	20	7	17	4	61	55
Sablefish (Longline)	2	–	12	–	5	–	24	18
Sablefish (Trap)	6	–	–	–	10	–	18	16
Salmon (Troll)	18	5	35	7	63	2	99	86
Seaweed (Hand Harvest)[12]	1	–	–	–	4	–	5	4
Shrimp (Trap)	6	–	1	–	2	–	9	9
Smelt (Brail – Dip Net)	7	–	11	–	1	–	14	14
Surfperch (Hook and Line)	7	–	9	–	1	–	17	14
Urchin (Dive)	–	–	–	–	23	17	35	32
Total	**77**	**20**	**91**	**14**	**102**	**26**		

[10] Since many fishermen make landings in multiple ports, the total number of individuals we interviewed in the NCSR is less than the sum of fishermen assigned to each port group.

[11] Rockfish – fixed gear includes nearshore, deeper nearshore, and lingcod using hook and line, longline, and trap fishing gear.

[12] Seaweed harvesters do not have a homeport, yet for reporting purposes, four seaweed survey respondents who operate across the Fort Bragg, Albion and Elk areas were indicated to operate out of Fort Bragg. One seaweed harvester who operates out of both Crescent City and Trinidad was indicated as belonging to the Crescent City homeport.

Table A.3 shows a breakdown of the number of fishermen interviewed by homeport and the general demographics of these respondents. By port group, Fort Bragg had the highest number of commercial fishery respondents, with 59 respondents citing it as their homeport. The average commercial fishery respondent was a 54 year old male with 30 years of fishing experience. The majority of respondents reported that 100% of their income came from fishing.

Table A.3: Survey representation by homeport grouping

		Age		Years experience		Income from fishing (%)	
Homeport	**# sampled**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Albion	11	52	50	27	25	77%	85%
Crescent City	50	56	53	32	30	90%	100%
Eureka	52	55	55	30	31	89%	100%
Fort Bragg	59	53	53	30	29	82%	100%
Shelter Cove	7	60	59	33	40	72%	75%
Trinidad	23	50	49	24	24	77%	80%
None Given	3	69	63	37	42	90%	100%
Outside Study Region	18	54	57	32	32	90%	100%
Study Region	**219**	**54**	**55**	**30**	**30**	**85%**	**100%**

Table A.4 displays survey responses on demographics, fishery related income, and vessel information broken out by commercial fishery. Dungeness crab – trap was the largest group of commercial fishery respondents (145) followed by salmon – troll (99) and rockfish – fixed gear (61). Rockfish – fixed gear is a combination of deeper nearshore rockfish, nearshore rockfish, and lingcod fisheries for hook and line, longline, and trap gear types, which are combined here (and throughout this report) at the request of respondents.

Many respondents across all gear types and fisheries reported that their entire personal income comes from fishing, with averages across fisheries between 78–100%. Aside from seaweed harvesters, urchin divers reported the highest average income from a specific fishery—an average of 88% of their fishing related income comes from urchin diving. Individuals who participated in fisheries with fewer than three respondents were given the option to have their statistics withheld from the report. Data shown here for commercial fisheries with fewer than three respondents are shown with explicit approval from the respondents.

Table A.4: Survey results by fishery and gear type

		Age		Gender		Years experience fishing		Income from fishing (%)		Income from specific fishery (%)		Vessel length (ft)		Haul capacity (lbs)	
Fishery	# sampled	Mean	Median	Male	Female	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Anchovy/Sardine (Lampara Net)	1	59	59	100%	0%	42	42	100%	100%	50%	50%	32	32	16,000	16,000
Dungeness Crab (Trap)	145	54	55	98%	2%	32	32	96%	100%	64%	65%	44	44	23,477	16,500
Hagfish (Trap)	9	53	54	100%	0%	27	26	100%	100%	25%	10%	41	41	17,250	16,500
Herring (Gillnet)	3	51	51	100%	0%	35	39	100%	100%	20%	25%	34	32	21,333	16,000
Rockfish (Fixed Gear)	61	53	52	100%	0%	29	28	86%	100%	39%	28%	32	30	14,173	6,000
Sablefish (Longline)	24	53	52	100%	0%	31	29	94%	100%	26%	20%	44	44	26,500	22,500
Sablefish (Trap)	18	50	51	94%	6%	30	29	96%	100%	34%	20%	45	47	23,533	20,000
Salmon (Troll)	99	53	54	97%	3%	31	32	87%	100%	34%	30%	39	39	16,490	10,000
Seaweed (Hand Harvest)[13]	5	56	56	60%	40%	20	18	100%	100%	100%	100%	–	–	–	–
Shrimp (Trap)	9	53	54	100%	0%	32	35	99%	100%	18%	10%	40	36	18,467	14,000
Smelt (Brail – Dip Net)	14	54	57	79%	21%	29	25	78%	100%	59%	65%	29	23	6,840	3,000
Surfperch (Hook & Line)	17	56	58	82%	18%	29	25	78%	95%	32%	20%	21	22	1,740	1,000
Urchin (Dive)	35	52	52	97%	3%	26	25	80%	95%	88%	100%	29	29	6,410	5,000

[13] Seaweed harvesters do not operate vessels. They hand harvest by walking or kayaking in rocky intertidal areas.

A.3.2. Commercial Passenger Fishing Vessel (CPFV)

A total of 22 CPFV operators were interviewed by field staff. By port group, Trinidad comprised the highest percentage of respondents (32%). Additional information on CPFV respondents is below in Table A.5.

Table A.5: CPFV respondents by port

Port	# of respondents	% of total respondents
Crescent City	2	9%
Trinidad	7	32%
Eureka	5	23%
Shelter Cove	3	14%
Fort Bragg	5	23%
NCSR	**22**	**100%**

The average CPFV respondent in the NCSR has operated one vessel for teen years, fishes an average of 97 days per year and takes an average of six passengers per trip (of whom 21%, on average, are from out of state). Average responses are shown in Table A.6.

Table A.6: Mean summary statistics for CPFV respondents

	Crescent City	Trinidad	Eureka	Shelter Cove	Fort Bragg	NCSR
Age (years)	62	44	57	51	44	50
Vessel Length (ft)	44	34	27	24	46	34
Number of vessels operated	1	1	1	1	1	1
Number of years operating	12	10	9	6	13	10
Number of vessels owned	1	1	1	1	1	1
Number of years owned	12	9	8	7	8	9
Days fishing per year	113	87	73	103	134	97
Number of passengers	5	6	4	5	10	6
Out of state passengers (%)	28%	21%	27%	8%	21%	21%
Number of crew	1	1	0	1	1	1

Table A.7 shows mean and median CPFV related income for the entire study region and for each port, as well as information on operating costs as a percentage of gross revenue. On average, CPFV operators receive 54% of their income from CPFV operations and 32% of their gross revenue goes towards operating costs, of which 9% goes towards crew and 16% goes towards fuel.

Table A.7: CPFV related income and operating costs

Port		% income	Operating costs	Labor costs	Fuel costs
Crescent City	Mean	50%	58%	4%	9%
	Median	50%	58%	4%	9%
Trinidad	Mean	49%	16%	13%	15%
	Median	50%	15%	8%	13%
Eureka	Mean	54%	43%	0%	21%
	Median	50%	38%	0%	20%
Shelter Cove	Mean	38%	30%	12%	12%
	Median	25%	30%	10%	10%
Fort Bragg	Mean	79%	33%	11%	18%
	Median	93%	25%	10%	10%
NCSR	Mean	54%	32%	9%	16%
	Median	50%	25%	4%	11%

CPFV respondents were asked to identify their primary trip type for each fishery in which they participate. All of the respondents operate rockfish trips and 95% operate salmon trips. Across all fisheries, the majority of respondents in the NCSR operate six pack trips (i.e., vessels that hold only up to six passengers). Within the NCSR, California halibut trips are concentrated in the Eureka area (specifically Humboldt Bay), while combo trips (where more than one species is fished – usually rockfish and Dungeness crab) occur in most ports. More results are shown in Table A.8.

Table A.8: CPFV trip type

		Crescent City		Trinidad		Eureka		Shelter Cove		Fort Bragg		NCSR	
Fishery		#	%	#	%	#	%	#	%	#	%	#	%
California Halibut	Charter	0	0%	1	17%	1	17%	0	0%	0	0%	2	33%
	Six Pack	0	0%	1	17%	3	50%	0	0%	0	0%	4	67%
	No Response	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	Total	**0**	**0%**	**2**	**33%**	**4**	**67%**	**0**	**0%**	**0**	**0%**	**6**	**100%**
Dungeness Crab	Charter	1	7%	1	7%	2	13%	0	0%	3	20%	7	46%
	Six Pack	1	7%	4	27%	1	7%	0	0%	1	7%	7	47%
	No Response	0	0%	0	0%	0	0%	0	0%	1	7%	1	7%
	Total	**2**	**13%**	**5**	**33%**	**3**	**20%**	**0**	**0%**	**5**	**33%**	**15**	**100%**
Pacific Halibut	Charter	0	0%	2	22%	1	11%	0	0%	0	0%	3	33%
	Six Pack	0	0%	1	11%	3	33%	2	22%	0	0%	6	67%
	No Response	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	Total	**0**	**0%**	**3**	**33%**	**4**	**44%**	**2**	**22%**	**0**	**0%**	**9**	**100%**
Rockfish	Charter	1	5%	2	10%	2	9%	1	5%	3	14%	9	41%
	Six Pack	1	5%	5	23%	3	14%	2	9%	1	5%	12	55%
	No Response	0	0%	0	0%	0	0%	0	0%	1	5%	1	5%
	Total	**2**	**9%**	**7**	**32%**	**5**	**23%**	**3**	**14%**	**5**	**23%**	**22**	**100%**
Salmon	Charter	1	5%	2	10%	2	10%	1	5%	3	14%	9	43%
	Six Pack	1	5%	4	19%	3	14%	2	10%	1	5%	11	52%
	No Response	0	0%	0	0%	0	0%	0	0%	1	5%	1	5%
	Total	**2**	**10%**	**6**	**29%**	**5**	**24%**	**3**	**14%**	**5**	**24%**	**21**	**100%**

CPFV respondents were also asked to identify their primary trip length for each fishery in which they participate. Halibut trips (both Pacific and California) have the highest average of full day trips while 73% of Dungeness crab fishing occurs on half day trips. More results are shown in Table A.9.

Table A.9: CPFV trip length

		Crescent City		Trinidad		Eureka		Shelter Cove		Fort Bragg		NCSR	
Fishery		#	%	#	%	#	%	#	%	#	%	#	%
California Halibut	1/2 day	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	3/4 day	0	0%	0	0%	2	33%	0	0%	2	33%	2	33%
	1 day	0	0%	2	33%	2	33%	0	0%	2	33%	4	67%
	No Response	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	Total	**0**	**0%**	**2**	**33%**	**4**	**67%**	**0**	**0%**	**4**	**67%**	**6**	**100%**
Dungeness Crab	1/2 day	1	7%	4	27%	2	13%	0	0%	2	13%	11	73%
	3/4 day	1	7%	0	0%	0	0%	0	0%	0	0%	1	7%
	1 day	0	0%	1	7%	1	7%	0	0%	1	7%	3	20%
	No Response	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	Total	**2**	**13%**	**5**	**33%**	**3**	**20%**	**0**	**0%**	**3**	**20%**	**15**	**100%**
Pacific Halibut	1/2 day	0	0%	1	11%	0	0%	0	0%	0	0%	1	11%
	3/4 day	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	1 day	0	0%	2	22%	4	44%	2	22%	4	44%	8	89%
	No Response	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	Total	**0**	**0%**	**3**	**33%**	**4**	**44%**	**2**	**22%**	**4**	**44%**	**9**	**100%**
Rockfish	1/2 day	1	5%	5	23%	0	0%	1	5%	0	0%	12	55%
	3/4 day	0	0%	0	0%	1	5%	1	5%	1	5%	2	9%
	1 day	1	5%	2	9%	4	18%	1	5%	4	18%	8	36%
	No Response	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	Total	**2**	**9%**	**7**	**32%**	**5**	**23%**	**3**	**14%**	**5**	**23%**	**22**	**100%**
Salmon	1/2 day	1	5%	4	19%	0	0%	0	0%	0	0%	10	48%
	3/4 day	0	0%	0	0%	1	5%	0	0%	1	5%	1	5%
	1 day	1	5%	2	10%	4	19%	3	14%	4	19%	10	48%
	No Response	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	Total	**2**	**10%**	**6**	**29%**	**5**	**24%**	**3**	**14%**	**5**	**24%**	**21**	**100%**

A.3.3. Recreational

As mentioned previously, the recreational fishing community was stratified into three key user groups:

- Private boat anglers;
- Kayak anglers; and
- Divers/Spear anglers.

Recreational fishermen had the opportunity to register and complete the survey for multiple user groups (e.g., private vessel and dive), and for this reason, the 574 respondents generated 687 survey responses. Table A.10 shows the number of user groups completed by each fisherman. The majority of respondents (82%) completed a survey for a single user group, while only 1% of respondents completed a survey for all three user groups.

Table A.10: Number of user groups completed per respondent

# of user group surveys completed	# of respondents	% of respondents
1	472	82%
2	97	17%
3	7	1%

Table A.11 shows the number of surveys completed for each user group. Private vessel angler respondents were the largest group; out of 574 respondents, 527 (91.5%) completed a private vessel survey.

Table A.11: Response statistics

User group	Total surveys
Dive	140
Kayak	20
Private Vessel	527
Total responses generated	**687**

A.3.3.1. Dive

Based on responses provided by survey participants, the average diver/spear angler is a 45 year old male who dives to fish 31 days per year. In addition, the majority of respondents stated that they are free divers who use a boat as their primary access method. Additional information is provided in Table A.12.

Table A.12: Dive survey response statistics

Age	Mean	45
	Median	47
Dives per trip	Mean	2
	Median	2
Average annual number of days diving (to fish)	Mean	31
	Median	15
Primary mode of diving	Free	70%
	Scuba	23%
	No Response	5%
	Other	1%
Access method[14]	Boat	68
	Shore	64
	Kayak	15
	No Response	11

A.3.3.2. Kayak

The average kayak respondent is a 46 year old male who has 11 years of kayak angling experience and fishes from a kayak 29 days per year. Additional information is shown in Table A.13.

Table A.13: Kayak survey response statistics

Age	Mean	46
	Median	49
Years experience	Mean	11
	Median	5
Average annual number of days kayaking (to fish)	Mean	29
	Median	25

Survey participants were asked to list up to four launch ports or access points based on frequency of usage. Overall, the most popular launch/access site amongst kayak anglers was Fort Bragg, with six respondents citing it among their top four launch sites (see Table A.14); however, Trinidad was the most popular primary site, with four respondents indicating it as their primary access site.

It should be noted that individuals were not required to list four launch/access sites but rather were given the option of listing up to four. The numbers of individuals not reporting a second, third, or fourth launch/access site are listed under "No Response".

It should also be noted that the launch/access sites provided by respondents were grouped together. For example, respondents who indicated Noyo Harbor or Fort Bragg were all grouped together as Fort Bragg. Within these areas, kayak launch sites could be boat ramps or an adjacent shore.

[14] Since respondents were allowed to choose multiple access methods, the total will add to more than 122 (the number of divers interviewed).

Table A.14: Top kayak launch/access sites

Launch/access	1	2	3	4	Total
Crescent City	2	0	1	0	3
Trinidad	4	1	0	0	5
Eureka	0	0	1	1	2
Cape Mendocino	1	0	0	0	1
Shelter Cove	0	1	0	0	1
Fort Bragg	1	3	2	0	6
Caspar	2	2	0	1	5
Van Damme State Park	1	0	1	1	3
Albion	1	1	0	1	3
Elk	0	0	2	1	3
Outside Study Region	1	1	0	0	2
Unknown	1	1	0	0	2
No Response	1	5	8	10	24

A.3.3.3. Private Vessel

The average respondent for the private vessel user group is a 52 year old male who has operated a vessel for 22 years and owned a vessel for 19 years. On average, private vessel users have 30 years of fishing experience and fish 39 days per year as private vessel anglers. Additional information on private vessel respondents is found in Table A.15.

Table A.15: Private vessel survey response statistics

Age	Mean	52
	Median	53
Years operating a vessel	Mean	22
	Median	20
Years of vessel ownership	Mean	19
	Median	15
Vessel length (ft)	Mean	21
	Median	21
Years experience	Mean	30
	Median	30
Average annual number of days fishing	Mean	39
	Median	30

Private vessel respondents were also asked to list their top four launch sites (Table A.16). Trinidad, the most popular primary site for kayakers, was also the most popular primary site for private vessel respondents.

Table A.16: Top private vessel launch sites

Launch/access	1	2	3	4	Total
Crescent City	67	9	6	0	82
Klamath River	0	3	1	0	4
Trinidad	81	20	3	2	106
Eureka	62	28	9	3	102
Fields Landing	8	4	3	0	15
Shelter Cove	9	10	10	4	33
Fort Bragg	28	15	1	3	47
Mendocino	0	0	0	1	1
Albion	31	8	2	0	41
Elk	0	1	0	0	1
Outside Study Region	14	22	11	4	51
Unknown	6	4	1	1	12
No Response	208	391	467	496	1562

APPENDIX A.1: Summary of North Coast Study Region commercial fisheries considered

Fishery	% of total NCSR fisheries revenues (2000–07 average)	% of total CA statewide fisheries revenues (2000–07 average)	% of CA statewide fisheries revenues landed in NCSR (2000–07 average)
Anchovy/Sardine (Lampara Net)[15]	0%	n/a	n/a
Dungeness Crab (Trap)	78%	52%	35%
Herring (Gillnet)	0%	3%	0%
Rockfish (Fixed Gear)[16]	4%	5%	2%
Salmon (Troll)	13%	20%	6%
Seaweed (Hand Harvest)[17]	1%	0%	n/a
Shrimp (Trap)	1%	0%	0%
Smelt (Brail – Dip Net)	1%	0%	0%
Surfperch (Hook and Line)	0%	0%	0%
Urchin (Dive)	5%	19%	2%

Example of how to interpret: From 2000–07, on average, the NCSR Dungeness crab trap fishery accounted for 78% of NCSR fishery related revenues and 52% of California (total) fishery related revenues. During that same time period, on average, 35% of all Dungeness crab trap fishery related revenues for the entire state of California came from the NCSR.

NCSR and statewide fishing revenue percentages were calculated using only the revenue from the fisheries listed above. Examples of fisheries that occur in the NCSR but that are not being considered include sablefish, hagfish, tuna, and trawl fisheries.

Percentages are provided only for the fisheries we created maps for in the NCSR MLPA process. Summary statistics included in this report for sablefish and hagfish are for informational purposes only.

[15] We were unable to obtain official landings/revenue data for the anchovy/sardine fishery. Based on anecdotal data from the survey respondent, the anchovy/sardine fishery value is less than 1% of the NCSR total fisheries revenue; however, it is a critical bait fishery to the west coast albacore tuna fishery. Moreover, the survey respondent is the only live bait supplier between Santa Cruz, CA and Westport, WA. Based on data collected by the American Albacore Fishing Association, a dollar of anchovy/sardine bait sold, on average, equates to $52 of ex-vessel albacore tuna revenue. Albacore tuna represents approximately 8% of NCSR fishing revenue when added to the fishing revenue of the fisheries listed above.

[16] Rockfish – fixed gear includes nearshore, deeper nearshore and lingcod using hook and line, longline and trap fishing gear.

[17] The percentages provided for the value of seaweed harvesting only represent the summed gross revenue (from 2000–07) of our five seaweed survey respondents. There are no existing data on the economic value of seaweed harvesting across the NCSR and California.

APPENDIX A.2: List of NCSR commercial fishing maps available in MarineMap

Fishery	Crescent City	Trinidad	Eureka	Shelter Cove	Fort Bragg	Albion	NCSR
Anchovy/Sardine (Lampara Net)	—	—	Yes	—	—	—	—
Dungeness Crab (Trap)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Herring (Gillnet)	Yes	—	Yes	—	—	—	—
Rockfish (Fixed Gear)[18]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Salmon (Troll)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seaweed (Hand Harvest)	Yes	—	—	—	Yes	—	—
Shrimp (Trap)	Yes	—	—	—	—	—	Yes
Smelt (Brail – Dip Net)	Yes	—	Yes	—	—	—	Yes
Surfperch (Hook and Line)	Yes	—	Yes	—	—	—	Yes
Urchin (Dive)	—	—	—	—	Yes	Yes	Yes

Above is a list of maps available for each commercial fishery. A "Yes" value indicates that a relative economic importance map is available in MarineMap for that particular fishery in a port or for the region. A null or "–" value indicates that either the data were not collected or that what data were collected do not adequately represent a given set of fishing grounds based on the sampling criteria described in Section 3.1.

[18] Rockfish – fixed gear includes nearshore, deeper nearshore, and lingcod using hook and line, longline, and trap fishing gear.

APPENDIX A.3: Number of CPFV respondents by port and species throughout the NCSR and datasets available in MarineMap

Fishery	Crescent City	Trinidad	Eureka	Shelter Cove	Fort Bragg	NCSR
California Halibut	0	2	4	0	0	6
Dungeness Crab	2	5	3	0	5	15
Pacific Halibut	0	3	4	2	0	9
Rockfish	2	7	5	3	5	22
Salmon	2	6	5	3	5	21

The table above indicates the number of CPFV operators who provided information for each species in each port. Maps are available for all indicated CPFV fisheries in each port. Through explicit consent from interview participants, all maps that have fewer than three respondents are also available. CPFV maps are provided only at the port level (not the region wide level) so that larger ports with a higher number of respondents do not bias the relative importance maps.

APPENDIX A.4: Number of recreational dive respondents by port and species throughout the NCSR and datasets available in MarineMap

Fishery	Crescent City	Trinidad	Eureka	Shelter Cove	Fort Bragg/ Albion[19]	NCSR
Abalone	5	7	11	20	96	130
Dungeness Crab	—	—	—	—	4	4
Rockfish/Bottomfish	3	3	5	16	39	68

Above is a list of the recreational dive fishing ground maps available for each port group. Port level maps are available for each species for which a sufficient number of respondents provided information; in all cases, the number of respondents is never less than three for confidentiality purposes. Recreational dive maps are provided only at the port level (not the region wide level) so that larger ports with a higher number of respondents do not bias the relative importance maps.

A null or "—" value indicates that either the data were not collected or that what data were collected do not adequately represent a given set of fishing grounds.

[19] For recreational fisheries, Fort Bragg and Albion were merged into one port group because of their proximity to each other and the large number of launch points in between them.

APPENDIX A.5: Number of recreational kayak angler respondents by county and species throughout the NCSR and datasets available in MarineMap

Fishery	Crescent City	Trinidad	Eureka	Shelter Cove	Fort Bragg/ Albion[20]	NCSR
California Halibut	—	—	—	—	2	2
Dungeness Crab	—	1	—	1	2	4
Pacific Halibut	—	1	—	—	—	1
Rockfish/Bottomfish	1	3	2	1	10	17
Salmon	1	2	1	—	3	7

Above is a list of the recreational kayak fishing ground maps available for each port group. Port level maps are provided for each species for which a sufficient number of respondents provided information; in all cases, the number of respondents is never less than three for confidentiality purposes. Recreational kayak maps are provided only at the port level (not the region wide level) so that larger ports with a higher number of respondents do not bias the relative importance maps.

A null or "—" value indicates that either data were not collected or that what data were collected do not adequately represent a given set of fishing grounds.

[20] For recreational fisheries, Fort Bragg and Albion were merged into one port group because of their proximity to each other and the large number of launch points in between them.

APPENDIX A.6: Number of recreational private vessel angler respondents by county and species throughout the NCSR and datasets available in MarineMap

Fishery	Crescent City	Trinidad	Eureka	Shelter Cove	Fort Bragg/ Albion[21]	NCSR
California Halibut	10	7	37	18	8	80
Dungeness Crab	71	32	62	26	47	238
Pacific Halibut	15	14	49	18	9	105
Rockfish/Bottomfish	169	63	111	31	105	479
Salmon	123	62	131	31	72	419

Above is a list of the recreational private vessel fishing ground maps available for each port group. Port level maps are provided for each species for which a sufficient number of respondents provided information; in all cases, the number of respondents is never less than three for confidentiality purposes. Recreational private vessel maps are provided only at the port level (not the region wide level) so that larger ports with a higher number of respondents do not bias the relative importance maps.

A null or "–" value indicates that either data were not collected or that what data were collected do not adequately represent a given set of fishing grounds.

[21] For recreational fisheries, Fort Bragg and Albion were merged into one port group because of their proximity to each other and the large number of launch points in between them.

APPENDIX A.7: List of CDFG official names and common names to be used in Ecotrust NCSR reports

Sector	Ecotrust common name in NCSR reports	CDFG species name(s)
Commercial	Anchovy/Sardine	Anchovy and Sardine
	Dungeness Crab	Dungeness Crab
	Hagfish	Pacific Hagfish
	Herring	Pacific Herring
	Rockfish	Nearshore Species: Black-and-yellow Rockfish, China Rockfish, Gopher Rockfish, Grass Rockfish (grass bass), Kelp Rockfish (sugar bass), Cabezon, Kelp Greenling, Monkeyface Prickleback (monkeyface eel) and California Scorpionfish (sculpin) Deeper Nearshore Species: Black Rockfish (black bass or black snapper), Blue Rockfish (blue bass or blue perch), Brown Rockfish (bolina), Copper Rockfish (chucklehead), Olive Rockfish (johnny bass), Quillback Rockfish and Treefish Rockfish (lipstick bass or convictfish) Lingcod
	Sablefish	Sablefish (blackcod)
	Salmon	Chinook Salmon (king)
	Seaweed	Sea Palm, Wakame, Kombu, Sweet Kombu, Nori, Ocean Ribbon, Dulse, Bull Whip Kelp, Cystosera, Mazzaella, Fucus, Grapestone and Codium Fragile
	Shrimp	Coonstripe Shrimp
	Smelt	Surf Smelt and Night Smelt
	Surfperch	Redtail Surfperch
	Urchin	Red Sea Urchin
CPFV	California Halibut	California Halibut
	Dungeness Crab	Dungeness Crab
	Pacific Halibut	Pacific Halibut
	Rockfish/Bottomfish	Yelloweye Rockfish, Canary Rockfish, Vermillion Rockfish (red snapper or red rockcod), Black Rockfish (black bass or black snapper), Black-and-yellow Rockfish, Blue Rockfish (blue bass or blue perch), Brown Rockfish (bolina), Cabezon, Calico Rockfish, California Scorpionfish (sculpin), California Sheephead, China Rockfish, Copper Rockfish (chucklehead), Gopher Rockfish, Grass Rockfish (grass bass), Kelp Greenling, Kelp Rockfish (sugar bass), Monkeyface Prickleback (monkeyface eel), Olive Rockfish (johnny bass), Quillback Rockfish, Rock Greenling and Treefish Rockfish (lipstick bass or convictfish)
	Salmon	Chinook Salmon (king)
Recreational	California Halibut	California Halibut
	Dungeness Crab	Dungeness Crab
	Pacific Halibut	Pacific Halibut
	Red Abalone (dive only)	Red Abalone
	Rockfish/Bottomfish	Same as CPFV
	Salmon	Chinook Salmon (king)

APPENDIX A.8: Shellfish summary statistics

During the months of January and February of 2010, Ecotrust personnel and field staff interviewed five shellfish companies in the North Coast Study Region (i.e., Eureka, McKinleyville and Samoa areas). The following section highlights the survey findings.

Shellfish operations participating in the survey include Taylor Mariculture LLC (including Kuiper Mariculture Inc.), Humboldt Bay Oyster Company, Coast Seafood, North Bay Shellfish and Aqua-Rodeo Oyster Farms.

Operations

Companies were asked to report the average number of active and inactive acres for their operations from 2000–08 (see Table H1). The five companies in total reported an average of 4,441.4 (active and inactive) under operation per year[22].

Companies also were asked to provide information about operating costs, which, on average, ranged from ~$2,000–$2,200,000 per year. On average, from 2000–08, these five companies had combined total operating costs of ~$3,221,000 per year. Although not broken out, it should be noted that total operating costs include required costs associated with water quality monitoring, disease prevention, and disease pathology, which account for approximately 2.7% of total annual operating costs.

Labor costs, on average, accounted for approximately 31% of the total annual operating costs. All five companies reported the average number of individuals employed from 2000–08, which varied substantially by company. Four of the five respondents had fewer than ten employees, while the fifth company employed a substantially higher number. On average, from 2000–08, these five companies had a combined total of 52 full-time employees and 11.5 part-time employees (see Table A.8.1).

Table A.8.1. Average number of employees per year (2000–08)

	Number of employees	
	Full-time	*Part-time*
Total (5 companies)	52	11.5

The species that companies reported growing and harvesting include Pacific oysters, Kumamoto oysters and Manila clams. All five companies grow and harvest Pacific oysters and Kumamoto oysters, although different companies focus on different product types (e.g., seed, shellstock). Only two companies reported Manila clam production. Average annual harvests/sales for these species from 2000–08 are reported in Table A.8.2.

[22] The total acreage does not include a small area sub-leased in the Crescent City Harbor as this area has been inactive over most of the study period. No further socioeconomic information was collected or included for this area.

Table A.8.2. Summary harvests by product type

Species	Product type	Companies reporting	Total
Pacific oyster	*Seed*	2	104,000,000
	Shellstock	3	190,000
	Shucked (gallons)	1	45,000-100,000
Kumamoto oyster	*Seed*	1	500,000
	Shellstock	4	5,649,000
Manila clam	*Seed*	2	320,000,000-390,000,000

Companies were asked to estimate the average price received by shellfish product type from 2000–08. The prices obtained for each shellfish type are provided in Table A.8.3.

Table A.8.3. Total products sold (average 2000–08)

Species	Unit	Units sold	Price range	Gross value estimate
Pacific oyster, seed	*$/1,000*	100,000	$3.80	$380,000
Pacific oyster, seed[23]	*$/1,000*	4,000	$40.00	$160,000
Pacific oyster shellstock	*$/each*	190,000	$0.40-0.42	$80,000
Pacific oyster, shucked	*$/gallon*	72,500	$39.00	$2,827,500
Kumamoto oyster, seed	*$/1,000*	500	$10.00	$5,000
Kumamoto oyster, shellstock	*$/each*	5,649,000	$0.45-1.80	$2,582,000
Manila clam, seed	*$/1,000*	355,000	$3.45-8.00	$1,930,000
			TOTAL	$7,964,500

[23] There are two sizes of Pacific oyster seed sold.

APPENDIX A.9: North Central Coast IPA potential impacts on Point Arena

It has been noted that fishing grounds for Point Arena overlap study region boundaries. In an effort to highlight the potential additive impacts of North Coast Study Region proposals, we include potential impacts to Point Arena resulting from the North Central Coast Study Region process. More specifically, the information contained in this appendix comes from the evaluation entitled *Summary of potential impacts of the Integrated Preferred Alternative (IPA) and the North Central Coast Regional Stakeholder Group (NCCRSG) MPA proposals on commercial and recreational fisheries in the North Central Coast Study Region*.

Maps depicting the commercial fishing grounds for Point Arena can be found on MarineMap.

Table A.9.1: Percentage of total commercial fishing grounds affected by IPA

Fisheries	Area	Value
Ca. Halibut	—	—
Coastal Pelagics	—	—
Market Squid	—	—
Deeper Nearshore Rockfish[24]	30.0%	26.4%
Nearshore Rockfish	16.1%	24.3%
Urchin	8.4%	10.4%
Dungeness Crab	8.0%	13.6%
Salmon	1.8%	12.4%

Table A.9.2: Estimated Annual Net Economic Impact (NEI) for Point Arena Commercial Fisheries under IPA

			Estimated Annual Net Economic Impact of MPA Proposals	
Fishery	**Baseline GER**	**Baseline NER (Profit)**	**$ reduction in profit**	**% reduction in profit**
Ca. Halibut	—	—	—	—
Coastal Pelagics	—	—	—	—
Market Squid	—	—	—	—
D. N. Rockfish	$1,424	$699	$291	41.7%
N. Rockfish	$64,259	$31,544	$12,073	38.3%
Urchin	$608,226	$366,963	$51,923	14.1%
Dungeness Crab	$46,951	$24,201	$4,771	19.7%
Salmon	$77,890	$41,610	$7,564	18.2%
All Fisheries	**$798,750**	**$465,016**	**$76,623**	**16.5%**

[24] It should be noted that the deeper nearshore rockfish and nearshore rockfish fisheries are combined in the North Coast Study Region as Rockfish (Fixed Gear).

Appendix B: Evaluation Methods

Draft Methods Used to Evaluate MPA Proposals in the MLPA North Coast Study Region

Commercial and Recreational Fishery Impacts

While fishery impacts are not the focus of the MLPA, they may be considered in designing alternative MPA proposals. The evaluation of maximum potential recreational and commercial fishery impacts utilizes region-specific data collected by MLPA contractor Ecotrust on areas of importance.

To evaluate the potential recreational and commercial fishery impacts, MLPA Initiative staff and contractors do the following:

- Conduct local knowledge interviews with recreational and commercial fishermen, using an interactive, custom computer interface, to collect geo-referenced information about the extent and relative importance of study region commercial and recreational fisheries.
- Organize impact analyses by port, fishery and/or user group.
- Evaluate and summarize the maximum potential impacts on commercial, commercial passenger fishing vessel (CPFV) and recreational fishing grounds both in terms of total area and value affected, with results summarized for both study region fishing grounds and total fishing grounds[25].
- Conduct an impact analysis for commercial and CPFV fisheries.
- Consider or identify "outliers" (i.e., fisheries and individual fishermen likely to experience disproportional impacts).
- Assess the effect of existing fishery management area closures and other constraints on fishing grounds.

Background

In order to conduct an analysis of the relative effects of MPA proposals on fisheries that are conducted in the North Coast Study Region (SCSR), we use data layers characterizing the spatial extent and relative stated importance of fishing grounds for key commercial, commercial passenger fishing vessel (CPFV) and recreational fisheries. This information was collected during interviews in the summer and fall months of 2009 (June through October), using a stratified, purposeful sample of 219 commercial fishermen and stratified, solicited samples of 22 CPFV operators and 574 recreational fishermen. Individual responses regarding the relative importance of ocean areas for each fishery were standardized using a 100-point scale and normalized to the reported fishing grounds.

Using the normalized data described above, we assess the potential effects of any MPA proposal using a variety of analyses (see Table B.1).

[25] Impact analyses represent a "worst case scenario" in which fishermen cannot fish in a different location.

Table B.1: Reported results

	Commercial	CPFV	Recreational
Potential impacts on fishing grounds (area and stated value)	✓	✓	✓
Potential net economic impacts	✓	✓	
Potential gross economic impacts	✓		
Disproportionate impacts on fisheries	✓	✓	

We report results for the commercial and CPFV fisheries at both the study region and port group levels. We report results for the recreational fisheries by user group (i.e., private vessel, kayak, and dive) and by port group (see Table B.2).

Table B.2: Summary of results by sector

	Commercial	CPFV	Recreational
# of fisheries	10 species	5 species	5 species
Level of analysis	Port-fishery combinations	Port-fishery combinations	Results reported by user group (private vessel, kayak, dive) and by port

Port groups for the commercial fisheries are defined as Crescent City, Trinidad, Eureka, Shelter Cove, Fort Bragg, and Albion[26]. Port groups for the CPFV fisheries are defined as Crescent City, Trinidad, Eureka, Shelter Cove, and Fort Bragg. Port groups for the recreational fisheries are defined as Crescent City, Trinidad, Eureka, Shelter Cove, and Fort Bragg/Albion.

It should be noted that, with respect to the recreational fishery analysis, the use of a stratified, solicited sample limits the use of traditional statistical measures (e.g., confidence intervals), meaning they may not deliver their advertised precision. Nevertheless, this approach does allow us to make broad generalizations about preferences of the overall recreational fishing population and the three user groups within the study area (i.e., private vessel, kayak, and dive), adding increased thematic resolution to the MLPA decision-making process.

Impact on Commercial Fishing Grounds: Methods

Marine protected area (MPA) proposals typically vary according to their spatial extent and the commercial fisheries they affect. More specifically, MPAs often vary by the number and types of fisheries permitted within their boundaries. Furthermore, study area fisheries themselves vary in spatial extent and frequently overlap. Many of them are conducted in fishing grounds that extend beyond the state waters of the NCSR, and because of this we report potential impacts both in terms of total fishing grounds and those that fall within the study area (i.e., zero to three nautical miles from shore). Since any one MPA may have different effects on different fisheries, and different fisheries may be affected differently by all MPAs, it is necessary to consider single MPAs and single fishery uses independently. Note that because current fishery closures affect all proposals equally, they have no differential effect.

A key assumption of this analysis is that each of the MPA proposals completely eliminates fishing

[26] In contrast to other commercial fisheries, seaweed harvesters do not have landings data associated with a port. Therefore, based on spatial harvest patterns, we define three harvest complexes within the study region: the Crescent City and Trinidad complex, the Fort Bragg and Albion complex and the Elk complex.

opportunities in areas closed to specific fisheries and that fishermen are unable to adjust or mitigate in any way. In other words, the analysis assumes that all commercial fishing in an area affected by an MPA would be lost completely, when in reality it is more likely that effort would shift to areas outside the MPA. The effect of such an assumption is most likely an overestimation of the impacts, or a "worst case scenario".

Potential Impacts on Area and Stated Value

We conduct an overlay of each MPA with each fishery considered in this study. MPAs are grouped according to level of protection, using the same levels of protection as elsewhere in the SAT evaluations. In other words, for each MPA and protection level within each proposal, we assess the commercial fisheries that would be affected.

We compile results in a series of spreadsheets, summarizing the effects of the various MPA proposals on commercial fisheries, both in terms of the area affected and the relative value lost. We use the same analytical methods as those developed and used in previous iterations of the MLPA process (Scholz et al. 2006; 2008; 2010), creating a weighted surface that represents the stated importance of different areas for each fishery. More specifically, we multiply these stated importance values by the proportion of in-study region landings (by landing port and by fishery). The percentage of area and value affected is calculated based on grounds identified within only the NCSR, not within the whole state of California. These estimates then feed into the economic impact assessment (described in Appendix B.1).

The percentage change in area and value for each of the commercial fisheries (both for the study region and for each port group) is determined by the intersection of each MPA proposal and the fishing grounds specific to that fishery. Each MPA within a proposal is classified by whether it would affect the fishery or not. If a fishery is affected by a MPA, the area and value are summarized and then divided by the total area and value for the entire fishing grounds as derived from interviews with fishermen, and the total study area. The total percentage of area and value affected for the total fishing grounds and the grounds inside the study area are then summarized by proposal for all MPAs affecting each fishery.

The percentage change in area and value for each of the commercial fisheries (both for the study region and for each port group) are determined by the intersection of each MPA proposal and the fishing grounds specific to that fishery. Each MPA within a proposal is classified by whether it would affect the fishery or not. If a fishery is affected by an MPA, the area and value are summarized and then divided by the total area and value for the entire fishing grounds as derived from interviews with fishermen, and the total study area. The total percentage of area and value affected for the total fishing grounds and the grounds inside the study area are then summarized for all MPAs affecting each fishery per proposal.

For the commercial fisheries, we also evaluate the additional impacts that potentially occur when considering the existing fishery management area closures and/or fishery exclusion zones. The fishing grounds, as defined by the fishermen through the interview process, represent the total area and value regardless of these existing or potential fishery management closures and/or fishery exclusion zones. In order to evaluate the effect of such closures, the fishing grounds that fall inside those areas are removed, and the value associated with the removed area redistributed to the remaining fishing grounds outside the closed areas. In other words, values are redistributed across only what could be considered the available fishing grounds in proportion to their relative value as

derived from the interviews. Using the same method described above, we determine the percentage change in value by the intersection of each MPA proposal with the total fishing grounds now constrained to areas not inside the closed areas (i.e., the "available fishing grounds").

Potential Primary Impacts on Ex-Vessel Value

In order to estimate the impacts to the commercial fishery sector associated with each of the MPA proposals, we estimate a "worst-case scenario" or maximum potential economic impact of each MPA proposal[27]. To accomplish this, we use methods similar to those in Scholz et al. (2008), which are based on methods utilized in the Central Coast Study Region process by Wilen and Abbott (2006). The modified analysis in Scholz et al. (2008), however, differs in a very important respect, that is, by having original survey data on fishermen's operating costs collected through the interview process.

As part of the fishermen interview process in the NCSR, field staff asked several questions related to operating costs, including:

- What percentage of your gross revenue goes towards crew share or labor?
- What percentage of your gross revenue goes towards fuel?
- What percentage of your gross revenue goes towards other costs?

With the opportunity to interview NCSR fishermen directly, information specific to the study region is gained. There is also the opportunity for data resolution regarding the types of costs fishermen face. Using data from the interviews, two cost categories are created: fixed and variable. Fixed costs include costs that are independent of the number of trips a fishing vessel makes or the duration of these trips. For example, vessel repairs and maintenance, insurance, and mooring and dockage fees are typically considered fixed costs. On the other hand, variable costs include costs that are dependent on the number of trips a vessel makes or the duration of these trips. Variable costs typically include fuel, maintenance, crew share, and gear repair/replacement. For the purpose of this study, crew wages and fuel costs are assumed to be variable costs. All other costs are assumed to be fixed costs.

The net economic impact (NEI) of each MPA proposal is calculated for each port group, and for the NCSR as a whole. The NEI results are presented as revenue reductions in both dollar terms ($ 2007) and percentage terms. The starting point for calculating NEI is baseline gross economic revenue (Baseline GER), which is gross revenue for the fishery in question absent any MPA proposal. Baseline GER is based on an eight-year average (2000–07) converted to 2007 dollars. The baseline net economic revenue (Baseline NER) is found by subtracting the fishery-specific fixed and variable costs from the Baseline GER. A similar net economic revenue calculation is performed for each MPA proposal and is then compared with Baseline NER to yield NEI.

Potential Disproportionate Impacts on Fisheries

We also use the results of our analysis to evaluate whether there are commercial port-fishery combinations that may be disproportionately affected by each of the MPA proposals. To assess these impacts, we use a box plot analysis to identify outliers within each fishery (calculated using estimated impacts on the stated value of total fishing grounds). In a box plot analysis, outliers are

[27] For a detailed description of the methods used, please see Scholz et al. (2008), which can be found at http://www.ecotrust.org/mlpa/Ecotrust_FinalReport_NCCSR_080701.pdf.

defined as extreme values that deviate significantly from the rest of the sample. Box plot analysis results can also inform convergence among MPA proposals within a fishery and/or relative potential impacts between fisheries.

Potential Disproportionate Impacts on Individuals

For the individual impact analysis, we evaluate if there are individual fishermen who would be disproportionally affected by each MPA proposal (i.e., 100% or a large portion of their grounds are inside a proposed MPA that would restrict fishing). To assess these impacts, we first overlay each fisherman's fishing grounds weighted by ex-vessel revenue (for each fishery in which the individual participates) with those areas being considered for closure under each proposal. We then summarize the potential impact on each fisherman's ex-vessel revenue across all fisheries in which the individual participates. The "worst-case scenario" still applies in that fishermen are assumed not to adjust to different fishing grounds.

We then use a box plot analysis to identify individual outliers. In a box plot analysis, outliers are defined as extreme values that deviate significantly from the rest of the sample. This analysis not only identifies individual outliers, but is able also to describe the relative impacts of proposals on individual fishermen.

Impact on CPFV and Recreational Fishing Grounds: Methods and Approach

Potential Impacts on Area and Stated Value

The methods and approach used to assess the impact of the various MPA proposals on CPFV and recreational fisheries are identical to those used to assess the impact on commercial fisheries (please refer to Appendix B.1 for a description of those methods) with one exception. While the stated importance values of the commercial fishing grounds are weighted by each fisherman's relative contribution to the total ex-vessel value of in-study region landings (both by landing port and by fishery), no weighting occurs in the calculation of CPFV and recreational fishing grounds.[28] Rather, the analysis is done using only stated importance values from the interviews.

The recreational data should be used with the following caveats:

- The data are not representative of the entire population of recreational fishermen due to the less than desirable (less than statistically significant) sample size (CPFV not included).
- The data should only be considered at the port/landing level, not at the entire study region level.
- The data represent interviewees' areas of value, not areas of effort.
- The data represent areas that are important to interviewees over their entire recreational fishing experience, not necessarily the areas that are important to them currently.

That said, based on conversations with leaders of the recreational fishing community, we believe that the data and the manner in which they were acquired allow us to produce results that speak broadly to the preferences of the overall recreational fishing population and also each user group and port/landing.

[28] No weighting occurs for the obvious reason that ex-vessel values do not exist for CPFV or recreational fishery landings.

As in the commercial fisheries impact analysis, the percentage change in area and value for each of the recreational fisheries (only for the port/landing) is determined by the intersection of each MPA proposal and the fishing grounds specific to that fishery.

Potential Primary Impacts on Value

Similar to the analysis of the commercial fisheries, we calculate the potential net economic impact for the CPFV fisheries as the average reduction in net economic revenue across all species considered. Please see the section on commercial fisheries for a description of the methods we use.

Potential Disproportionate Impacts on Fisheries

For the CPFV fisheries, we also evaluate whether there are port-fishery combinations that may be disproportionately affected by each MPA proposal. Please see the section on commercial fisheries for a description of the methods we use.

References for Appendix B

Scholz, A. J., C. Steinback, S. Kruse, J. Bonkoski, S. Hetrick, N. Lyman, S. Lloyd and L. Weiss. 2010. Commercial and recreational fishing grounds and their relative importance off the South Coast of California. Report submitted to California Marine Life Protection Act Initiative (forthcoming).

Scholz, A. J., C. Steinback, S. Kruse, M. Mertens and M. Weber. 2008. Commercial and recreational fishing grounds and their relative importance off the North Central Coast of California. Report submitted to California Marine Life Protection Act Initiative (June 30).

Scholz, A. J., C. Steinback and M. Mertens. 2006. Commercial fishing grounds and their relative importance off the Central Coast of California. Report submitted to California Marine Life Protection Act Initiative (May 4).

Wilen, J. and J. Abbott. 2006. Estimates of the Maximum Potential Economic Impacts of Marine Protected Area Networks in the Central California Coast. Final report submitted to the California Marine Life Protection Act Initiative in partial fulfillment of Contract #2006-0014M (July 17).

Appendix B.1: Socioeconomic Impact Assessment Methods

In order to estimate the socioeconomic impact to the commercial fishery sector associated with each of the MPA proposals, staff from Ecotrust, contractor to the MLPA Initiative, will estimate the maximum potential impact for each of the MPA proposals using methods developed in the Central Coast process (Wilen and Abbott 2006) and refined in the North Central Coast and South Coast processes (Scholz et al. 2008; 2010). The analysis assumes that each of the MPA proposals completely eliminates fishing opportunities in areas closed to specific fisheries and that fishermen are unable to adjust or mitigate in any way (Wilen and Abbott 2006). The results can be considered by each group (i.e., stakeholders, SAT, BRTF, Initiative staff, FGC) as trade-offs for protections relative to socioeconomic impacts and can be weighed in siting and evaluating the various MPA proposals. The remainder of this paper describes the steps needed to complete the maximum potential impact analysis in the North Coast Study Region.

1: Generate Baseline Estimates of Gross Economic Revenue

The first step involves calculating a baseline estimate (1) from which to derive estimates of the socioeconomic impact associated with changes in commercial fisheries that might be induced by each MPA alternative and (2) against which to compare those estimates. The baseline estimate is generated using gross fishing revenues from California Department of Fish and Game landing receipts reported for ports in the North Coast Study Region. An eight-year average (2000–07) derived from the regional landing receipts and converted into 2007 dollars is used.

More specifically, to generate baseline estimates of gross economic revenue (GER), for any fishery, *f*, $BGER_f$ is the average ex-vessel value of the fishery in 2007 dollars, where

$BGER_f = \sum_{p \in P} BGER(f, p)$, the sum of the baseline estimates of GER for this fishery over all ports.

Staff also define the fisheries specific to each port, or in other words, create a baseline estimate of gross economic revenue for each port. For a specific port, *p*, being considered in the North Coast Study Region, the baseline estimate ($BGER_p$) can be calculated as the sum of the baseline estimates of GER for this port over all fisheries:

$$BGER_p = \sum_{f \in F} BGER(f, p).$$

The baseline gross economic revenue ($BGER_{TOT}$) for <u>all</u> commercial fisheries ($f \in F$) being considered in the North Coast Study Region is therefore:

$$BGER_{TOT} = \sum_{f \in F} BGER_f = \sum_{f \in F} \sum_{p \in P} BGER(f, p) \text{ or equivalently,}$$
$$BGER_{TOT} = \sum_{p \in P} BGER_p = \sum_{p \in P} \sum_{f \in F} BGER(f, p).$$

2: Generate Gross Economic Revenue for the Various MPA Alternatives

The next step involves using results from the Ecotrust mapping exercise, specifically stated importance indices for the fishing grounds, to estimate the socioeconomic impact associated with changes in the commercial fisheries that might be induced by each MPA alternative. For a description of the methods used to create stated importance indices, please see Scholz et al. (2006).

For any fishery, *f*, port, *p*, and any MPA alternative, *a*:

$$GER(f, p, a) = BGER(f, p) - GEI(f, p, a)$$

where $GEI(f, p, a)$ is the estimated gross economic impact on fishery, *f*, at any port, *p*, under any alternative, *a*.

Therefore,

$$GER_f(a) = \sum_{p \in P} GER(f, p, a) \text{ and } GER_p(a) = \sum_{f \in F} GER(f, p, a)$$

as well as

$$GEI_f(a) = \sum_{p \in P} GEI(f, p, a) \text{ and } GEI_p(a) = \sum_{f \in F} GEI(f, p, a).$$

Gross economic revenue under any alternative, *a*, ($GER_{TOT}(a)$), for <u>all</u> commercial fisheries ($f \in F$) being considered in the North Coast Study Region can be calculated as:

$$GER_{TOT}(a) = \sum_{f \in F} GER_f(a) = \sum_{p \in P} GER_p(a) = \sum_{f \in F} \sum_{p \in P} GER(f, p, a) = \sum_{p \in P} \sum_{f \in F} GER(f, p, a).$$

From this it can be said that, for any MPA alternative, *a*,

$$GEI_{TOT}(a) = BGER_{TOT} - GER_{TOT}(a)$$

where GEI_{TOT_a} is defined as the total gross economic impact on all commercial fisheries under any alternative, *a*. Therefore,

$$GEI_{TOT}(a) = \sum_{f \in F} GEI_f(a) = \sum_{p \in P} GEI_p(a) = \sum_{f \in F} \sum_{p \in P} GEI(f, p, a) = \sum_{p \in P} \sum_{f \in F} GEI(f, p, a).$$

3: Generate Baseline Estimates of Net Economic Revenue

In order to compute net economic benefits, staff (1) estimate the share of gross fishing revenues represented by costs and (2) scale the baseline estimate (i.e., gross fishing revenues) calculated in Step 1 using the estimated cost shares. In the Central Coast process, an estimate of 65% was used across all fisheries (Wilen and Abbott 2006). For the North Coast process, several cost related

questions are asked during interviews with fishermen in an effort to improve on this estimate as well as allow for the ability to account for cost variability among different fisheries. After all interviews are completed, the cost data are broken out by fishery or fisheries. For example, cost data for a fisherman who fished both salmon and crab would be aggregated with only other interviewees participating in both those fisheries. A mean cost estimate will then be calculated for each category.

Costs will be broken into two categories: fixed costs and variable costs. Fixed costs include costs that are independent of the number of trips a vessel makes or the duration of these trips. For example, vessel repairs and maintenance, insurance and mooring and dockage fees are typically considered fixed costs. On the other hand, variable costs include costs that are dependent on the number of trips a vessel makes or the duration of these trips. Variable costs typically include fuel, maintenance, crew share and gear repair/replacement. For the purpose of this study, crew wages and fuel costs will be considered variable costs. All other costs will be considered fixed costs.

For any fishery, *f*, net economic revenue is calculated as:

$$BNER_f = BGER_f - C_{X_f} - C_{V_f}$$

where C_{X_f} is the fixed cost associated with any fishery, *f*, and is set as a fixed dollar value, and C_{V_f} is the variable cost associated with any fishery, *f*, and is a fixed percentage of $BGER_f$.

Baseline net economic revenue ($BNER$) for <u>all</u> commercial fisheries ($f \in F$) being considered in the North Coast Study Region can be calculated as:

$$BNER_{TOT} = \sum_{f \in F} BNER_f \ .$$

4: Generate Estimates of Net Economic Revenue for the Various MPA Alternatives

In order to compute net economic revenue for each of the various MPA alternatives, staff (1) estimate the share of gross fishing revenues represented by costs under each MPA alternative and (2) scale the estimated gross fishing revenues for that alternative accordingly. Costs are calculated using the methods described in Step 3.

For any fishery, *f*, and any MPA proposal, *a*,

$$NER_f(a) = GER_f(a) - C_{X_f} - C_{V_f} \ .$$

For any MPA alternative, *a*, net economic revenue for <u>all</u> commercial fisheries ($NER_{TOT}(a)$) can be calculated as:

$$NER_{TOT}(a) = \sum_{f \in F} NER_f(a) \ .$$

5: Generate Estimate of the Potential Primary Net Economic Impact for the Various MPA Alternatives

Using the results from the previous steps, the potential primary net economic impact (NEI) of a particular MPA alternative, *a,* on a particular fishery, *f,* can then be calculated as:

$$NEI_f(a) = BNER_f - NER_f(a).$$

The potential primary NEI of any MPA alternative, *a,* on <u>all</u> commercial fisheries ($f \in F$) can then be calculated as:

$$NEI_{TOT}(a) = BNER_{TOT} - NER_{TOT}(a).$$

6: Generate Estimate of the Potential Primary Gross Economic Impact for the Various MPA Alternatives

Using the results from steps 1–5, the potential primary gross economic impact (GEI) of a particular MPA alternative, *a,* on a particular fishery, *f,* can then be calculated as:

$$GEI_f(a) = BGER_f - GER_f(a).$$

The potential primary GEI of any MPA alternative, *a,* on <u>all</u> commercial fisheries ($f \in F$) can then be calculated as:

$$GEI_{TOT}(a) = BGER_{TOT} - GER_{TOT}(a).$$

Example of Estimate Costs

For fishery *f*, assume the following proportion of gross economic revenue goes to the following costs:

- 20% = fixed costs
- 20% = crew wages
- 10% = fuel costs → 30% = variable costs

Assume that baseline gross economic revenue equals $10,000. Under the baseline, fixed costs equal $2,000 and variable costs equal $3,000, resulting in total costs of $5,000. Assume that under MPA alternative *a,* gross economic revenue now equals $5,000. Under this alternative, fixed costs will still equal $2,000; however, variable costs will be recalculated as:

$5,000 * 0.3 = $1,500.

This results in total costs of $3,500 under MPA alternative *a.*

References for Appendix B.1

- Scholz, A. J., C. Steinback, S. Kruse, J. Bonkoski, S. Hetrick, N. Lyman, S. Lloyd and L. Weiss. 2010. Commercial and recreational fishing grounds and their relative importance off the South Coast of California. Report submitted to the California Marine Life Protection Act Initiative (forthcoming).
- Scholz, A. J., C. Steinback, S. Kruse, M. Mertens and M. Weber. 2008. Commercial and recreational fishing grounds and their relative importance off the North Central Coast of California. Report submitted to the California Marine Life Protection Act Initiative (June 30).
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- Wilen, J. and J. Abbott. 2006. Estimates of the Maximum Potential Economic Impacts of Marine Protected Area Networks in the Central California Coast. Final report submitted to the California MLPA Initiative in partial fulfillment of Contract #2006-0014M (July 17).

Appendix C: Scope of Work

Resources Legacy Fund Foundation

MLPA INITIATIVE PROFESSIONAL SERVICES AGREEMENT

This Agreement is made between Ecotrust ("Contractor") and the Resources Legacy Fund Foundation ("RLFF"), this 1st day of May 2009. In consideration of Contractor's retention by RLFF to perform professional services for the MLPA Initiative, the parties agree as follows:

Duties, Term, Compensation

1. **Professional Services.** Contractor agrees to render professional services as an independent contractor to RLFF for the period commencing on the date of this Agreement and concluding on December 31, 2010, unless this Agreement is terminated in accordance with Section 5. This period is called the "Professional Services Period."

2. **Duties.** Contractor's services are described in the Scope of Work specified in Exhibit A. During the Professional Services Period, Contractor shall perform all these duties to the best of its ability, although Contractor is not required to devote all productive time and energies exclusively to the activities described in the Scope of Work.

3. **Assistance to the Task Force.** At all times, Contractor will report to the Executive Director under the MLPA Blue Ribbon Task Force ("Task Force") as described in the memorandum of understanding ("MOU") between the California Resources Agency ("Agency"), California Department of Fish and Game ("Department") and RLFF.

4. **Compensation & Expenses.** Contractor's sole compensation pursuant to this Agreement shall not exceed $375,000, inclusive of all fees, expenses, and direct project costs. Contractor will bill RLFF monthly using the Invoice Template attached as Exhibit B, and will be paid within thirty (30) days of receipt by RLFF, absent any unresolved billing issues. When filling in the invoice, Contractor will record services performed using the hourly rate box. Failure to use the attached template may result in delayed payments.

5. **Termination.** Either party may terminate this Agreement for any reason or no reason upon thirty (30) days' prior written notice, subject to payment by RLFF of invoices for any outstanding work as of the termination date.

Other Obligations between parties

6. **Independent Contractor Legal Relationship.** Contractor's relationship with RLFF is solely that of an independent contractor and not in any way that of an employee or agent of RLFF. Contractor is responsible for direct payment of any federal or state taxes on the compensation paid under this Agreement, as well as for any such payments with respect to Contractor's employees or subcontractors. Contractor is not authorized to bind RLFF or make any representations on its behalf in any matter.

7. **Acknowledgement of Ineligibility for Benefits.** Contractor shall not be entitled to, and shall not seek any benefits made available to RLFF employees, including, but not limited to: group health insurance (including dental, vision, and any other enhancements from time to time), disability insurances, group term life insurance, participation in any retirement plan for RLFF employees, a salary reduction plan for certain child care and medical care costs, continuing education reimbursements, or training programs. Contractor shall also be responsible for independently obtaining any professional liability insurance.

8. **Ownership of Property and Work Product.** All documents, records, apparatus, equipment and other physical or intellectual property furnished to Contractor by the State of California acting by and through its agencies departments, and employees or produced by the Contractor or others in connection with this Agreement, shall be and remain the sole property of the State. Contractor shall return any of such property in Contractor's possession, custody or control to the State immediately as and when so requested. Even if the State does not so request, Contractor shall return all such State property upon the termination of this Agreement.

General

9. **No Assignment.** The services to be rendered pursuant to this Agreement are personal in nature, and Contractor may not assign any rights and obligations under this Agreement without written consent of RLFF.

10. **Governing Law.** The services to be rendered shall be governed by the laws of the State of California. Each article shall be independent and separable from all other articles, and the invalidity of an article shall not affect the enforceability of any of the other articles.

11. **No Continuing Waiver.** RLFF's waiver or failure to enforce the terms of this Agreement or any similar agreement in one instance shall not constitute a waiver of its rights hereunder with respect to other violations of this or any other agreement.

12. **Entire Agreement.** This Agreement contains the entire agreement between RLFF and Contractor relating to the subject matter hereof, and supersedes all prior and contemporaneous negotiations, correspondence, understandings and agreements between the parties relating to the subject matter hereof. This Agreement may be modified or amended only by mutual written consent of the parties.

13. **Notice.** Any notice to RLFF required or permitted under this Agreement shall be given in writing at the RLFF office. Any such notice to Contractor shall be given in a like manner and, if mailed, shall be addressed to Contractor at the last known business address then shown in RLFF's files. Notices by personal service are deemed given on the date of delivery; notices by mail are deemed given on the second business day after mailing.

14. **Dispute Resolution.** All disputes arising out of or related to the subject matter of this Agreement will be resolved by arbitration conducted by a private arbitration service under the laws of the State of California. Venue for any arbitration shall be in Sacramento County, California. Any arbitration will be governed by the rules of evidence and procedure then in effect in the Sacramento County Superior Court. The arbitrator will have the power and discretion to permit discovery under the California Code of Civil Procedure and will award reasonable costs and expenses, including attorneys' fees, to the prevailing party. The award of the arbitrator may be entered as a judgment in any court of competent jurisdiction. Pending a final result from this arbitration, either party may apply to the appropriate court for injunctive relief against breaches of this Agreement.

15. **Confidentiality.** At RLFF's sole discretion, Contractor understands and agrees that this Agreement, and any invoice submitted to RLFF by Contractor, may be released to the public without further notice to Contractor. Contractor has no expectation of privacy with respect to this Agreement or any materials, documents, proof of payment, or correspondence associated herewith.

16. **Optional Carbon Offsetting.** Commencing in June 2008, RLFF is conducting a one-year optional carbon offsetting program. Contractor's travel associated with tasks described in Exhibit A is eligible for this offset program. Details and instructions regarding this program are included.

CONTRACTOR:	**ACCEPTED FOR THE RLFF:**
By: _____	By: _____
Print Name:_____	Print Name: Michael R. Eaton
Title: _____	Title: Executive Director, RLFF
Date: _____	Date: _____

EXHIBIT A

SCOPE OF WORK

ACCORDING TO THE SEPARATE MEMORANDUM OF UNDERSTANDING ("MOU") BETWEEN THE RESOURCES AGENCY ("AGENCY"), THE DEPARTMENT OF FISH AND GAME ("DEPARTMENT") AND RESOURCES LEGACY FUND FOUNDATION ("RLFF"), RLFF HAS AGREED TO FUND PROFESSIONAL SERVICES FOR THE MARINE LIFE PROTECTION ACT ("MLPA") INITIATIVE, A PUBLIC-PRIVATE PARTNERSHIP BETWEEN THE AGENCY, THE DEPARTMENT, AND RLFF.

Professional Services

Ecotrust shall compile knowledge from recreational and commercial fishermen to create a comprehensive picture of fishing patterns in Northern California in support of the MLPA Initiative North Coast Study Region ("NCSR"). Specific activities include:

Component 1—Outreach and Education

1. Meet with select fishing community members from the NCSR to solicit their suggestions and ideas for improving the project.
2. Identify key individuals from the different fishing fleets of interest (to be identified with Department staff).
3. Hold meetings with NCSR fishing groups and partners to discuss and clarify what data is being collected, why it is being collected, and how it will be used in the MLPA Initiative process.
4. Distribute documents that clearly describe the purpose of the project, including: the consent form each fisherman will be asked to sign before their data can be used; and protocol for handling and aggregating data.

Component 2—Fleet Stratification and Sampling Design: Commercial Fleet

1. Work with Department staff and regional experts to define the region's fisheries in terms of how they are managed.
    a. Differentiate in terms of practices and/or species (group)-gear configurations, focusing on the following fisheries: Dungeness crab (trap); salmon (troll); nearshore fishery (hook & line); deep nearshore fishery (hook & line); sablefish (longline); sablefish (trap); urchin (dive); shrimp (trap); and hagfish (trap).
    b. Use geographic groups or subgroups as a means of classifying participants and supporting representative sampling. Geographic groups include: Fort Bragg (includes Albion); Eureka (includes Trinidad, Fields Landing and Shelter Cove); and Crescent City.
    c. Identify proportion of in-region landings made by fishermen residing there, elsewhere in the state, and out of state through landing receipts provided by the Department.
2. Once the groupings have been defined, stratify the sample population of fishermen and later evaluate their fishing effort in the region by linking their grounds to landing receipts to ensure that the sample is representative in terms of percentage of fishermen participating in a fishery.

3. Based on the sample population within the fishery groupings and geographic groups or subgroups, use criteria that are consistent with representing:
    a. At least 50% of the total landings and/or ex-vessel revenue from 2000-2008, and compare that to most recent years of activity, 2006-2008.
    b. At least 5 fishermen, except in cases where the sample population is fewer than 5.
4. Conduct an estimated 200 interviews in the NCSR to satisfy the criteria outlined above. Estimate to be confirmed or revised once the region's fisheries are defined in terms of how they are managed.
5. Using the criteria listed above, clearly document and present results that describe how the sample was defined and what the final classifications represent in terms of:
    a. Total number of fishermen.
    b. Criteria for selection (i.e. how much did they need to land to be associated with a fishery group?).
    c. How many fishermen engage in multiple fisheries.
    d. Whether there are fishermen that are not captured because they are missing from the landing receipts or have inadequate contact information.
    e. What their association is with the ports in the region (landing vs. home).

Component 3—Fleet Stratification and Sampling Design: Recreational Fleet

To address differing values of fishing grounds between different recreational user groups, stratify the recreational fishing fleet according to user type and geographical region or access areas. An initial phase of the research will determine the recreational consumptive population and an appropriate classification scheme that will provide useful information for stakeholders and decision makers. At a minimum the following primary user types shall be assessed:

a. Kayak and human powered vessels.
b. Motor powered private vessels.
c. Commercial Passenger Fishing Vessels (including "6-packs").
d. Diving.

Due to the unknown size of the recreational fishing community within the NCSR, the first phase of this research shall be to accurately design a sampling scheme that is representative of the identified user classes and at the same time feasible to conduct under possible time and budgetary constraints.

Component 4—Data Collection: Commercial Fleet

After introductory meetings have been conducted with representatives of the fishing community, field staff shall begin contacting fishermen to set up interviews using one-on-one or small group formats. Field staff will use Open OceanMap to collect shapes representing participants' fishing grounds and other non-spatial attributes, including demographics, basic operations (gear types, crew size/composition, operating costs and revenues), and other descriptive characteristics. Every measure shall be taken to ensure and protect the confidentiality of the information provided by fishermen. This includes new functions in Open OceanMap, obtaining consent of individual participants, and collection and analysis protocols that mask all names and identifying characteristics of an individual's fishing grounds. Up to seven local and regional graduate students may be recruited to serve as field staff for the summer of 2009, and one on-site field staff coordinator will serve as a liaison between Ecotrust staff located in Portland and the field staff.

1. All interviews will follow a shared protocol for each fishery the interviewee participates in:
    a. Using electronic nautical charts of the area, fishermen are to be asked to identify all areas that are of critical economic importance over their cumulative fishing experience, and to rank these using a weighted percentage—an imaginary "bag of 100 pennies" that they distribute over the fishing grounds.
    b. All spatial information shall be collected on a fixed spatial scale, ideally to correspond with those of other maps and GIS layers used by stakeholders to delineate MPA alternatives.
    c. Non-spatial information pertaining to demographics and basic operations shall also be collected.
    d. Additional indicators shall be used to help further define how the participants interpret the question of ranking areas that are of economic importance to them:
        - How far they travel to an area to fish.
        - The type of vessel and gear used.
        - Percentage of household income derived from fishing.
2. To address concerns regarding the protection of a participant's confidentiality during and after the interview, Open OceanMap shall be customized so that once the last shape of the fishing grounds has been captured:
    a. The shapefile is immediately compressed using a password protected zip file.
    b. The original shapefile will be deleted and the secure zip file will be submitted to Ecotrust staff.
    c. Ecotrust staff will be the only ones that will have password access to the files.
    d. Users will not be allowed to add existing or previously created data to Open OceanMap.

Component 5—Data Collection: Recreational Fleet

Data collection for the recreational fleet shall be similar to that of the commercial fleet. The basic interview structure shall be identical in terms of questions asked, however, in many cases it is assumed that face-to-face interviews will not be possible, except for Commercial Passenger Fishing Vessel ("CPFV") captains. This assumption is based on the geographic distribution of users (dispersed over a large area) and the sheer number of interviews required to meet a reasonable and defensible sample size. Due to these factors, a combination of both in-person interviews and the use of a remote (web-based) data collection instrument shall be used. The web-based toll allows for interviewees to enter shapes into the system via the Internet while talking to the interviewer over the telephone. An OpenLayers front end shall be used that allows for entry of data through an on-line, interactive mapping interface. Data shall be stored within a feature server on Ecotrust server infrastructure and eventually exported as a shapefile to be included in the quality assurance/quality control and data analysis processes to facilitate the interviewing process and allow for a broader interview process than otherwise possible. The web-based data collection tool may be updated through a collaborative process with the University of California, Santa Barbara, established through a separate contractual arrangement with RLFF in support of the MLPA Initiative to develop the MarineMap decision support tool, to make the user interaction more user friendly and the quality assurance/quality control process more efficient.

Component 6—Quality Assurance/Quality Control

1. Modify secure web-based application to facilitate the verification of recreational data as well as commercial data to allow each participant to log-in and verify that their shapes and information are accurate, along with the final characterization of the fishing grounds to which he/she contributed.
    a. Those without access to the Internet will be sent hard copies of their information to verify and provide comment (must provide consent).
    b. Submit final data products to the MLPA Initiative to be used in the stakeholder MPA design and evaluation process.
2. Conduct follow-up meetings with participants and fishing community in each of the ports to verify results.

Component 7—Analysis and Evaluation of the Commercial Fishing Grounds

1. Process participants' raw shapefiles using automated analytical programs created in Phase 1 and Phase 2 of the MLPA Initiative to generate raster datasets of the fishing grounds.
2. Evaluate measure of weighting through the proportion of in-sample ex-vessel landings (both by landing port and by fishery).
3. Summarize data in aggregate form, displaying the relative value based on in-sample landings or a crude measure of spatial distribution of gross value for each fishery as they were defined in Component 2.
4. Evaluate the fishing grounds based on the stratification of the sampled population to determine if results influence or change the fishing footprint. Results shall be used to inform the MLPA Initiative process on the potential impacts to different geographical groups and sectors of the fleet.
5. Stratify the sample population within a fishery based on the following individual criteria or a combination of:
    a. Landings and/or ex-vessel revenues associated with the region (i.e., "highliners" vs. everybody else).
    b. Vessel size.
    c. Home port vs. landing port.
6. Use and document additional information collected in the interviews to further define the stated importance of the participants' fishing grounds by:
    a. Demographics.
    b. Basic operational costs.
    c. How far they travel to an area to fish.
    d. Vessel and gear type.
    e. Percentage of household income derived from fishing, and the proportion attributed to each fishery in which they participate.

Component 8—Analysis and Evaluation of the Recreational Fishing Grounds

Methods used to create the weighted surface of the recreational fishing grounds shall be identical to that used for the commercial fisheries, except that the analysis shall be done using only stated importance values from the interviews instead of by ex-vessel values for the fishery landings.

Component 9—Socioeconomic Impact Analysis: Commercial Fleet

Estimate the "worst-case scenario" or maximum potential economic impact to the commercial fishery sector by combining data generated in this study with other information readily available from other sources to allow stakeholders, the Science Advisory Team ("SAT"), Task Force, Fish and Game Commission, and MLPA Initiative staff to generate first order estimates of the economic impacts of proposed MPA alternatives.

1. Generate a baseline estimate using gross fishing revenues from the landing receipts in the region, 2000-2008.
2. Scale gross base case revenues by factors that represent the share of the costs in gross revenues.
3. Apply the methods used in the North-Central Coast Study Region and South Coast Study Region to compute and compare net economic values for the various MPA package alternatives using weighted stated importance indices from the fishing grounds.
4. Use primary net revenue losses in conjunction ("multiplier effect") with estimated secondary and tertiary effects like net benefits/costs to supporting businesses and consumption service industries to determine total community impacts.
5. Determine induced impacts based on the spending of net benefits in the community. The sum of the local expenditures that the fishermen (i.e. vessel owner and crew) generate in their community.

Component 10—Socioeconomic Impact Analysis: Recreational Fleet

Because detailed economic information pertaining to the recreational fleet is not readily available (e.g., landing receipts), the impact of the various MPA proposals on recreational fisheries shall not be weighted by any sort of value (in-study landings), but rather, using only stated importance values from the interviews.

Component 11—When the Data can be Used by the Stakeholders

Field work shall have begun by May 2009, with the goal of completing interviews by August/September 2009. After the data has been reviewed by the participants and the fishing community, final data products shall be delivered to MLPA Initiative staff for use by the regional stakeholder group, pending any unforeseen problems. The start and end dates will be adjusted in consultation with the MLPA Initiative staff to suit the NCSR timeline and the progress of the education and outreach efforts.

Component 12—Customize and Automate Outputs to the Needs of the Users

In consultation with MLPA Initiative staff, examine multiple ways in which the data generated from the study could be interpreted and used in the design and evaluation of potential MPA network alternatives. Data shall be integrated into existing tools (MarineMap) in order support stakeholder deliberations, and to generate customized and automated reports. For stakeholder deliberations, results shall be presented in summarized tables that will describe in detail the following measures for both individual MPAs and entire network packages:

1. Stated importance in terms of value, effort, and area.
2. Maximum potential economic impact.
3. Number of fisheries.

The aim of these outputs is to help inform stakeholders as they begin siting the placement of their MPAs, and also to inform the SAT, BRTF, and MLPA Initiative staff when evaluating the potential socioeconomic effects of the alternative MPA network proposals through the support of Department staff. Possible examples include:

1. Quantify specific impacts to individual fishermen, select fleets, and ports.
2. Used as a multi-cost layer in MARXAN (Possingham, 2002) or MARXAN with Zones, that can help inform the optimization of solutions where sites are selected to maximize the conservation of physical and biological features and minimize costs to consumptive and non-consumptive users (socio-economic).
3. Support and possibly validate the modeling work done by SAT parallel modeling group, specifically the work being done by Chris Costello, University of California, Santa Barbara, on behalf of the MLPA Initiative.

To protect the confidentiality of individual participants and the fishing community and sufficiently support the MLPA Initiative process, Contractor shall work with the Department and MLPA Initiative staff to integrate datasets into MarineMap and advise them on how and what can be used in the stakeholder process.

Component 13—Documentation\Dissemination of Methods and Results

All methods and final results pertaining to the project will be clearly documented and submitted to the MLPA Initiative. Additionally, multiple manuscripts will be prepared and submitted to peer-reviewed scientific journals.

Deliverables

Deliverables are broken into three main sections:

1. Spatial datasets and maps depicting areas of relative importance for both recreational and commercial fishers. Metadata describing the bounds of uncertainty and appropriateness of use shall accompany these geospatial products. The geospatial products delivered to the MLPA Initiative shall include aggregate maps of relative importance for each fishery and user group, aggregated from original source data so as to preserve confidentiality and the single interview scale. Aggregate maps with a spatial resolution of 250 - 100 meters will be the primary product deliverable, however, it may be determined that due to confidentiality issues, coarser resolution products may be preferable. Geospatial data will be provided only to the MLPA NCSR regional stakeholder group, SAT, and MLPA Initiative staff, and shall not be made available to the general public.

2. Reports:
    a. Report documenting statistical sampling methodology to estimate areas of relative importance for both recreational and commercial fishermen delivered to MLPA Initiative staff, NCRS regional stakeholder group, SAT, and BRTF.
    b. A report documenting MPA evaluation methods and results submitted to the MLPA Initiative SAT for review and implementation.
    c. Presentation of research results to MLPA Initiative regional stakeholder group, SAT, and the Task Force.
    d. Article submitted to peer-reviewed journal describing research methods and results.

3. An analysis of MPA siting alternatives for various recreational user types and commercial fisheries to help inform stakeholders and decision makers in the decision making process. It is anticipated that this type of information will be used in near real-time (via MarineMap) within the construct of the MLPA Initiative SAT and MLPA NCSR regional stakeholder group.

Due to the often sensitive nature of spatial fishing information, data (i.e., individual responses, high resolution aggregated data) will not be made available to the public. All individual responses shall be kept confidential.

Key Staff

- Charles Steinback, Director of Marine Planning
- Astrid Scholz, Vice President Knowledge Systems
- Jon Bonkoski, GIS Analyst

Point of Contact

Contractor will work at the direction of the MLPA Initiative Executive Director for matters pertaining to services and work products. For matters pertaining to compensation and reimbursement associated with this Agreement, Contractor will report to Program Analyst Robin Jenkins at (916) 442-4880 or rjenkins@resourceslawgroup.com.

AMENDMENT TO PROFESSIONAL SERVICES AGREEMENT

This Amendment modifies the Professional Services Agreement ("Agreement") entered into by the Resources Legacy Fund Foundation ("RLFF") and Ecotrust ("Contractor") on May 1, 2009 for professional services for the Marine Life Protection Act ("MLPA") Initiative, a public-private partnership between the Resources Agency, the Department of Fish and Game, and RLFF. The Agreement is amended as follows:

1. The cap for total compensation for services and reimbursable expenses shall be increased $38,850, from an amount not to exceed $375,000 as provided for in the original Agreement, to an amount not to exceed $413,850.

2. The additional compensation shall be used to expand on the current activities contained in Exhibit A, Component 2.4, of the original Agreement by increasing the number of commercial and recreational fishermen interviews to include seaweed (kelp) harvesters, and to single out smaller ports (Trinidad, Albion, and Shelter Cove). The additional compensation shall also provide for ancillary tasks associated with the increased number of interviews, including: in-house quality control; external review with the fishermen; and written work products that will be used in the North Coast MLPA Initiative process.

3. All other terms and conditions of the Agreement shall remain in effect.

CONTRACTOR: _____ DATE: 10/1/2009

Print Name: ASTRID SCHOLZ

ACCEPTED FOR RLFF: _____ DATE: 10/9/09

Michael R. Eaton, Executive Director

Appendix D: Summary Report

Summary of Potential Impacts of the North Coast Enhanced Compliance Alternative and Revised Round 3 North Coast Regional Stakeholder Group Marine Protected Area Proposals on Commercial and Recreational Fisheries in the North Coast Study Region

Draft, January 14, 2011
Astrid Scholz, ajscholz@ecotrust.org, Sarah Kruse, Charles Steinback, Jon Bonkoski,
Cheryl Chen and Leanne Weiss

D.1. INTRODUCTION

The purpose of this project is to analyze the relative effects of the North Coast Enhanced Compliance Alternative and Revised Round 3 North Coast Regional Stakeholder Group Marine Protected Area Proposals on commercial and recreational fisheries in the Marine Life Protection Act (MLPA) North Coast Study Region (NCSR). For detailed information on how data were collected and/or analyzed, please see *Survey Methods and Summary Statistics for Ecotrust's North Coast Study Region Fishery Uses and Values Project* (Appendix A). For information on the methods used to evaluate these data, please see Chapter 11 of the MLPA Master Plan Science Advisory Team (SAT) *Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA North Coast Study Region.* Additional proposal-specific information on potential fishery-specific impacts (to the NCSR and to total area and value) for each marine protected area (MPA) in these two proposals is available in the series of Excel files that will be posted online at: http://www.dfg.ca.gov/mlpa/mpaproposals_nc.asp.

To analyze the NCSR fisheries, we used data layers characterizing the spatial extent and relative importance of fishing grounds for ten commercial and five commercial passenger fishing vessel (CPFV) and six recreational fisheries. We collected this information during the summer and fall of 2009 (June through October) using a stratified, representative sample of 219 commercial fishermen and a stratified, solicited sample[29] of 22 CPFV and 574 recreational fishermen. Individual responses regarding the relative importance of ocean areas for each fishery were standardized using a 100-point scale and normalized to the reported fishing grounds. Based on these data, we evaluate the potential economic impacts on the commercial, CPFV, and recreational fishing grounds in terms of both total area and total stated value under the North Coast Enhanced Compliance Alternative (ECA) and Revised Round 3 North Coast Regional Stakeholder Group Marine Protected Area Proposal (RNCP).

The standard evaluation of potential impacts to commercial, CPFV, and recreational fisheries is provided in this report. We also conduct first-order impact and disproportionate impact analyses for the commercial and CPFV fisheries (see Table D.1).

[29] The use of a solicited sample may cause traditional statistical measures (e.g., confidence intervals) to be less precise. Nevertheless, it does allow us to make generalizations about preferences of the overall recreational fishing population and about the three user groups within the study area. We feel that this adds thematic resolution to the MLPA Initiative MPA planning process.

Table D.1. Analyses conducted

	Commercial	CPFV	Recreational
Potential impacts on fishing grounds (area & value)	✓	✓	✓
Potential net economic impacts	✓	✓	
Potential gross economic impacts	✓		
Disproportionate impacts on fisheries	✓	✓	

A key assumption of our analysis is that each of the MPA proposals completely eliminates fishing opportunities in areas closed to specific fisheries and that fishermen are unable to adjust or mitigate in any way. In other words, the analysis assumes that all fishing in an area affected by an MPA is lost completely, when in reality it is more likely that fishermen will shift their efforts to areas outside of the MPA. The effect of such an assumption is most likely an overestimation of the impacts, or a "worst case scenario".

The remaining sections of this document summarize the potential impacts. We report commercial and CPFV results by port group. We report recreational results by port group and by user group (i.e., dive, kayak, and private vessel). For a description of the ports included in each port group, please see our *Draft Survey Methods and Summary Statistics for Ecotrust's North Coast Study Region Fishery Uses and Values Project* (Appendix A).

In all tables presented, a 'dashed line' represents a fishery that does not occur or a fishery for which insufficient data were collected to merit presentation. For more detailed statistics, please see the tables in Appendix D.1.

D.2. RESULTS FOR COMMERCIAL FISHERIES

We summarize here our analysis of the potential impacts on the ten commercial fisheries:

- anchovy/sardine – lampara net
- Dungeness crab – trap
- herring – gillnet
- rockfish – fixed gear
- salmon – troll
- seaweed – hand harvest[30]
- shrimp – trap
- smelt – brail (dip net)
- surfperch – hook and line
- urchin – dive[31]

[30] Seaweed – hand harvest is excluded from the potential net economic impact analysis. For reporting purposes, four seaweed survey respondents who operate across the Fort Bragg, Albion, and Elk areas were indicated as operating out of Fort Bragg and one survey respondent who operates out of both Crescent City and Trinidad was indicated as operating out of Crescent City.

[31] For the purposes of the potential net economic impact analysis, urchin – dive is broken into two sub-groups due to differences in operating costs (i.e., urchin – dive captain (those who own or operate a boat) and urchin – walk-on dive). Based on communication with NCSR urchin divers, we determined that the most reasonable estimate of operating costs for walk-on divers was a fixed 30% of gross economic revenue. For dive captains, we estimated average operating costs using data from the interview process. It should be noted that the ex-vessel revenue reported for dive captains does not include the 30% of walk-on divers' gross landings that captains receive for boat operating costs.

The rockfish fishery includes the nearshore, deeper nearshore, and lingcod fisheries, which were combined at the recommendation of the NCSR fishing community into a single fishery. The results for commercial fisheries are separated into port groups (i.e., Crescent City, Trinidad, Eureka, Shelter Cove, Fort Bragg, and Albion).

D.2.1. Potential Impacts on Commercial Fishing Grounds (Area and Stated Value)

The RNCP and ECA propose the same commercial fishing regulations for each MPA so their potential impacts are identical. That said, the degree of potential impact varies across both ports and fisheries. As mentioned previously, this report only presents evaluation results. Evaluation methods are presented in a separate document (Appendix B).

For information on the potential impacts (in terms of both total area and total stated value) on commercial fishing grounds for the port-fishery combinations considered, please see Tables D.1.1–D.1.2 in Appendix D.1.

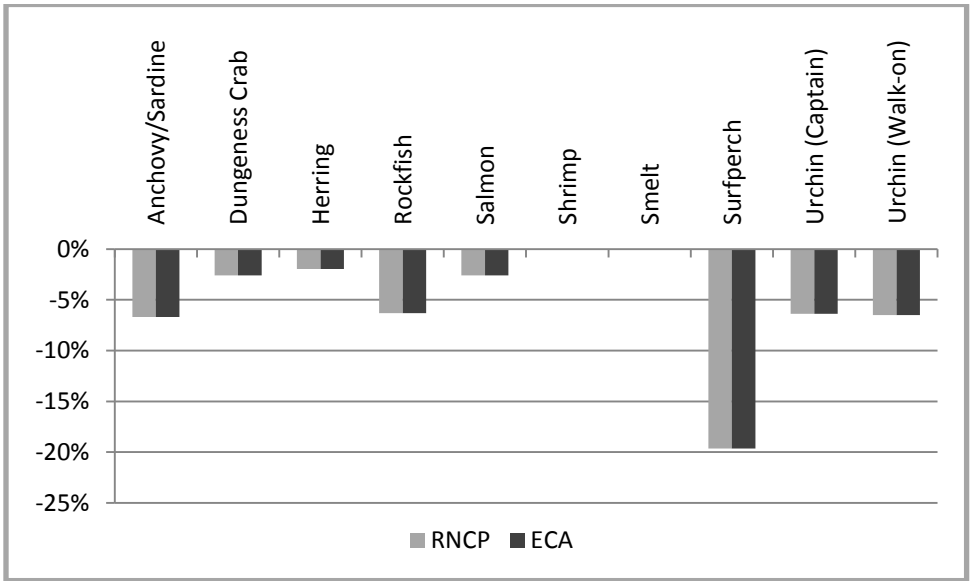
D.2.2. Potential Net Economic Impacts on Commercial Fisheries

Figure D.1 summarizes the potential net economic impact (NEI) on commercial fisheries under the RNCP and ECA proposals, calculated as a percentage reduction in annual net economic revenue (i.e., profit) (for associated values, see Table D.3). RNCP and ECA are estimated to have identical potential NEI across all fisheries in the study region—3.0%.

To analyze the potential net economic impacts across the study region, we focus on the top four commercial species (i.e., Dungeness crab, salmon, urchin, and rockfish), as they comprise approximately 98.1% of the total NCSR ex-vessel revenue. Several patterns emerge from our analysis:

- The Dungeness crab fishery sees the highest range of potential net economic impacts (in dollars). Estimated potential annual impacts on the Dungeness crab fishery are $177,737.
- The rockfish fishery generally sees the lowest range of potential impacts (in dollars), assuming the two urchin fisheries are combined. RNCP and ECA have estimated potential annual impacts on the rockfish fishery of $18,640.

Figure D.1: Estimated annual net economic impact on commercial fisheries (% reduction in profit)



The potential impacts from each proposal are broken out by port in Table D.2 and Figure D.2. Again, the potential impacts are identical for RNCP and ECA; however, the potential impacts vary by port. On average, Fort Bragg sees higher potential net economic impacts. Tables D.3–D.9 show potential net economic impacts by fishery for each port and for the NCSR.

Table D.2: Estimated annual net economic impact on commercial fisheries by port (reduction in profit)

	RNCP	ECA
Port	**$ Reduction in Profit**	
Crescent City	$128,129	$128,129
Trinidad	$15,724	$15,724
Eureka	$32,064	$32,064
Shelter Cove	$250	$250
Fort Bragg	$97,892	$97,892
Albion	$4,118	$4,118
NCSR	**$278,177**	**$278,177**

	% Reduction in Profit	
Crescent City	3.0%	3.0%
Trinidad	2.4%	2.4%
Eureka	1.6%	1.6%
Shelter Cove	0.6%	0.6%
Fort Bragg	4.8%	4.8%
Albion	2.0%	2.0%
NCSR	**3.0%**	**3.0%**

Figure D.2: Estimated annual net economic impact on commercial fisheries by port (% reduction in profit)

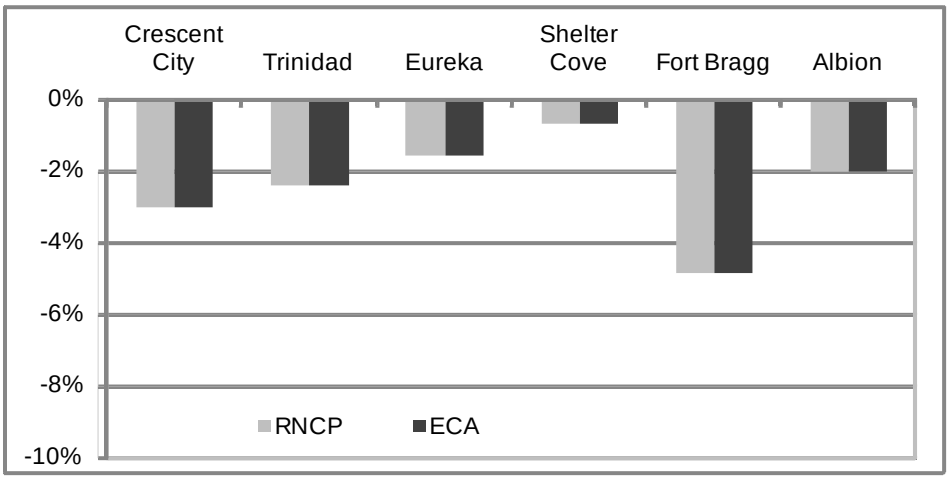


Table D.3: Estimated annual net economic impact for Crescent City

Fishery	Baseline GER[32]	Estimated Costs	Baseline NER[33] (Profit)	RNCP	ECA
				$ Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	$10,615,878	$6,677,468	$3,938,410	$124,347	$124,347
Herring (Gillnet)	$2,127	$1,234	$893	$0	$0
Rockfish (Fixed Gear)	$391,258	$210,877	$180,381	$1,261	$1,261
Salmon (Troll)	$189,503	$111,297	$78,206	$2,281	$2,281
Shrimp (Trap)	$251,315	$158,029	$93,286	$0	$0
Smelt (Brail – Dip Net)	$16,532	$10,015	$6,517	$0	$0
Surfperch (Hook and Line)	$5,986	$3,230	$2,755	$241	$241
Urchin (Dive Captain)	—	—	—	—	—
Urchin (Walk-on Dive)	—	—	—	—	—
All Fisheries	**$11,472,598**	**$7,172,150**	**$4,300,448**	**$128,129**	**$128,129**
				% Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	100%	63%	37%	3.2%	3.2%
Herring (Gillnet)	100%	58%	42%	0.0%	0.0%
Rockfish (Fixed Gear)	100%	54%	46%	0.7%	0.7%
Salmon (Troll)	100%	59%	41%	2.9%	2.9%
Shrimp (Trap)	100%	63%	37%	0.0%	0.0%
Smelt (Brail – Dip Net)	100%	61%	39%	0.0%	0.0%
Surfperch (Hook and Line)	100%	54%	46%	8.7%	8.7%
Urchin (Dive Captain)	—	—	—	—	—
Urchin (Walk-on Dive)	—	—	—	—	—
All Fisheries	**—**	**—**	**—**	**3.0%**	**3.0%**

[32] GER is Gross Economic Revenue
[33] NER is Net Economic Revenue

Table D.4: Estimated annual net economic impact for Trinidad

Fishery	Baseline GER	Estimated Costs	Baseline NER (Profit)	RNCP	ECA
				$ Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	$1,756,959	$1,105,140	$651,818	$13,464	$13,464
Herring (Gillnet)	—	—	—	—	—
Rockfish (Fixed Gear)	$19,776	$10,659	$9,117	$2,093	$2,093
Salmon (Troll)	$11,671	$6,854	$4,816	$167	$167
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	—	—	—	—	—
Surfperch (Hook and Line)	—	—	—	—	—
Urchin (Dive Captain)	—	—	—	—	—
Urchin (Walk-on Dive)	—	—	—	—	—
All Fisheries	**$1,788,406**	**$1,122,654**	**$665,752**	**$15,724**	**$15,724**
				% Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	100%	63%	37%	2.1%	2.1%
Herring (Gillnet)	—	—	—	—	—
Rockfish (Fixed Gear)	100%	54%	46%	23.0%	23.0%
Salmon (Troll)	100%	59%	41%	3.5%	3.5%
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	—	—	—	—	—
Surfperch (Hook and Line)	—	—	—	—	—
Urchin (Dive Captain)	—	—	—	—	—
Urchin (Walk-on Dive)	—	—	—	—	—
All Fisheries	**—**	**—**	**—**	**2.4%**	**2.4%**

Table D.5: Estimated annual net economic impact for Eureka

Fishery	Baseline GER	Estimated Costs	Baseline NER (Profit)	RNCP	ECA
				$ Reduction in Profit	
Anchovy/Sardine (Lampara Net)	$44,428	$36,875	$7,553	$506	$506
Dungeness Crab (Trap)	$5,062,040	$3,184,061	$1,877,978	$21,762	$21,762
Herring (Gillnet)	$9,574	$5,553	$4,021	$96	$96
Rockfish (Fixed Gear)	$51,344	$27,673	$23,671	$5,361	$5,361
Salmon (Troll)	$202,095	$118,692	$83,402	$2,192	$2,192
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	$106,148	$64,306	$41,842	$0	$0
Surfperch (Hook and Line)	$20,445	$11,034	$9,411	$2,149	$2,149
Urchin (Dive Captain)	—	—	—	—	—
Urchin (Walk-on Dive)	—	—	—	—	—
All Fisheries	**$5,496,074**	**$3,448,196**	**$2,047,879**	**$32,064**	**$32,064**
				% Reduction in Profit	
Anchovy/Sardine (Lampara Net)	100%	83%	17%	6.7%	6.7%
Dungeness Crab (Trap)	100%	63%	37%	1.2%	1.2%
Herring (Gillnet)	100%	58%	42%	2.4%	2.4%
Rockfish (Fixed Gear)	100%	54%	46%	22.6%	22.6%
Salmon (Troll)	100%	59%	41%	2.6%	2.6%
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	100%	61%	39%	0.0%	0.0%
Surfperch (Hook and Line)	100%	54%	46%	22.8%	22.8%
Urchin (Dive Captain)	—	—	—	—	—
Urchin (Walk-on Dive)	—	—	—	—	—
All Fisheries	**—**	**—**	**—**	**1.6%**	**1.6%**

Table D.6: Estimated annual net economic impact for Shelter Cove

Fishery	Baseline GER	Estimated Costs	Baseline NER (Profit)	RNCP	ECA
				$ Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	$18,626	$11,716	$6,910	$0	$0
Herring (Gillnet)	—	—	—	—	—
Rockfish (Fixed Gear)	$14,575	$7,856	$6,720	$108	$108
Salmon (Troll)	$63,003	$37,003	$26,001	$142	$142
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	—	—	—	—	—
Surfperch (Hook and Line)	—	—	—	—	—
Urchin (Dive Captain)	—	—	—	—	—
Urchin (Walk-on Dive)	—	—	—	—	—
All Fisheries	**$96,205**	**$56,574**	**$39,630**	**$250**	**$250**
				% Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	100%	63%	37%	0.0%	0.0%
Herring (Gillnet)	—	—	—	—	—
Rockfish (Fixed Gear)	100%	54%	46%	1.6%	1.6%
Salmon (Troll)	100%	59%	41%	0.5%	0.5%
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	—	—	—	—	—
Surfperch (Hook and Line)	—	—	—	—	—
Urchin (Dive Captain)	—	—	—	—	—
Urchin (Walk-on Dive)	—	—	—	—	—
All Fisheries	**—**	**—**	**—**	**0.6%**	**0.6%**

Table D.7: Estimated annual net economic impact for Fort Bragg

Fishery	Baseline GER	Estimated Costs	Baseline NER (Profit)	RNCP	ECA
				$ Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	$1,015,833	$638,967	$376,866	$18,165	$18,165
Herring (Gillnet)	—	—	—	—	—
Rockfish (Fixed Gear)	$143,137	$77,147	$65,990	$9,579	$9,579
Salmon (Troll)	$2,556,982	$1,501,744	$1,055,238	$27,560	$27,560
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	—	—	—	—	—
Surfperch (Hook and Line)	—	—	—	—	—
Urchin (Dive Captain)	$670,057	$322,505	$347,552	$27,318	$27,318
Urchin (Walk-on Dive)	$264,179	$79,254	$184,926	$15,270	$15,270
All Fisheries	**$4,650,189**	**$2,619,617**	**$2,030,572**	**$97,892**	**$97,892**
				% Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	100%	63%	37%	4.8%	4.8%
Herring (Gillnet)	—	—	—	—	—
Rockfish (Fixed Gear)	100%	54%	46%	14.5%	14.5%
Salmon (Troll)	100%	59%	41%	2.6%	2.6%
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	—	—	—	—	—
Surfperch (Hook and Line)	—	—	—	—	—
Urchin (Dive Captain)	100%	48%	52%	7.9%	7.9%
Urchin (Walk-on Dive)	100%	30%	70%	8.3%	8.3%
All Fisheries	**—**	**—**	**—**	**4.8%**	**4.8%**

Table D.8: Estimated annual net economic impact for Albion

Fishery	Baseline GER	Estimated Costs	Baseline NER (Profit)	RNCP	ECA
				$ Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	$2,401	$1,510	$891	$0	$0
Herring (Gillnet)	—	—	—	—	—
Rockfish (Fixed Gear)	$22,362	$12,053	$10,310	$238	$238
Salmon (Troll)	$4,362	$2,562	$1,800	$25	$25
Shrimp (Trap)	—	—	—	—	—
Smelt (Brail – Dip Net)	—	—	—	—	—
Surfperch (Hook and Line)	—	—	—	—	—
Urchin (Dive Captain)	$226,722	$109,124	$117,599	$2,319	$2,319
Urchin (Walk-on Dive)	$105,897	$31,769	$74,128	$1,536	$1,536
All Fisheries	**$361,745**	**$157,018**	**$204,727**	**$4,118**	**$4,118**
				% Reduction in Profit	
Anchovy/Sardine (Lampara Net)	—	—	—	—	—
Dungeness Crab (Trap)	100%	63%	37%	0.0%	0.0%
Herring (Gillnet)	—	—	—	—	—
Rockfish (Fixed Gear)	100%	54%	46%	2.3%	2.3%
Salmon (Troll)	100%	59%	41%	1.4%	1.4%
Shrimp (Trap)	100%	63%	37%	—	—
Smelt (Brail – Dip Net)	—	—	—	—	—
Surfperch (Hook and Line)	—	—	—	—	—
Urchin (Dive Captain)	100%	48%	52%	2.0%	2.0%
Urchin (Walk-on Dive)	100%	30%	70%	2.1%	2.1%
All Fisheries	**—**	**—**	**—**	**2.0%**	**2.0%**

Table D.9: Estimated annual net economic impact for the NCSR

Fishery	Baseline GER	Estimated Costs	Baseline NER (Profit)	RNCP	ECA
				$ Reduction in Profit	
Anchovy/Sardine (Lampara Net)	$44,428	$36,875	$7,553	$506	$506
Dungeness Crab (Trap)	$18,471,736	$11,618,862	$6,852,874	$177,737	$177,737
Herring (Gillnet)	$11,701	$6,787	$4,915	$96	$96
Rockfish (Fixed Gear)	$642,453	$346,264	$296,189	$18,640	$18,640
Salmon (Troll)	$3,027,616	$1,778,153	$1,249,463	$32,366	$32,366
Shrimp (Trap)	$251,315	$158,029	$93,286	$0	$0
Smelt (Brail – Dip Net)	$122,680	$74,322	$48,358	$0	$0
Surfperch (Hook and Line)	$26,431	$14,264	$12,167	$2,389	$2,389
Urchin (Dive Captain)	$896,780	$431,629	$465,151	$29,637	$29,637
Urchin (Walk-on Dive)	$370,076	$111,023	$259,053	$16,805	$16,805
All Fisheries	**$23,865,216**	**$14,576,208**	**$9,289,008**	**$278,177**	**$278,177**
				% Reduction in Profit	
Anchovy/Sardine (Lampara Net)	100%	83%	17%	6.7%	6.7%
Dungeness Crab (Trap)	100%	63%	37%	2.6%	2.6%
Herring (Gillnet)	100%	58%	42%	1.9%	1.9%
Rockfish (Fixed Gear)	100%	54%	46%	6.3%	6.3%
Salmon (Troll)	100%	59%	41%	2.6%	2.6%
Shrimp (Trap)	100%	63%	37%	0.0%	0.0%
Smelt (Brail – Dip Net)	100%	61%	39%	0.0%	0.0%
Surfperch (Hook and Line)	100%	54%	46%	19.6%	19.6%
Urchin (Dive Captain)	100%	48%	52%	6.4%	6.4%
Urchin (Walk-on Dive)	100%	30%	70%	6.5%	6.5%
All Fisheries	**—**	**—**	**—**	**3.0%**	**3.0%**

D.2.3. Potential Gross Economic Impacts on Commercial Fisheries

Potential gross economic impact (GEI) is calculated as a percentage reduction in annual gross economic revenue. Unlike net economic impact (NEI), GEI does not account for fishermen's operating costs. Therefore, the percentage reduction in gross economic revenue is less than the percentage reduction in net economic revenue (i.e., profit). However, the dollar reduction in gross economic revenue is greater than the dollar reduction in net economic revenue.

To analyze the potential gross economic impacts across the study region, we focus on the top four commercial species (i.e., Dungeness crab, salmon, urchin, and rockfish), as they comprise approximately 98.1% of the total NCSR ex-vessel revenue. Several patterns emerge from our analysis:

- The Dungeness crab fishery sees the highest range of potential gross economic impacts (in dollars). RNCP and ECA have estimated potential impacts on the Dungeness crab fishery of $285,272.
- The rockfish fishery sees the lowest range of potential gross economic impacts (in dollars). RNCP and ECA have estimated potential impacts on the rockfish fishery of $26,600.
- The rank order and relative differences for the two proposals are similar for both GEI and NEI (in section 2.2); however, the magnitude of the impacts differs.

On average, RNCP and ECA are estimated to have potential gross economic impacts of 1.8% annually across the study region. Figures D.3 and D.4 compare the potential annual GEI with the potential annual NEI on the commercial fisheries considered. The rank order of the proposals remains the same; all that changes is the magnitude of the potential impacts.

Figure D.3: Estimated annual GEI (% reduction in revenue) and NEI (% reduction in profit) on commercial fisheries

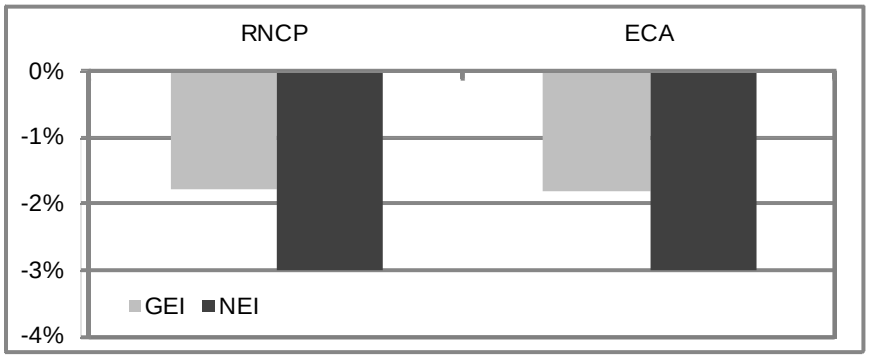
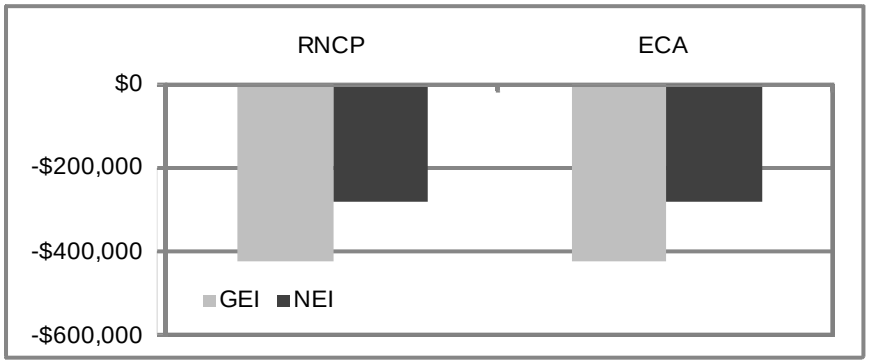


Figure D.4: Estimated annual GEI ($ reduction in revenue) and NEI ($ reduction in profit) on commercial fisheries (in millions)



The potential impacts from each proposal are broken out by port in Table D.10 and Figure D.5. On average, Fort Bragg sees higher potential impacts. Tables D.11–D.17 show potential gross economic impacts by fishery for each port and for the NCSR.

Table D.10: Estimated annual gross economic impact on commercial fisheries by port (reduction in revenue)

Port	Baseline GER	RNCP	ECA
		$ Reduction in Revenue	
Crescent City	$11,501,714	$205,162	$205,162
Trinidad	$1,788,406	$24,849	$24,849
Eureka	$5,496,074	$50,251	$50,251
Shelter Cove	$96,205	$369	$369
Fort Bragg	$4,819,786	$138,502	$138,502
Albion	$361,745	$5,201	$5,201
NCSR	**$24,063,930**[34]	**$424,334**	**$424,334**
		% Reduction in Revenue	
Crescent City	100%	1.8%	1.8%
Trinidad	100%	1.4%	1.4%
Eureka	100%	0.9%	0.9%
Shelter Cove	100%	0.4%	0.4%
Fort Bragg	100%	2.9%	2.9%
Albion	100%	1.4%	1.4%
NCSR	**—**	**1.8%**	**1.8%**

[34] This total includes the revenue reported by our five seaweed survey respondents, who represent approximately 69% of the total poundage of seaweed landed in the NCSR. For reporting purposes, four survey respondents who operate across the Fort Bragg, Albion and Elk areas were indicated as operating out of Fort Bragg and one survey respondent who operates out of both Crescent City and Trinidad was indicated as operating out of Crescent City.

Figure D.5: Estimated annual gross economic impact on commercial fisheries by port (% reduction in profit)

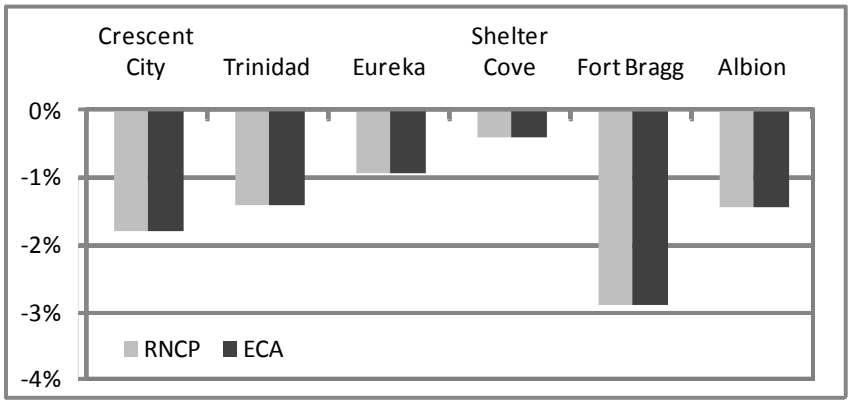


Table D.11: Estimated annual gross economic impact for Crescent City

Fishery	Baseline GER	RNCP	ECA
		$ Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	$10,615,878	$199,578	$199,578
Herring (Gillnet)	$2,127	$0	$0
Rockfish (Fixed Gear)	$391,258	$1,800	$1,800
Salmon (Troll)	$189,503	$3,449	$3,449
Seaweed (Hand Harvest)	$29,116[35]	$0	$0
Shrimp (Trap)	$251,315	$0	$0
Smelt (Brail – Dip Net)	$16,532	$0	$0
Surfperch (Hook and Line)	$5,986	$335	$335
Urchin (Dive)	—	—	—
All Fisheries	**$11,501,714**	**$205,162**	**$205,162**
		% Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	100%	1.9%	1.9%
Herring (Gillnet)	100%	0.0%	0.0%
Rockfish (Fixed Gear)	100%	0.5%	0.5%
Salmon (Troll)	100%	1.8%	1.8%
Seaweed (Hand Harvest)	100%	0.0%	0.0%
Shrimp (Trap)	100%	0.0%	0.0%
Smelt (Brail – Dip Net)	100%	0.0%	0.0%
Surfperch (Hook and Line)	100%	5.6%	5.6%
Urchin (Dive)	—	—	—
All Fisheries	**—**	**1.8%**	**1.8%**

[35] We obtained permission to display this value from the seaweed survey respondent who is indicated as operating out of Crescent City.

Table D.12: Estimated annual gross economic impact for Trinidad

Fishery	Baseline GER	RNCP	ECA
		$ Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	$1,756,959	$21,611	$21,611
Herring (Gillnet)	—	—	—
Rockfish (Fixed Gear)	$19,776	$2,986	$2,986
Salmon (Troll)	$11,671	$252	$252
Seaweed (Hand Harvest)	—	—	—
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	—	—	—
Surfperch (Hook and Line)	—	—	—
Urchin (Dive)	—	—	—
All Fisheries	**$1,788,406**	**$24,849**	**$24,849**
		% Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	100%	1.2%	1.2%
Herring (Gillnet)	—	—	—
Rockfish (Fixed Gear)	100%	15.1%	15.1%
Salmon (Troll)	100%	2.2%	2.2%
Seaweed (Hand Harvest)	—	—	—
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	—	—	—
Surfperch (Hook and Line)	—	—	—
Urchin (Dive)	—	—	—
All Fisheries	**—**	**1.4%**	**1.4%**

Table D.13: Estimated annual gross economic impact for Eureka

Fishery	Baseline GER	RNCP	ECA
		$ Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	$44,428	$1,204	$1,204
Dungeness Crab (Trap)	$5,062,040	$34,928	$34,928
Herring (Gillnet)	$9,574	$165	$165
Rockfish (Fixed Gear)	$51,344	$7,650	$7,650
Salmon (Troll)	$202,095	$3,314	$3,314
Seaweed (Hand Harvest)	—	—	—
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	$106,148	$0	$0
Surfperch (Hook and Line)	$20,445	$2,989	$2,989
Urchin (Dive)	—	—	—
All Fisheries	**$5,496,074**	**$50,251**	**$50,251**

		% Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	100%	2.7%	2.7%
Dungeness Crab (Trap)	100%	0.7%	0.7%
Herring (Gillnet)	100%	1.7%	1.7%
Rockfish (Fixed Gear)	100%	14.9%	14.9%
Salmon (Troll)	100%	1.6%	1.6%
Seaweed (Hand Harvest)	—	—	—
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	100%	0.0%	0.0%
Surfperch (Hook and Line)	100%	14.6%	14.6%
Urchin (Dive)	—	—	—
All Fisheries	**—**	**0.9%**	**0.9%**

Table D.14: Estimated annual gross economic impact for Shelter Cove

Fishery	Baseline GER	RNCP	ECA
		$ Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	$18,626	$0	$0
Herring (Gillnet)	—	—	—
Rockfish (Fixed Gear)	$14,575	$155	$155
Salmon (Troll)	$63,003	$214	$214
Seaweed (Hand Harvest)	—	—	—
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	—	—	—
Surfperch (Hook and Line)	—	—	—
Urchin (Dive)	—	—	—
All Fisheries	**$96,205**	**$369**	**$369**
		% Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	100%	0.0%	0.0%
Herring (Gillnet)	—	—	—
Rockfish (Fixed Gear)	100%	1.1%	1.1%
Salmon (Troll)	100%	0.3%	0.3%
Seaweed (Hand Harvest)	—	—	—
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	—	—	—
Surfperch (Hook and Line)	—	—	—
Urchin (Dive)	—	—	—
All Fisheries	**—**	**0.4%**	**0.4%**

Table D.15: Estimated annual gross economic impact for Fort Bragg

Fishery	Baseline GER	RNCP	ECA
		$ Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	$1,015,833	$29,154	$29,154
Herring (Gillnet)	—	—	—
Rockfish (Fixed Gear)	$143,137	$13,670	$13,670
Salmon (Troll)	$2,556,982	$41,679	$41,679
Seaweed (Hand Harvest)	$169,597	$0	$0
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	—	—	—
Surfperch (Hook and Line)	—	—	—
Urchin (Dive)	$934,237	$53,999	$53,999
All Fisheries	**$4,819,786**	**$138,502**	**$138,502**
		% Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	100%	2.9%	2.9%
Herring (Gillnet)	—	—	—
Rockfish (Fixed Gear)	100%	9.6%	9.6%
Salmon (Troll)	100%	1.6%	1.6%
Seaweed (Hand Harvest)	100%	0.0%	0.0%
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	—	—	—
Surfperch (Hook and Line)	—	—	—
Urchin (Dive)	100%	5.8%	5.8%
All Fisheries	**—**	**2.9%**	**2.9%**

Table D.16: Estimated annual gross economic impact for Albion

Fishery	Baseline GER	RNCP	ECA
		$ Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	$2,401	$0	$0
Herring (Gillnet)	—	—	—
Rockfish (Fixed Gear)	$22,362	$340	$340
Salmon (Troll)	$4,362	$38	$38
Seaweed (Hand Harvest)	—	—	—
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	—	—	—
Surfperch (Hook and Line)	—	—	—
Urchin (Dive)	$332,619	$4,823	$4,823
All Fisheries	**$361,745**	**$5,201**	**$5,201**
		% Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	—	—	—
Dungeness Crab (Trap)	100%	0.0%	0.0%
Herring (Gillnet)	—	—	—
Rockfish (Fixed Gear)	100%	1.5%	1.5%
Salmon (Troll)	100%	0.9%	0.9%
Seaweed (Hand Harvest)	—	—	—
Shrimp (Trap)	—	—	—
Smelt (Brail – Dip Net)	—	—	—
Surfperch (Hook and Line)	—	—	—
Urchin (Dive)	100%	1.5%	1.5%
All Fisheries	**—**	**1.4%**	**1.4%**

Table D.17: Estimated annual gross economic impact for the NCSR

Fishery	Baseline GER	RNCP	ECA
		$ Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	$44,428	$1,204	$1,204
Dungeness Crab (Trap)	$18,471,736	$285,272	$285,272
Herring (Gillnet)	$11,701	$165	$165
Rockfish (Fixed Gear)	$642,453	$26,600	$26,600
Salmon (Troll)	$3,027,616	$48,947	$48,947
Seaweed (Hand Harvest)	$198,714	$0	$0
Shrimp (Trap)	$251,315	$0	$0
Smelt (Brail – Dip Net)	$122,680	$0	$0
Surfperch (Hook and Line)	$26,431	$3,324	$3,324
Urchin (Dive)	$1,266,856	$58,822	$58,822
All Fisheries	**$24,063,930** [36]	**$424,334**	**$424,334**

		% Reduction in Revenue	
Anchovy/Sardine (Lampara Net)	100%	2.7%	2.7%
Dungeness Crab (Trap)	100%	1.5%	1.5%
Herring (Gillnet)	100%	1.4%	1.4%
Rockfish (Fixed Gear)	100%	4.1%	4.1%
Salmon (Troll)	100%	1.6%	1.6%
Seaweed (Hand Harvest)	100%	0.0%	0.0%
Shrimp (Trap)	100%	0.0%	0.0%
Smelt (Brail – Dip Net)	100%	0.0%	0.0%
Surfperch (Hook and Line)	100%	12.6%	12.6%
Urchin (Dive)	100%	4.6%	4.6%
All Fisheries	**—**	**1.8%**	**1.8%**

[36] This total includes the revenue reported by our five seaweed survey respondents, who represent approximately 69% of the total poundage of seaweed landed in the NCSR.

D.2.4. Disproportionate Impacts on Commercial Fisheries

We also evaluate whether there are port-fishery combinations that may be disproportionately affected by the RNCP and ECA proposals.

To assess these impacts, we use a box plot analysis (see Figure D.1.1 in Appendix D.1) to identify outliers within each fishery (calculated using estimated impacts on the stated value of total fishing grounds). In a box plot analysis, outliers are defined as extreme values that deviate significantly[37] from the rest of the sample. Box plot analysis results can also inform convergence among MPA proposals within a fishery and/or relative potential impacts between fisheries.

In terms of potential impacts, no port-fishery combinations are found to be statistically significant outliers (within each fishery); however, across all fisheries, four port-fishery combinations are disproportionately impacted under both proposals: Trinidad – rockfish, Eureka – rockfish, Eureka – surfperch. and Fort Bragg – rockfish.

D.3. RESULTS FOR COMMERCIAL PASSENGER FISHING VESSELS (CPFV)

We summarize here our analysis of the potential impacts on the five CPFV fisheries: California halibut, Dungeness crab, Pacific halibut, rockfish/bottomfish, and salmon. The rockfish/bottomfish fishery includes lingcod and the nearshore and deeper nearshore fish species, which were combined at the recommendation of the NCSR fishing community into a single fishery. The results for CPFV fisheries are broken out by port group (i.e., Crescent City, Trinidad, Eureka, Shelter Cove, and Fort Bragg).

D.3.1. Potential Impacts on CPFV Fishing Grounds (Area and Stated Value)

The RNCP and ECA proposals vary considerably in their potential effects, both between and across fisheries. As mentioned previously, this report only presents results. Evaluation methods are presented in a separate document (Appendix B).

For information on the potential impacts on CPFV fishing grounds for the port-fishery combinations considered, please see Tables D.1.3–D.1.4 in Appendix D.1.

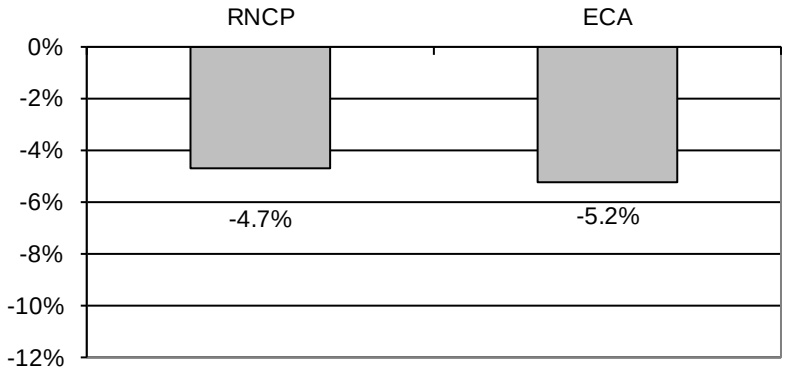
D.3.2. Potential Net Economic Impacts on CPFV Fisheries

Similar to our analysis of the commercial fisheries, we calculate the potential net economic impact (NEI) on the CPFV fisheries as the average percentage reduction in net economic revenue across the fisheries considered in each port (for a list of fisheries considered in each port, please see *Draft Survey Methods and Summary Statistics for Ecotrust's North Coast Study Region Fishery Uses and Values Project)*. Unlike the commercial fisheries, however, we assume a similar cost structure across the CPFV port groups for reasons of confidentiality (i.e., $n = 22$).

[37] That is, the deviation is unlikely to have occurred by chance from a statistical perspective.

Figure D.6 summarizes the potential net economic impact on CPFV fisheries by fishery.

Figure D.6: Estimated annual net economic impact on CPFV fisheries (% reduction in profit)



The potential impacts on CPFV fisheries under RNCP and ECA are further separated by port in Table D.18. On average, Fort Bragg and Shelter Cove are estimated to see the highest potential net economic impacts to CPFV fisheries (as a percentage), while Crescent City is estimated to see the lowest potential impact. It is interesting to note that potential impacts increase moving north to south (i.e., Crescent City to Fort Bragg).

Table D.18: Estimated annual net economic impact on CPFV fisheries by port (reduction in profit)

Port	Baseline GER	Estimated Costs	Baseline NER (Profit)	RNCP	ECA
				% Reduction in Profit	
Crescent City	100%	51.8%	48.2%	0.0%	0.0%
Trinidad	100%	51.8%	48.2%	0.5%	0.6%
Eureka	100%	51.8%	48.2%	4.3%	4.4%
Shelter Cove	100%	51.8%	48.2%	9.2%	10.3%
Fort Bragg	100%	51.8%	48.2%	9.7%	10.8%
NCSR	**100%**	**51.8%**	**48.2%**	**4.7%**	**5.2%**

D.3.3. Difference in MPA Specific Potential Impacts on CPFV Fisheries

There are four CPFV port-fishery combinations where there is a difference in potential impacts between the RNCP and the ECA. Differences in the potential impacts on CPFV fisheries can be attributed to differences in the allowed take for three specific MPAs proposed in the ECA: Samoa Offshore SMCA, Big Flat Offshore SMCA, and Vizcaino Offshore SCMA. For each of the CPFV fisheries listed in Table D.19, they are allowed in the RNCP proposal, but not the ECA proposal. For additional details of the specific CPFV port-fishery combinations affected by these differences, please see Table D.19.

Table D.19: Difference in MPA specific potential impacts on CPFV fisheries

		Potential Impact on Area		Potential Impact on Value	
ECA MPAs	**Port-Fishery**	**RNCP**	**ECA**	**RNCP**	**ECA**
Samoa Offshore SMCA	Trinidad – Ca. Halibut	0.0%	16.2%	0.0%	0.4%
Samoa Offshore SMCA	Eureka – Pac. Halibut	4.3%	7.4%	2.4%	3.0%
Big Flat Offshore SMCA	Shelter Cove – Rockfish/Bottomfish	4.8%	8.9%	4.3%	6.9%
Vizcaino Offshore SCMA	Fort Bragg – Rockfish/Bottomfish	2.5%	6.4%	3.4%	5.9%

D.3.4. Disproportionate Impacts on CPFV Fisheries

For a discussion of the methods we use to identify whether there are port-fishery combinations that could be disproportionately affected by the MPA proposal alternatives considered, please see Section D.2.4.

Figure D.1.2 in Appendix D.1 presents the box plot analysis for the CPFV fisheries (calculated using estimated impacts on the stated value of total fishing grounds).

In terms of potential impacts, no port-fishery combinations are found to be statistically significant outliers (within each fishery); however, across all fisheries, one port-fishery combination is disproportionately impacted under both proposals – Shelter Cove Pacific halibut.

D.4. RESULTS FOR RECREATIONAL FISHERIES

We summarize here our analysis of the potential impacts on the six recreational fisheries: abalone (dive only), California halibut, Dungeness crab, Pacific halibut, rockfish/bottomfish, and salmon. The rockfish/bottomfish fishery includes lingcod and the deeper nearshore and nearshore fish species, which were combined, at the recommendation of the NCSR fishing community, into a single fishery. The results for recreational fisheries are broken out by user group (i.e., dive, kayak, and private vessel) and by port group (i.e., Crescent City, Trinidad, Eureka, Shelter Cove, and Fort Bragg/Albion).

D.4.1. Potential Impacts on Recreational Fishing Grounds (Area and Stated Value)

Each proposal impacts the recreational fishing grounds differently. For example, the rockfish/bottomfish fishery generally sees higher potential impacts across all ports and user groups. Similarly, Fort Bragg/Albion private vessel recreational fisheries generally see higher potential impacts across the fisheries considered when compared to other ports-user group combinations.

Due to the large number of fisheries, user groups and port groups considered, we present potential impacts (both in terms of total area and stated value) for the two proposals considered in Tables D.1.5–D.1.8 in Appendix D.1.

D.4.2. Difference in MPA Specific Potential Impacts on Recreational Fisheries

There are five private vessel, one dive, and one kayak port-fishery combinations where there are differences in the potential impacts between the RNCP and the ECA. Differences in the potential impacts on these recreational fisheries can be attributed to differences in the allowed take for four specific MPAs proposed in the ECA: Reading Rock SMCA, Samoa Offshore SMCA, Big Flat Offshore SMCA and Vizcaino Offshore SCMA. For each of the fisheries listed in Tables D.20–D.22, the fisheries are allowed in the RNCP proposal, but not the ECA proposal.

Table D.20: Difference in MPA specific potential impacts on private vessel fisheries

		Potential Impact on Area		Potential Impact on Value	
ECA MPAs	**Port-Fishery**	**RNCP**	**ECA**	**RNCP**	**ECA**
Reading Rock SMCA	Crescent City – Rockfish/Bottomfish	1.9%	5.3%	0.1%	0.1%
Reading Rock SMCA	Trinidad – Rockfish/Bottomfish	2.7%	6.3%	0.2%	5.4%
Samoa Offshore SMCA	Eureka – Pacific Halibut	2.7%	3.7%	0.5%	0.8%
Big Flat Offshore SMCA & Vizcaino Offshore SMCA	Shelter Cove – Rockfish/Bottomfish	0.3%	10.0%	0.1%	7.0%
Vizcaino Offshore SMCA	Fort Bragg – Rockfish/Bottomfish	3.8%	5.3%	5.0%	7.5%

Table D.21: Difference in MPA specific potential impacts on kayak fisheries

		Potential Impact on Area		Potential Impact on Value	
ECA MPAs	**Port-Fishery**	**RNCP**	**ECA**	**RNCP**	**ECA**
Vizcaino Offshore SMCA	Fort Bragg – Rockfish/Bottomfish	2.1%	12.0%	1.7%	5.4%

Table D.22: Difference in MPA specific potential impacts on dive fisheries

		Potential Impact on Area		Potential Impact on Value	
ECA MPAs	**Port-Fishery**	**RNCP**	**ECA**	**RNCP**	**ECA**
Big Flat Offshore SMCA & Vizcaino Offshore SMCA	Fort Bragg – Abalone	2.4%	4.5%	2.3%	2.9%

APPENDIX D.1: Summary Tables of Potential Impacts

Table D.1.1: Percentage area of total commercial fishing grounds affected by port

Port	Fishery	RNCP	ECA
Crescent City	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	1.1%	1.1%
	Herring (Gillnet)	0.0%	0.0%
	Rockfish (Fixed Gear)	9.4%	9.4%
	Salmon (Troll)	0.8%	0.8%
	Seaweed (Hand Harvest)[38]	0.0%	0.0%
	Shrimp (Trap)	0.0%	0.0%
	Smelt (Brail – Dip Net)	0.0%	0.0%
	Surfperch (Hook and Line)	7.7%	7.7%
	Urchin (Dive)	---	---
Trinidad	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	2.5%	2.5%
	Herring (Gillnet)	---	---
	Rockfish (Fixed Gear)	11.8%	11.8%
	Salmon (Troll)	1.0%	1.0%
	Seaweed (Hand Harvest)	---	---
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	---	---
	Surfperch (Hook and Line)	---	---
	Urchin (Dive)	---	---
Eureka	Anchovy/Sardine (Lampara Net)	7.7%	7.7%
	Dungeness Crab (Trap)	2.6%	2.6%
	Herring (Gillnet)	5.9%	5.9%
	Rockfish (Fixed Gear)	9.1%	9.1%
	Salmon (Troll)	1.0%	1.0%
	Seaweed (Hand Harvest)	---	---
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	0.0%	0.0%
	Surfperch (Hook and Line)	9.5%	9.5%
	Urchin (Dive)	---	---

[38] These values represent impacts on seaweed harvesters who operate out of both Crescent City and Trinidad.

Table D.1.1 (continued): Percentage area of total commercial fishing grounds affected by port

Port	Fishery	RNCP	ECA
Shelter Cove	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	0.0%	0.0%
	Herring (Gillnet)	---	---
	Rockfish (Fixed Gear)	9.0%	9.0%
	Salmon (Troll)	1.0%	1.0%
	Seaweed (Hand Harvest)	---	---
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	---	---
	Surfperch (Hook and Line)	---	---
	Urchin (Dive)	---	---
Fort Bragg	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	3.1%	3.1%
	Herring (Gillnet)	---	---
	Rockfish (Fixed Gear)	8.6%	8.6%
	Salmon (Troll)	0.7%	0.7%
	Seaweed (Hand Harvest)[39]	0.0%	0.0%
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	---	---
	Surfperch (Hook and Line)	---	---
	Urchin (Dive)	8.2%	8.2%
Albion	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	0.0%	0.0%
	Herring (Gillnet)	---	---
	Rockfish (Fixed Gear)	3.5%	3.5%
	Salmon (Troll)	0.6%	0.6%
	Seaweed (Hand Harvest)	---	---
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	---	---
	Surfperch (Hook and Line)	---	---
	Urchin (Dive)	8.2%	8.2%

[39] These values represent impacts on seaweed harvesters who operate across the Fort Bragg, Albion, and Elk areas.

Table D.1.2: Percentage value of total commercial fishing grounds affected by port

Port	Fishery	RNCP	ECA
Crescent City	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	1.9%	1.9%
	Herring (Gillnet)	0.0%	0.0%
	Rockfish (Fixed Gear)	0.5%	0.5%
	Salmon (Troll)	1.8%	1.8%
	Seaweed (Hand Harvest) [40]	0.0%	0.0%
	Shrimp (Trap)	0.0%	0.0%
	Smelt (Brail – Dip Net)	0.0%	0.0%
	Surfperch (Hook and Line)	5.6%	5.6%
	Urchin (Dive)	---	---
Trinidad	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	1.2%	1.2%
	Herring (Gillnet)	---	---
	Rockfish (Fixed Gear)	15.1%	15.1%
	Salmon (Troll)	2.2%	2.2%
	Seaweed (Hand Harvest)	---	---
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	---	---
	Surfperch (Hook and Line)	---	---
	Urchin (Dive)	---	---
Eureka	Anchovy/Sardine (Lampara Net)	2.7%	2.7%
	Dungeness Crab (Trap)	0.7%	0.7%
	Herring (Gillnet)	1.7%	1.7%
	Rockfish (Fixed Gear)	14.9%	14.9%
	Salmon (Troll)	1.6%	1.6%
	Seaweed (Hand Harvest)	---	---
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	0.0%	0.0%
	Surfperch (Hook and Line)	14.6%	14.6%
	Urchin (Dive)	---	---

[40] These values represent impacts on seaweed harvesters who operate out of both Crescent City and Trinidad.

Table D.1.2 (continued): Percentage value of total commercial fishing grounds affected by port

Port	Fishery	RNCP	ECA
Shelter Cove	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	0.0%	0.0%
	Herring (Gillnet)	---	---
	Rockfish (Fixed Gear)	1.1%	1.1%
	Salmon (Troll)	0.3%	0.3%
	Seaweed (Hand Harvest)	---	---
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	---	---
	Surfperch (Hook and Line)	---	---
	Urchin (Dive)	---	---
Fort Bragg	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	2.9%	2.9%
	Herring (Gillnet)	---	---
	Rockfish (Fixed Gear)	9.6%	9.6%
	Salmon (Troll)	1.6%	1.6%
	Seaweed (Hand Harvest) [41]	0.0%	0.0%
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	---	---
	Surfperch (Hook and Line)	---	---
	Urchin (Dive)	5.8%	5.8%
Albion	Anchovy/Sardine (Lampara Net)	---	---
	Dungeness Crab (Trap)	0.0%	0.0%
	Herring (Gillnet)	---	---
	Rockfish (Fixed Gear)	1.5%	1.5%
	Salmon (Troll)	0.9%	0.9%
	Seaweed (Hand Harvest)	---	---
	Shrimp (Trap)	---	---
	Smelt (Brail – Dip Net)	---	---
	Surfperch (Hook and Line)	---	---
	Urchin (Dive)	1.5%	1.5%

[41] These values represent impacts on seaweed harvesters who operate across the Fort Bragg, Albion, and Elk areas.

Table D.1.3: Percentage area of total CPFV fishing grounds affected by port

Port	Fishery	RNCP	ECA
Crescent City	California Halibut	---	---
	Dungeness Crab	0.0%	0.0%
	Pacific Halibut	---	---
	Rockfish/Bottomfish	0.0%	0.0%
	Salmon	1.2%	1.2%
Trinidad	California Halibut	0.0%	16.2%
	Dungeness Crab	0.0%	0.0%
	Pacific Halibut	2.1%	2.1%
	Rockfish/Bottomfish	0.9%	0.9%
	Salmon	2.0%	2.0%
Eureka	California Halibut	0.0%	0.0%
	Dungeness Crab	0.0%	0.0%
	Pacific Halibut	4.3%	7.4%
	Rockfish/Bottomfish	9.3%	9.3%
	Salmon	2.2%	2.2%
Shelter Cove	California Halibut	---	---
	Dungeness Crab	---	---
	Pacific Halibut	14.9%	14.9%
	Rockfish/Bottomfish	4.8%	8.9%
	Salmon	0.0%	0.0%
Fort Bragg	California Halibut	---	---
	Dungeness Crab	35.9%	35.9%
	Pacific Halibut	---	---
	Rockfish/Bottomfish	2.5%	6.4%
	Salmon	6.3%	6.3%

Table D.1.4: Percentage value of total CPFV fishing grounds affected by port

Port	Fishery	RNCP	ECA
Crescent City	California Halibut	---	---
	Dungeness Crab	0.0%	0.0%
	Pacific Halibut	---	---
	Rockfish/Bottomfish	0.0%	0.0%
	Salmon	0.0%	0.0%
Trinidad	California Halibut	0.0%	0.4%
	Dungeness Crab	0.0%	0.0%
	Pacific Halibut	0.0%	0.0%
	Rockfish/Bottomfish	0.1%	0.1%
	Salmon	1.7%	1.7%
Eureka	California Halibut	0.0%	0.0%
	Dungeness Crab	0.0%	0.0%
	Pacific Halibut	2.4%	3.0%
	Rockfish/Bottomfish	11.8%	11.8%
	Salmon	1.9%	1.9%
Shelter Cove	California Halibut	---	---
	Dungeness Crab	---	---
	Pacific Halibut	16.3%	16.3%
	Rockfish/Bottomfish	4.3%	6.9%
	Salmon	0.0%	0.0%
Fort Bragg	California Halibut	---	---
	Dungeness Crab	9.5%	9.5%
	Pacific Halibut	---	---
	Rockfish/Bottomfish	3.4%	5.9%
	Salmon	8.9%	8.9%

Table D.1.5: Percentage area of total recreational fishing grounds affected by port for RNCP

Port	User Group	Abalone	California Halibut	Dungeness Crab	Pacific Halibut	Rockfish/ Bottomfish	Salmon
Crescent City	Dive	0.0%	---	---	---	1.1%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	5.4%	0.0%	2.7%	1.9%	1.4%
Trinidad	Dive	0.0%	---	---	---	0.0%	---
	Kayak	---	---	---	---	0.0%	---
	Private Vessel	---	0.0%	1.9%	0.0%	2.7%	1.1%
Eureka	Dive	1.0%	---	---	---	12.7%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	3.1%	0.2%	2.7%	9.4%	0.7%
Shelter Cove	Dive	0.0%	---	---	---	0.0%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	0.0%	0.0%	5.9%	0.3%	0.0%
Fort Bragg/ Albion	Dive	2.4%	---	0.0%	---	11.1%	---
	Kayak	---	---	---	---	2.1%	2.6%
	Private Vessel	---	6.5%	6.2%	7.2%	3.8%	0.8%

Table D.1.6: Percentage value of total recreational fishing grounds affected by port for RNCP

Port	User Group	Abalone	California Halibut	Dungeness Crab	Pacific Halibut	Rockfish/ Bottomfish	Salmon
Crescent City	Dive	0.0%	---	---	---	0.4%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	3.2%	0.0%	3.8%	0.1%	0.4%
Trinidad	Dive	0.0%	---	---	---	0.0%	---
	Kayak	---	---	---	---	0.0%	---
	Private Vessel	---	0.0%	0.1%	0.0%	0.2%	0.4%
Eureka	Dive	0.0%	---	---	---	14.7%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	0.1%	0.0%	0.5%	12.5%	0.1%
Shelter Cove	Dive	0.0%	---	---	---	0.0%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	0.0%	0.0%	7.8%	0.1%	0.0%
Fort Bragg/ Albion	Dive	2.3%	---	0.0%	---	8.7%	---
	Kayak	---	---	---	---	1.7%	0.6%
	Private Vessel	---	4.0%	7.7%	7.5%	5.0%	3.1%

Table D.1.7: Percentage area of total recreational fishing grounds affected by port for ECA

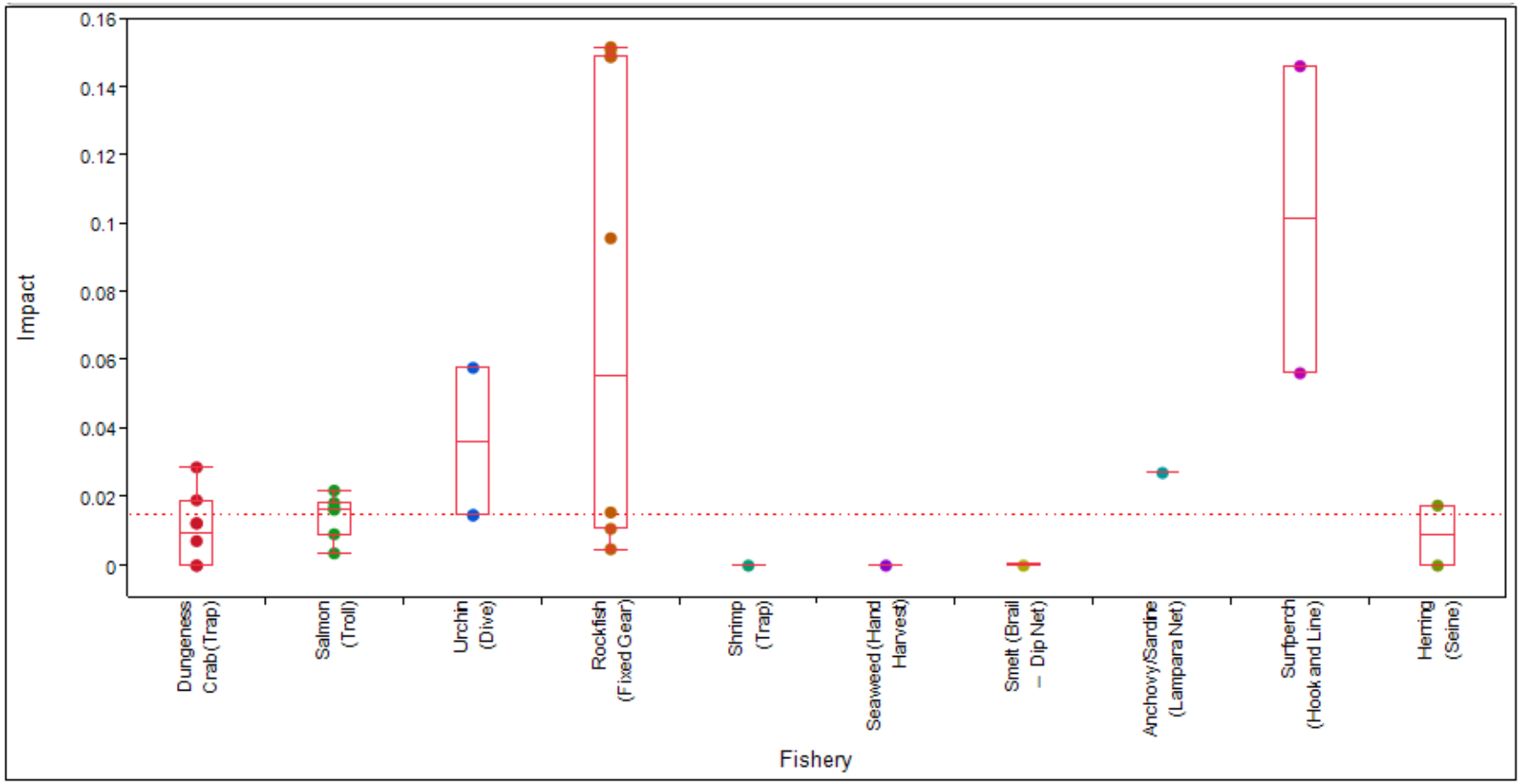
Port	User Group	Abalone	California Halibut	Dungeness Crab	Pacific Halibut	Rockfish/ Bottomfish	Salmon
Crescent City	Dive	0.0%	---	---	---	1.1%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	5.4%	0.0%	2.7%	5.3%	1.4%
Trinidad	Dive	0.0%	---	---	---	0.0%	---
	Kayak	---	---	---	---	0.0%	---
	Private Vessel	---	0.0%	1.9%	0.0%	6.3%	1.1%
Eureka	Dive	1.0%	---	---	---	12.7%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	3.1%	0.2%	3.7%	9.4%	0.7%
Shelter Cove	Dive	0.0%	---	---	---	0.0%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	0.0%	0.0%	5.9%	10.0%	0.0%
Fort Bragg/ Albion	Dive	4.5%	---	0.0%	---	11.1%	---
	Kayak	---	---	---	---	12.0%	2.6%
	Private Vessel	---	6.5%	6.2%	7.2%	5.3%	0.8%

Table D.1.8: Percentage value of total recreational fishing grounds affected by port for ECA

Port	User Group	Abalone	California Halibut	Dungeness Crab	Pacific Halibut	Rockfish/ Bottomfish	Salmon
Crescent City	Dive	0.0%	---	---	---	0.4%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	3.2%	0.0%	3.8%	0.1%	0.4%
Trinidad	Dive	0.0%	---	---	---	0.0%	---
	Kayak	---	---	---	---	0.0%	---
	Private Vessel	---	0.0%	0.1%	0.0%	5.4%	0.4%
Eureka	Dive	0.0%	---	---	---	14.7%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	0.1%	0.0%	0.8%	12.5%	0.1%
Shelter Cove	Dive	0.0%	---	---	---	0.0%	---
	Kayak	---	---	---	---	---	---
	Private Vessel	---	0.0%	0.0%	7.8%	7.0%	0.0%
Fort Bragg/ Albion	Dive	2.9%	---	0.0%	---	8.7%	---
	Kayak	---	---	---	---	5.4%	0.6%
	Private Vessel	---	4.0%	7.7%	7.5%	7.5%	3.1%

Figure D.1.1: Disproportionate impacts on commercial fisheries

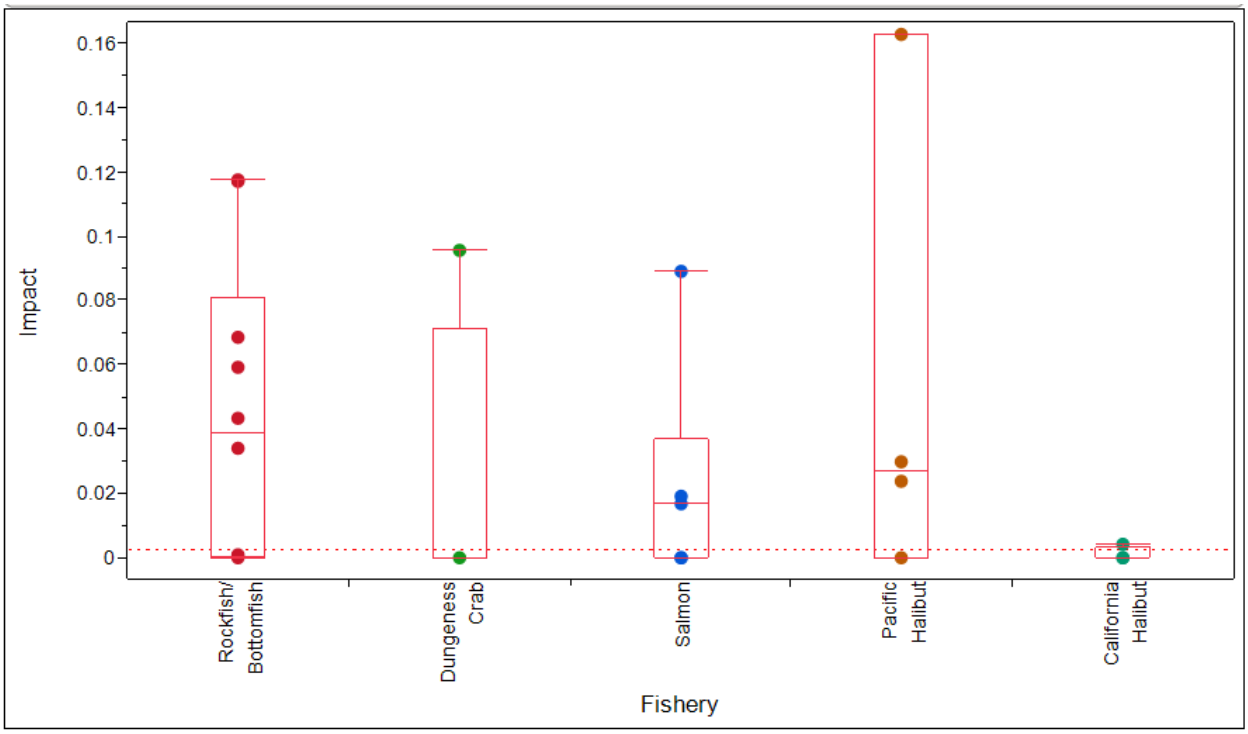
Each dot in Figure D.1.1 represents the potential impact of the proposal on the stated value of fishing grounds in a specific port for a specific fishery (from Table D.1.2). All points not in a box or on a line are considered statistically significant outliers (i.e., port-fishery combinations that may be disproportionately affected). The commercial fisheries are listed along the x-axis in descending order of importance using average baseline gross economic revenue from 2000–07 as a proxy for importance[42]. Please see Section 2.4 for further information on box plot analysis for the commercial fisheries as well as identification of the potential outliers.



[42] For all species except seaweed – hand harvest, we used the Department of Fish and Game's landing data. For seaweed, which is recorded only by pounds landed on a region wide scale, we used the average gross economic revenue reported by our five seaweed survey respondents, who represent approximately 69% of the total poundage of seaweed landed in the NCSR.

Figure D.1.2: Disproportionate impacts on CPFV fisheries

Each dot in Figure D.1.2 represents the potential impact of the MPA proposal on the stated value of fishing grounds in a specific port for a specific fishery (from Table D.1.4). All points not in a box or on a line are considered statistically significant outliers (i.e., port-fishery combinations that may be disproportionately affected). The CPFV fisheries are listed along the x-axis in order of importance using the cumulative number of fish landed (by species) from 2000–07[43] as a proxy for importance. Data on the number of fish landed were obtained from the California Department of Fish and Game's Annual Reports of Statewide Fish Landings by the CPFV Fleet. Please see Section 3.3 for further information on box plot analysis for the CPFV fisheries as well as identification of the potential outliers.



[43] Rockfish/bottomfish landings (2000–07) were calculated using the species groupings defined in Appendix A.7 of the *Survey Methods and Summary Statistics for Ecotrust's North Coast Study Region Fishery Uses and Values Project* (Appendix A). This calculation may be an underestimate as kelp greenling and blue, canary, copper, gopher and yelloweye rockfish landings were not available in 2001. Nevertheless, the total number of rockfish/bottomfish landed was the highest of all the CPFV fisheries. Landings of unspecified invertebrates were used as a proxy for Dungeness crab landings as the NCSR fishing community indicated that, almost exclusively, invertebrates caught by the CPFV fleet are crab. Landings of unspecified flatfish were used as a proxy for Pacific halibut landings because CPFV operators principally target or sell "halibut" trips and because landings of other flatfish, such as sanddab (which is reported separately) or sole, are only a minor incidental from targeting halibut.

Appendix E: Consent Forms

In-Person Consent Form (Commercial, CPFV, and Recreation)

MLPA Initiative – North Coast Study Region
Fisheries Uses and Values Project – Project Description

The Marine Life Protection Act (MLPA) is a state law directing the California Department of Fish and Game (CDFG) to design and manage an improved network of marine protected areas off California's coast. To implement this law, a public-private partnership has been formed between the California Resources Agency, CDFG and Resources Legacy Fund Foundation—the MLPA Initiative. As part of this effort, Ecotrust has been retained to collect, compile and analyze information pertaining to commercial and recreational fisheries on the northern California coast. The project is designed to provide spatially explicit socioeconomic information to the MLPA Initiative.

The goal of the Fishery Data Collection and Analysis Project is to compile a comprehensive picture of the commercial and recreational fishing use patterns along the north coast of California, using the expert knowledge of fishermen themselves. The purpose of this project is fourfold:

1. Incorporate commercial and recreational fishermen's knowledge into the deliberations of the Regional Stakeholder Group in the MLPA North Coast Study Region;
2. Use this information to improve on the spatial resolution and accuracy of CDFG landings and logbook data;
3. Develop accurate maps of the local fishing grounds and their economic importance to the local fleets; and
4. Estimate the maximum potential socioeconomic impact of proposed MPA networks to the commercial and recreational fishery sector.

This kind of spatially explicit information on commercial fisheries and their value will ensure representation of socioeconomic values in the design, implementation and management of marine protected areas.

During the summer and fall months of 2009, Ecotrust personnel will interview approximately 400 fishermen along the northern California coast. Fishermen will be selected based on their willingness to participate as well as CDFG data and recommendations by peers. The interview approach is based on peer-reviewed, social science techniques for collecting local expert knowledge.

Ecotrust personnel will contact fishermen directly and arrange for interviews with contracted staff based in the region (from Alder Creek near Point Arena north to the California/Oregon border). Interviews will be administered one-on-one, in small groups and/or online. Ecotrust will then conduct follow-up meetings by fishery and/or gear group in which the information collected will be validated by fishermen.

Due to the sensitive nature of commercial fishing information, only Ecotrust staff (operating under a strict confidentiality protocol) will handle the raw data collected during the interviews. All information will be kept anonymous and confidential on the individual level. Analyses and results will be presented only in aggregate form, and will be reviewed in aggregate form by participating fishermen from each fishery. The information will be used to create a comprehensive profile of the

commercial fishing use patterns and values along California's north coast, and may also be written up in a peer-reviewed journal.
Your willingness to participate and/or to refer other fishermen we should contact is not only appreciated, but indeed vital to the success of this project. If you have any questions or concerns, contact Charles Steinback at charles@ecotrust.org or 971.404.5632 or Jon Bonkoski at jbonkoski@ecotrust.org or 503.467.0804. The project website is www.ecotrust.org/mlpa.

If you agree to participate under the conditions described above, please print and sign your name.

Participant's name _____ Signature _____ Date _____

Field Staff signature (agent of Ecotrust) _____ Date _____

Confidentiality

Ecotrust will take every measure possible to protect the confidentiality of sensitive information provided by fishermen during and after the interview process. These measures include functions in Open OceanMap, consent forms for individual participants and collection and analysis protocols that mask all names and identifying characteristics of an individual's fishing grounds.

- Explicit consent will be obtained from all participants and will be recorded by Ecotrust personnel.
- All information on the individual level will remain anonymous and confidential. Only Ecotrust staff (operating under a strict confidentiality protocol) will handle the raw data collected during the interviews.
- Analyses and results will be presented in aggregate form for participating fishermen from each fishery to review before results are finalized.
- Open OceanMap has been customized to protect individual confidentiality. Participants will not be allowed to add to existing or previously created data to Open OceanMap.

Quality Assurance/Quality Control

While Ecotrust field staff is conducting interviews, Ecotrust analysts will begin creating and editing "clean" datasets based on additional notes regarding the exact location of certain areas provided during the interview. After the information has been cleaned, fishermen will be contacted and given the opportunity to review their individual information at their convenience through a secure, web-based application that Ecotrust developed for the North Central and South Coast Study Regions. This application allows each participant to log in to verify that his/her shapes and information are accurate and to review the final characterization of the fishing grounds to which s/he contributed. Those without access to the internet will be sent a hard copy of their information to verify.

Once interviews have been completed, Ecotrust will hold follow-up meetings with participants and fishing community representatives in each port. After the participants review and accept the final data products and verify their accuracy and content for public consumption (MLPAI process), Ecotrust will submit the products for use in the marine planning process.

Analysis and Evaluation of Fishing Grounds

Ecotrust analysts in our Portland, Oregon office will standardize and compile all the responses. These responses will then be aggregated into a series of maps that show the total extent of the fishing grounds for each fishery, as well as the areas of greater use or greater economic significance. Gradations of color will indicate areas where more pennies were allocated, effectively showing areas

that are more frequently used and/or more important. These intermediary products will be validated by fishermen in a series of follow-up meetings to make sure that we captured the information correctly.

Information from this project will be used to create a comprehensive profile of the commercial, CPFV, and recreational fishing use patterns and values along the northern California coast. Analyses and results (in aggregate form) will be made available for use in the context of the MLPA Initiative and the discussion, implementation and management of marine protected areas in California state waters—specifically the North Coast Regional Stakeholder Group. Results may also be written up in a peer-reviewed journal.

All participants, whose explicit consent will be recorded by Ecotrust personnel, agree to let their information be used in this manner.

Online Consent Form (Recreation)

MLPA Initiative – North Coast Study Region
Fisheries Uses and Values Project – Project Description

You have until Nov. 15th 2009 to finish this web survey. It will likely take you at least 30 minutes to an hour to complete so give yourself enough time. You can leave and come back to the survey as many times as you'd like until you're done, but it's important that you finish the whole thing or we can't use your information at all. If you need additional help please first refer to all instructions, videos and frequently asked questions provided. If you still find yourself not able to complete this survey online, please contact us using the info at the end of this email and we will find a way to get your information.

By activating this account you agree to participate under the following conditions:
The Marine Life Protection Act (MLPA) is a state law directing the California Department of Fish and Game (CDFG) to design and manage an improved network of marine protected areas off California's coast. To implement this law, a public-private partnership has been formed between the California Resources Agency, CDFG, and Resources Legacy Fund Foundation—the MLPA Initiative. As part of this effort, Ecotrust has been retained to collect, compile and analyze information pertaining to recreational fisheries along the northern California coast. The project is designed to provide spatially explicit information to the MLPA Initiative and the information collected in this project will improve upon what is currently available regarding recreational fisheries.

The goal of the Recreational Fisheries Uses Project is to characterize recreational fishing areas of relative importance and recreational fishing use patterns along the northern California coast, using the expert knowledge of fishermen themselves. The purpose of this project is twofold:

1. Develop accurate maps of the local recreational fishing grounds and characterize their relative importance to recreational fishermen; and 2. Incorporate recreational fishermen's knowledge into the deliberations of the Regional Stakeholder Group in the MLPA North Coast Study Region.

This kind of spatially explicit information on recreational fisheries will ensure representation of recreational values in the design, implementation and management of marine protected areas.

During the summer and early fall 2009, Ecotrust personnel will be contacting recreational fishermen along the northern California coast to be interviewed. The format will be on-line, with follow-up meetings by user group in which the information collected will be validated by fishermen. Due to the sensitive nature of the information, only Ecotrust staff (operating under a strict confidentiality protocol) will handle the raw data generated during the interviews. All information collected in the interviews is anonymous and confidential on the individual level. All analyses and results will be presented only in aggregate form. The information will be used to create a comprehensive profile of the recreational fishing use patterns and values along California's north coast, and may also be written up in a peer-reviewed journal. If appropriate, there may be the opportunity for release of aggregated study results for uses other than the MLPA process, but in line with the purposes of this research; however, your individual results will never be included in any release of aggregated results without your explicit consent.

Your willingness to participate is not only appreciated, but indeed vital to the success of this project. If you have any questions or concerns, contact Jon Bonkoski at jbonkoski@ecotrust.org 503.467.0804 or Leanne Weiss at lweiss@ecotrust.org 503.467.0809. The project website is www.ecotrust.org/mlpa